Body, Numbers, Light.
Color Phenomena of *Eye-Ocean*

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programming, spatial perception, light phenomena.

Abstract :
What happens in the virtual reality created by numbers that would not be possible in the concrete reality from an artistic point of view ? Can we create differently through numbers ? Negative numbers generate in *Eye-Ocean*, the studied 3D artwork, a non realist virtual black light in dialog with a brighter one, a white light that becomes gradually colorful : the two opposite lights move, play, unite and fight together continuously. The visual space they create on a screen-surface becomes ambivalent : is it flat or deep ? Sensations of closeness and remoteness hinder the clear understanding of the size of the moving lights. Despite its abstraction, the image succeeds in evoking landscapes, body fragments, cells or cosmos. The viewer is experiencing an unknown sensual materiality, in a strange flux of volume, emptiness and feelings.

INTRODUCTION

Before I present my current project from the point of view of color, I would like to introduce you to a few principles that unconsciously lead my artistic research.

When I first heard of computer art, it was at the early 80's, because of the movie *Tron* [1]. I could not believe that such a process existed. I hadn't seen the images, but I could not understand how emotional images could be created with/by/on/through mathematical and programming process. For me, rather basically, art is about sensitiveness, subjectivity, the unconscious, ... and mathematic – or programming – is a question of logic, rationality, consciousness. Art and mathematic cannot go together. Probably because I like absurdity, I needed to understand, I finally went to see by myself what kind of art was possible with this process, and if it could generate something new and interesting according to artistic criteria. For that, I had to keep the process radical, extreme – ie. I have to program the image – in order to see what strangeness this could bring.

The second point I want to make is that my vocation is to be a painter. It means I like painting and more precisely abstract lyric painting. I am under the influence of this abstract visual

language. Moreover, painting theories had influenced me. For example, the idea that art is always breaking or distorting conventions, and that one may de-construct a process or a system to understand it better. Actually, I have always found my ideas in de-constructing and questioning 3D processes and 3D visual elements/conventions. That way I could see how they behave, how they resist my desire to distort.

The third and last point is my ... great ... inability to program and my need to understand what I write in programming language. So my code has to remain very elementary, very simple. No mystery must hide in my code. It goes with the idea complexity of code cannot generate/explain computer art. Whenever art would emerge from this creation process, it would have to locate somewhere else. It means as well that programming difficulties make me suffer. But this ambivalent state is finally very important because many of my ideas come from mistakes, or from my *bad* way of writing commands.

The project I am now finishing, *Into the Hollow of Darkness*, is the fourth one I undertook. It began 9 years ago. It is divided into 2 parts both of which are intimately connected to questions of perception. The first part, *Eye-Ocean*, is visual and focuses on 3D light phenomena, light is thus seen as the last constructive element or zero degree of 3D image and more generally of electronic image. The second part, *Outre-Ronde*, focuses on interactivity : I am interested in the way we look at things, and specially how the way we look changes what we look at. Interactivity allows to make metaphors literally visible. This interactive project is a panoramic installation, that I will not present here for time and technical reasons [2]. This project is being supported by Interface-Z, Le Cube and ZKM [3].

All you see is generated in real time 3D (50/30 images per second). Nothing, no texture, no image, is saved except for the running code itself. The code, which I wrote myself (inside a working environment /home-software that other people [4] helped me to construct) is always controlling the parameters that generate, create, construct everything visible once the code is run. I allowed the code to be open enough so I can interact with the variables in real time and change the appearance of the image (for presentations or for public performances).

The image is composed of an animated surface face on a black background, a screen in the screen. On this surface, 2 spots are moving, a black one and a brighter one, a colored one. Sometimes a uniform colored mass ('aplat') is coming and going – called fog. It will not happen more than this, it is a very minimalist abstract animation : the only events will be the variation of the colors, of the shape of the spots, of the darkness and speed of the surface.

(2)

I come now to my presentation. The first part will deal with the way I programed the changes of color, and how this process – this dynamic organization – influenced my choices or not : organization choices for the language itself inside the program or for the resulting choices of form and color. The second part will analyze how the color behaves in space, how it beams, how it becomes a strange matter, how the space of the surface opens itself and how the surface becomes quasi living, breathing, sensual, like a sensitive living being. At the end of each part I will present the way I think I put the human into color.

I will not speak much on symbolism. Symbolism and mysticism matters are delicate and complex. I will generally avoid symbolic interpretations that are so-called universal, « cliché », such as white/positive/hope and black/negative/fear or pink/feminine, etc. I could not deny that they may underly my sub-conscious motivations. But I would argue that I dream them, not as truths but as elements on which I can jump and vary. Could not a pink be tough or acrid ? Could not a black stain be welcoming ? These elements– the first type being too schematic and the second type too subjective and more poetic than scientific– don't seem to enrich the discussion. However, as Kandinsky and Klee had done at the beginning of the 20th century [5], I seem to look for vital qualities of movements, forms and colors, perhaps in order to find, in the art-work, quality of presence and subtleties of sensation [6]. It could be so because of some underlying animism, mysticism or cosmic visions. I do not believe that here lies the debate. I will limit my text to the elements that allow a better analysis of the creative process and perception.

My analysis is based on the render I can observe at home, on my own screen, with an Nvidia graphic card. Some effects may vary according to the graphic card constructor, and particularly between video projection and cathodic screen, specially for dark or subtle colors.

TO PROGRAM COLOR

To discover what numbers (and mathematics) can offer to the exploration of light, I play with them in order to find singular light phenomena.

Color components

Color is made visible on the screen by luminophores, light elements : pixels are lighted. As long as the image is on the screen, it is a luminous image. In 3D space, you have light objects, kind of lamps, mathematic points which behave according to physical properties : they light other objects depending on the distance, on the angle, on the reflexive surface and of course on the light object itself. Among the main light visual parameters, you control the spot (or halo, specular) and the boundaries or environment of the halo (diffuse). All of them have red, green, blue components, as the pixel color does. Their effects are close to 'real' physical lights like those used in the theater for example, but you manipulate/move/change them through numbers and functions. They are only numbers. If you don't like numbers in computer generated images, forget it.

They obey physical rules, but because they only are numbers, they can go beyond physical rules, and are freed from realistic phenomena. It is what I am looking for in computer art, a logic we can play with, distort, and which can generate something unexpected. It is one of the strengths of programming language : to choose parameters, you are not dependent on 'predetermined cursors' in 'predetermined tools windows' which have fixed boundaries, and on documentation reductions. Code yourself, don't trust the documentation and always try the extreme limits of any function.

Elementary color choices

The first result of my exploration of light phenomena through numbers was the discovery of black lights. Negative parameters (illegal in the documentation) produce negative lights. It means that black lights are antagonist lights that can absorb or destroy bright lights according to their varying powers of lighting. Once the black light had been discovered, I needed a second one – a second pole which had to be white, bright, and variable in color. It took me at least one year to understand that.

The second result of playing with numbers to choose colors was the discovery of gray. I wasn't very keen on gray before this project. But because its numbers are special, equal (r = g = b), that is to say, easy to code, it has existed from the beginning in the program and has taken on a pivotal position. I could thus see better the colored grays, which can really be wonderful, specially when the color is not completely affirmed, and is still trying to emerge. I think this gray tone, which is in a way neutral, drab, dull, but very appreciated by Chinese people because of that [7], is necessary to make the colors gradually rise from it, as if gray would be the substrate, the basic ground of colors. (these 2 first points will be more analyzed in my second part). In fact, Klee presents the gray as a place where the jump from chaos to order can be obtained, or as a bridge between what comes (or « what is born ») and what dies [8]. Grey is a potential– a passage place.

(3)

Dynamics of numbers

The third result of playing with numbers, the main one, is not attached to a particular tint. It is based on trajectory of parameters. Why should I choose one precise value when so many others exist and may generate interesting colors that I haven't time enough to test ? Numbers and words are as abstract and therefore as volatile as thought. You have one thought, you can change it just by thinking [9], and hop, you have another thought, or here, another number. And moreover you have operations on numbers : they play with themselves. Why should we be faithful or tied to just one when there is an infinity of them ? It makes the thoughts more dynamical.

But, in digital realm, with color, you have another level of variable. Color itself is an addition/synthesis of parameters : it is composed by three parameters, red, green, blue. If you change one component, you change the whole result. So you can play successively with a first one, then with a second one, etc. without changing the others simultaneously, changing only one component at a time. Numbers vary thus with different rhythms.

This method is possible to do thanks to programming language : it allows you to set a suite of orders (commands) that will be executed by the machine for each image. The machine calculates its current values and will re-execute the commands for the following image with possible little changes that one can choose and code.

So I built a kind of gearing system on trajectories or paths which is controlling and generating all the visual changes of the animation. For the bright light, I have 10 paths to change the specular (color inside the light) : first path, I increase the red around a saved pivot value with a variable amount calculated by a restricted cyclic function. Second I do the same on green. Third, on blue,

forth on red and green together (yellow), etc. The same method is implemented on the diffuse (color outside) of the same bright light. Because I don't change all 3 parameters of the color at the same time, the new color depends on the previous one, that depends on the previous one too. Little variations accumulate. Another parameter makes the color range of this function change, another controls the speed of the variation. Another determines the way to order the paths : in a growing way or in a random one. So I can combine my 'open' choices in different ways and the colors would be different. The space position affects the color too : I have 5 paths to move the lights in depth (among them, one where nothing moves), 4 ways to move the lights laterally. Other parameters determine when to trigger this or that parameter (for example, to control the colored fog variation paths, colors and shifting, or the variations of the surface, for its color/diffuse/specular ones or its movement). I may have 30 main parameters. Parameters act sometimes on each other : when the fifth path of depth position of light is chosen, I increment the specular variation, that, later, will trigger the diffuse variation. In fact, layers of parameter interfere.

Control hypothesis

There is a special joy in playing like that with many variables, with a system that will be activated and then will evolve alone, showing colors and phenomena that would have been roughly chosen. Of course I lost control, I don't remember everything I decided to code. It belongs to the pleasure to create something strange that then escapes, a sort of magic autonomous machinery. I like to be surprised by the combinations of colors that appear. You cannot foresee precisely what will happen. Every times it is different because of these little accumulations of variations. We could argue that human is not anymore in this kind of construction. However the will not to control every thing is still a will, quite important in fact. I guess it is linked to the pleasure of generating a world that one can then endlessly observe and possibly admire.

But in my case, I must confess the pleasure was not immediate. Despite the harmonizing black light whose tint is not changing in itself, my system of combined colored values did not always give good color matches. And I wanted it to be always good – in a pictorial sens. Now, one cannot asset on the pure numbers if a set of colors is suitable or not. Only a human eye can judge. To limit the garish sets, I had to reduce the range of variations, and to give more directions to the system. First, the fog's color is almost determined, it is chosen through small variations around some precise tints : light or old pink, dirty white, varying gray, varying orange, black, rarely yellow or blue, more rarely green... In fact, warm or 'natural' colors, living body colors are more frequent, as if the body itself would have wanted to infiltrate the work. In some paths, parameters darken the current color or made it redder, bluer or more gray. Unfortunately I haven't found how to *dirty* a color with digital operation... Question of vision probably. Between trajectories, by interpolation, fog colors intermingle with one another creating other tints : so sometimes wonderful dark browns may appear. In a second phase, I reduced the range of the diffuse color which affects the surface more globally : it is only a third of the specular one. It is more discreet, not too directly perceived.

On the other hand, I re-opened the system a little bit : sometimes, according to some conjunctions of parameters, the bright light's color, whatever it is, is given to the fog. Therefore a few resonances appear between different shapes. Numbers can thus shift inside the building.

I can control original numbers, but their effect is not easy to determine. Some parameters interact visually with others : for example the diffuse of the surface and the ones of the lights, according to their respective positions. I am still trying to understand how lights specular and diffuse affect each other. It took me 2 years to test and adjust the paths and parameters combination.

So I could not avoid taking back the control of the 'jam', and choosing precisely some colors to create a kind of intimate harmony, unforeseeable but globally soft.

Let us see now how colors behave in space.

BEHAVIORS OF COLOR IN SPACE

A radiance behavior

The first amazing behavior of the color in my project is its radiance. It is obvious with the bright spot, specially when it is white, intense, and alone on the surface, or when the surface has become very dark, almost invisible, increasing the effects of the bright light. In fact, this radiance is a direct consequence of the light properties. Light is radiant in itself.

But is is not so self-evident with the black light. Its center is dense, wider that the white one, and attracts your gaze. When you look closer at the entire spot, you see that the limits are not precise, they are wide, and fuzzy, blurred. The black from the inside gradually becomes gray or colored – according to the color of the white spot's 'diffuse' which gives its color to the surrounding surface – while going away from the center, as if the the color was slowly spreading around. These boundaries give a sens of movement of diffusion, of emanation, of radiation, as if the dark were a center or a source of energy. If the black zone is small on the darkened surface, it has a brighter surround that creates like a halo : its own bright lighting power. When one light is inside the other one – which is then bigger –, because of their opposed values, some effects are multiplied : the biggest extends the effect of the smallest, and the back-and-forth movements of the lights increase the phenomena. Hanging colors are vibrating in space [10].

An unknown matter

The second behavior of color I would like to mention is color's propensity to become an unknown or ambivalent matter. Matter is not a property of light, nor of digital imaging at all ! It is not easy to identify where the feeling of it being matter comes from because every thing is always moving and changing. It is also related to the sens of diffusion. Because of the slow undulations of the surface, the form of the spots is never fixed, never perfectly round. It is more an ovoid form which is always varying, going from a disc to an ellipsoidal, till it becomes an eight lying on its side. This organic form seems to be very elastic.

(4)

Let us look first at the black light in relation to its environment. Its identity is not clear. According to its size and the relative position of the other light, it may sometimes appear like a mark, a stain, the bright light's shadow, or sometimes it is a hollow (I will come back later on this

point). Because the black color is the same for the background and for one light, it gains in importance. Together, they will acquire unexpected matter quality. When this black zone is big, and set on the edge of the surface, the environment, as a mass, seems to invade the surface. Occasionally a black fog is slowly entering the surface as if it were a heavy fluid, almost a matter, the same matter as the environment again. Sometimes, the lights are so small and the surface invisible that black from the background is invading the whole surface, the whole space, with a strange density. Sometimes the smooth surface is perturbed by movements, the black round spot is thus scattered in small bits animated in an agitated sort of way, and they seem to be denser than before. The way they adhere to the surface is stronger, they grasp the surface, as if they were afraid to slip. The surface itself has become a fascinating silky matter.

Let us observe now how the 2 lights behave together. When the 2 lights are one over the other one, sometimes they have the same size : you cannot distinguish one from the other. There is a brief spell when their union seems to become a fusion. The color area vibrates, trembles. It is like looking through hot air. Is the separation difficult ? We can then begin to distinguish 2 poles of tints, one darker than the other : the separation, in fact, the *transformation* has happened. It always makes me think of a kind of creation of matter, a kind of alchemy. I have the sensation the colors were united, unified in a unique body, and after a while, they are created. The vibration is an important element : light phenomena and matter phenomena are blending as if light and matter fused to differentiate / individuate / create colors. Once the color is created, it can vary and increase.

This article helped me to understand that *Eye-Ocean* is not so much about peculiar colors or sets of colors but about emergence of color, about elusive, untouchable emergence and variation of colors.

An ambivalence space

The third point I would like to develop is the ambivalence of space, aroused by the sensations of matter.

The depth of the surface is uncertain : is it a flat surface or a deep space ? The white spot seems to be a full, convex volume, but on the other hand the black one seems to be an empty, concave form, able to dig into the surface and to bend it. The form of the plane surface begins not to be so sure.

Moreover, the continuous movements of the colored spots in – or over – the surface make it difficult to place them exactly. The perception is confused because their size keeps changing. Is it that because of changes in location (geometric rules of distance) ? Or is it because of a size that would really change in time, that would, for example, grow or decrease ? When the surface is dark and the color a faint light, there is nothing to tie it down to, no landmark. Is the faint light as far as it seems to be ? When it is on the edge or the corner of the surface, it is easier to judge because the surface seems to be closer to the screen. When the 2 spots are one inside the other, the smaller one seems to be closer, because it is in front of the other. But at the same time, because its size is smaller and decreasing, it gives the sensation it is going away, plunging into the body of the other color. The concentric contrasted and moving discs are fascinating. They make it harder to think. And so increases the confusion.

What is more, when the black spot is very big, it can almost cover the entire surface, which opens up as an emptiness, a deep emptiness, a very powerful and threatening one [11]. We look inside this strange space, fearing we might be sucked in, searching for something unknown.

It is easier to see the ambivalence of the surface when a fog has a sharp edge (Nvidia). It makes the flat surface obvious and close to the screen while the blurry moving spots keep saying 'we like to dive in depth'. The animation is always being punctuated by pictorial games on the perception of space.

(5)

A sensual living system

The last and fourth point of this part deals with sensuality and vitality of the whole colored system. The movement of the two opposed lights is based on power balance and on love balance : they move and look for each other, they come together and conjoin. But they also eat or swallow each other. Because of the organic aspect of the black area, some ephemeral compositions can evoke body orifices or breasts. The warm colors of the fog, pink, red, orange, or colored grays, more present than others, along with their hazy soft edges, suggest a calm, smoothing atmosphere. The movement of the blurred edges of the fog on the surface, generally slow, coming and going, seems to me like the space caressing the surface. The fog is hiding and revealing some surface phenomena, giving birth to an underlaying – and all embracing – diffused eroticism. The tenderness of light pink, the tenderness of the scarcely visible changes of colors, can sometimes make me cry or even provoke sexual desire.

This abstract sensuality is linked to the feeling of living which the surface generates : the appearing and disappearing of the spots in the black depth, the ovoid form, almost a cell form, the creation of colors and the bipolarity of black and bright moving together induce a sensation of continuous birth and death. The undulation of the surface and the coming-and-going movements of the colors suggest breathing. The oscillations and slow variations rock the viewer, as if he/she were in a cradle. The slowness and darkness add to this feeling. We have before us a fascinating unknown living system.

Other elements wake up, excite the vision (and thus the body) of the viewer : the uncertainties of space, the incessant movements, but also some total disappearances. The screen is sometimes completely black, nothing is to be seen any more. It can last 10 seconds, which is quite a huge amount of time in our society. For us to look into black in silence. The viewer is put in the situation where he or she wants to see something but cannot. So they feel frustrated. They cannot deny that. They know they are waiting for something to appear. So they feel better they want to see. The viewer is put in a conscious position of desire in front of an enigmatic and abstract dancing body.

This text has underlined my concerns about a visual, abstract, even metaphorical body. I try to create correspondences between the moving form as a quasi-body and the body of the viewer. Arbitrary personal choices of soft colors counterbalance cold programming. The radical artificialness of the creation principle -to create with mathematics- triggers in me, creator of these images, because of an imagination of inversion [12], because of a vital insubordination to the “killing geometries” [13], the desire to infiltrate there some organic,

lifelike, body, sensuality. Slow movements and sensual textures, ambiguous spaces and evocative figures attract the gaze and create an intimate ambiance, stimulating the viewer's perception so that he/she is having a bodily experience.

REFERENCES :

[1] *Tron*, Lisberger, Walt Disney, USA, 1981.

[2] I wrote an article on the genesis of this project : *Into the Hollow of Darkness, Realizing a 3D Interactive Environment*, Isea2002, in *Leonardo*, Vol. 37, n° 3, USA, 2004, p. 204-209, 215.

For on-line articles or images and details on my research, see http://aslemeur.free.fr

[3] See the links below :

- http://www.interface-z.com/
- http://www.lesiteducube.com/
- http://www.zkm.de/

I would also like to thank my employer, the French University, that gives me so much freedom in my research.

[4] I have been working with various persons who, purely out of interest, had dedicated their « free » time to the projects:

Winter 2001 - 2002 : Francis Bras had helped me to define the technical side of the project, developed the sensor device, and found the first students. He then helped me for the interactive part of the project till now.

June 2002 - Summer 2003 : collaboration with Gilles Baptest and Gregory Daniel, students of l'EPITEC, school of computer sciences.

September 2003 - to present : Collaboration with Didier Bouchon, a computer scientist and the technical director of Atelier d'Art3000 – Le Cube.

Anthoni Schiochet, a student of l'Ecole Centrale d'Electronique, was the third trainee to help me. (see website for more information).

[5] Kandinsky, W., *Du spirituel dans l'art [Concerning the Spiritual in Art]* (1989), in Denoël (Ed.), Paris.

-- *Point Ligne Plan [Point and Line to Plane]* (1970), in Denoël (Ed.), Paris.

Klee, P., *Théorie de l'art moderne [Introduction to Modern Art]* (sd), in Denoël/Gonthier (Ed.), Bâle.

[6] My own expressions is closer to the vocabulary of Rothko. To describe what he is looking for, he speaks of the

"appearance of existence"
of the space. (Translation of A-S Le Meur)

Rothko, M., *La réalité de l'artiste [The Artist's Reality]* (2004), in Flammarion (Ed.), p. 106.

[7] Jullien, F., *In Praise of Blandness, Proceeding from Chinese Thought and Aesthetics* (1994), in MIT Press (Ed.).

[8] Klee, P*., op. cit.*, pp. 55-56.

[9] Language here is understood as matter. Philosophers and psychoanalysts would think differently.

[10] Painters such as Mark Rothko or Odilon Redon, or artist such as James Turrell, may have influenced me. Rothko often refers to the tactility of space in his writings, *op. cit*.

[11] Someone told me

"one can even be afraid"
without daring to say what one is afraid of.

[12] Durand, G., *Les structures anthropologiques de l'imaginaire [Anthropological Structures of the Imagination]* (1992), in Dunod (Ed.), Paris, p. 238.

[13] Michaux, H., « Combat contre l'espace », in *Passages,* (1963), in Gallimard (Ed.), Paris, p. 49.

FIGURES :

All images had been created after *Eye-Ocean*, by Anne-Sarah Le Meur, using 3D real time generative image, home software, silence, 2003 – 2007.

NB : Change in perception of space and tactility is significantly influenced by these factors : The small size of the images, the loss of colors and movement, use of print surface instead illumination, quality of the contrasts in the prints, etc... Download the *Eye-Ocean* program from the website and run it in order to get a better understanding of what I am referring to.

http://aslemeur.free.fr/projets/oeil_eng.htm

(1) *Petithalonoir :* The black zone has its own lighting power, a brighter surround area that creates a halo.

(2) *Double* : The black light is bigger than the brighter one. Their appearance of volume differs. The black one seems to be concave, the white one convex. The white one seems to be located on the black stain, though much faraway.

(3) *Gray* : The two spots are fighting to get the power on the other one. The black fog, as the dense substance of the background is passing, temporarily hiding them. The surface is troubled by movements. Colors are not born yet.

(4) *Diffusion_peu :* The two lights begin to separate. The slight difference of colors (light grey and light pink) and difference in positions make the surface tremble. A black fog enters from the top. The organic shape and color become erotic.

(5) *Granoirliss :* The black zone is almost as big as the surface, sometimes making me feel that it is a matter opening a strange deep space. The white light is very small, hard to locate, over or in the black zone, far away in the depth ?

(6) *Scatered_pinkf :* The raw, literal 3D surface is scattered by movements, breaking the unity of each light in several small distinguishable elements. The pink fog is slowly shifting while changing color from pink to beige.