

$3D = 2D$

A metaphor for human perception

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Motto:

“Toute la conduite de notre vie dépend de nos sens, entre lesquels celui de la vue étant le plus universel et le plus noble, il n'y a point de doute que les inventions qui servent à augmenter sa puissance ne soient des plus utiles qui puissent être.”

“All the conduct of our lives depends on our senses, among which the sense of sight being the most universal and most noble, there is no doubt that the inventions which serve to augment its power are the most useful that could be made.”

René Descartes , La Dioptrique (1637)

Acknowledgements:

I have had in my life many events which belongs now to my past and to my memory and I suppose that for any humans determine the way how a human character evolves. The battle for survival in a newly societal system during the last two decades of my life had developed in me the urge to make something according to my feelings and not necessary belonging to my physical needs. I studied Arts at a relatively advanced age for that but I felt completely in my natural environment and I knew that this is my right way of life, "the call".

Following these studies, I aimed further and higher. Many factors conducted me to Universität für angewandte Kunst Vienna and consequently will become such a memorable event, an intense period of my life. This period, definitely have changed my life and my paradigm over the world.

I would like to address my deeply feelings of appreciation to the collective which gave me the chance to be part of "die angewandte"'s Master of Art & Science:

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*This work is dedicated to my beloved children:
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Chapter1. Introduction. Motivation. Question.

I have always been concerned about what reality exactly means. After much confusing searching, I discovered that reality is a huge complex human concept, encompassing principles of physics, anatomic structures, physiological processes, psychological dimensions, and cognitive science, to say nothing of the wholly new empirical theory of perception, philosophy, cultural background, personal experiences – the list can go on. I will try to simplify some of these and make an understandable path, at least for someone who is not a specialist in any of these fields of research, like myself.

I intend this work to be one part scientific, one part fantastic (containing an alternate reality), and the last part explaining and detailing my exhibition as an experiment. It is about how we perceive and understand reality.

As a foreigner, an implant in the Austrian culture, I have had difficulties adapting myself in many aspects to the local culture. I conceive more of overlapping maps of understanding than of fundamentally opposing understandings. Nevertheless, a continuous process of adapting to something different, a different culture for example, is in itself a complex process of comparison, upgrading, achieving automatism and reflection.

In the new technological society, we live in a constant state of adaptation.

It is something new for an individual, more or less intuitive, with new processes for new results. One must learn just the right combination of buttons in a different language than one's one.

It is not the purpose of this work to evaluate all the elements which when combined are our perception of the world. I will focus on visual perception, the interpretation of incoming visual data, visual cultural representations, and - my main field of expertise - artworks about this perception.

The title, 3D=2D, has different connotations, but mainly it is a variation of the same problem: the stereoscopic view over the environment.

This is based on a personal experience. As a child, I received corrective surgery of the eye muscles, as I suffered from a bad convergent strabismus or esotropia. I remember that I had double vision for months, and was thus unable to find really my way around, just helping myself with other senses, touch, hearing. After years of endless corrective exercises and huge eye glasses, I still don't have binocular vision, known as stereoscopic vision, but rather a monocular vision. The brain is choosing which of the eye is suitable to deliver the information for me. In spite of that, what is remarkable, during the years of trial and error the brain found its way to deliver to me the three-dimensional space that I needed in order to survive in my environment.

Another aspect of how we understand the reality around us is the cultural heritage, and the social and political inputs. I am a living fossil of a dead world – the communist experiment. I am also contemporary with the newly (for me) democratic and capitalist world in its all childhood aspects: wild, greedy, materialistic but also rewarding and, most important, free. My experience of this will inform much of this work.

The main question of this work is:

Is reality the summation of the congruent overlapping maps of our perception?

Chapter2. Human Perception of Reality.

2.1. Social - Political – Cultural.

I do not pretend to be the judge of a system or a sociologist. But I can share from my experiences how I perceived reality in those days of my youth.

When the communist system was falling apart I was 22 years old. My childhood, my teen-years, my formation as an individual belong to those years.

It was a multifaceted society. A huge cage, a zoo, the visitors of the zoo were the so-called providential rulers (I am reminded of *Animal Farm* – George Orwell¹, 1945) .

Communism was a pretext for having large masses under control. Everything was pre-programmed. The industry, the agriculture, the future. The past was re-written. The way people should look, talk and express themselves. The way cities, villages, buildings should look. The ultimate goal was the creation of a so-called “new man”, it wasn't even another name, like “the socialist man” or something else. It was something so abstract, that I was really troubled, as a child, about this prophecy.

I remember huge artworks describing this type of man in some very abstract forms: poems, writings, paintings. Everything was about fight, power and transformation in something very abstract, indefinite and with no physical end or goal. Basically, this man was to be modest, hard-working, highly moral, completely dedicated to the triumphant socialist society, ready to sacrifice himself for the high purposes of the apparatus. Part of a huge machine which became an entity (remember *Metropolis* - Fritz Lang², 1929). We spoke of The Party as of a living entity. The crushing effect of this kind of entity was present everywhere. They weren't any institutions in service of the society as we know they have to be; they had become alive, self-breeding, self-talking (*Brazil*-Terry Gilliam³, 1985). The rulers of this machine they were almost anonymous, with the exception of the great ruler, the only person who was allowed to have visions and ideas (*Nineteen Eighty-Four* - George Orwell; film by Michael Radford⁴). Others they weren't individuals but were “they”. They were talking about themselves using a majestic plural “We”. Later, I learnt that this is called *nosism*⁵, and the use of this majestic plural is meant to denote the excellence, the power, the high ranking position of that person. The uses of “We” (meant to be a support from a deity - “God and I...”) actually was another form of expressing the crushing power of the Machine, the hideous apparatus. And, also, was a fatuous baboonery of the dignity of a legit system, the former constitutional democratic monarchy. “We” referred to capitals, Police, or Government, or City Council. They were forbidden places for normal mortals. If you were invited there, for example, it was a huge menace. The machine could crush you at once, for minor reasons, or for no reason at all, as it had done before with millions of people. The school was on the same pattern. It was the anti-camera of the real system. The whole system was based on menace, like a recreation of a vengeful God of the Old Testament.

The creation of the “new-man” was based on brain washing, starting with the younger generations. Songs, texts, literature, poetry, newspapers, films, documentaries were used extensively to

1 George Orwell - Eric Arthur Blair (1903 – 1950), known by his pen name George Orwell, was an English novelist and journalist .

2 Fritz Lang - Friedrich Christian Anton "Fritz" Lang (1890 – 1976) Austrian-German-US film-maker, screenwriter, film producer, actor

3 Terry Gilliam - Terence Vance "Terry" Gilliam (born 22 November 1940) is an American-born British screenwriter, film director, animator, actor and member of the Monty Python comedy troupe.

4 Michael Radford - (born 24 February 1946) is an English film director and screenwriter.

5 Nosism - from the Latin “nos”, is the practice of using the pronoun “we” to refer to oneself.

brain-wash our virgin minds. The group-reading of the interminable speeches of the Highest Ruler of the country was obligatory and quite often. And, so on. Each one of us was more or less touched by the long arms of this apparently indestructible machine. My father was in prison and forced home for years. I was against my will taken and put in a forced labour camp, when I was 16.

This was the “real” reality.

The official reality, generally speaking, was a description of a luminous world, happy and prosperous, aiming for a more happily future. The Heavens on Earth. The promise was all around. Written, or sung or spoken.

But the huge contrast of what was really the reality around had an effect of a living everyday oxymoron. Everything was grey and decaying, like a forgotten graveyard of civilization. Only black shadows, dead trees, from time to time a crow from a crow, everything covered by a toxic fog with a mouldy smell of a silent swamp. There is no words to describe the despair of the people caught in this giant Maelstrom; no escape, no chance, just everyday fight for living until a very close future. And from the intangible heights came the Lie. Everyday, the same. An unbelievable pink version of this graveyard. It is maybe possible to characterize this like an official utopia in a distopian reality.

And now comes an other reality. Our reality. Which had nothing in common with the incredible, unbelievable, beyond any sense of “reality” official version. Everybody resisted the brain-washing. We were all against this beyond of power of understanding masquerade. There were endless jokes, songs or whatever other forms of resistance against the official version of reality. We didn't even think of ourselves as the same people; we had a completely different life, away from the intoxication, the gap was too big to have any kind of communication. They were “they”, we were “we”. We were dividing the world between “Inside” and “Outside”, meaning inside the cage or outside of it.

Among ourselves – friends, colleagues, family – we were acting normal like any human being who has to say something or is aware of itself. In this dark pit of hopes, the information was coming thin and irregular, like a breeze of fresh air from a too-high small window in a prison cell. Every night we were listening to the freedom. They were radio stations like Voice of America, or Free Europe, giving us information, but most important, hope. Hope is better than water in desert, it can fill up empty stomachs better than food. The jamming stations from the Government were working hard, but the information was coming, sometimes louder, sometimes unintelligible. This was like an everyday prayer, the family around the radio, most of the time at the light of a candle (the power for population was cut out, the Machine was more important). Next day, any important news was spreading like a savanna fire, from mouth to mouth, carried away by the wind of hope.

The family was the lifeboat of the huge steam-boat. The family provided the care, the proper education, the moral values, the direction in life. There I learned how to have an appropriate behaviour, there I learned about whatever is important in life.

Other sources of information were the video-tapes, the Western magazines and the music. Most of them were coming from relatives which were already Outside. The value of these pieces of papers, or LP's was invaluable. They were worth more than their weight in gold. They circulated from hand to hand, or we had listening or viewing sessions in someone's home. We were behaving and copying whatever came from Outside, good or bad, just to be different from the official version of the “new-man”. We wore jeans and long hair. In the evenings in parks or in classrooms we were chased by some

too zealous policeman or indoctrinate teachers who would liked to cut our hair out or strip down our decadent outfit. Sometimes they caught us, sometimes they didn't.

This was another reality. The antithetic resistance. For sure we were more pro-capitalism than the westerners themselves. This silent resistance was so widespread that even the people involved in the repressive apparatus were against the system. The policemen were more often than not keeping their eyes and ears elsewhere, watching young with long hair, or hearing jokes about the Mighty Leader. The teachers were more often concessive and indulgent with our behaviour and clothing style. Many of our teachers held classes out of the official curriculum, teaching us forbidden things. Most of the low hierarchy officials led a double life, one during the work time, one outside of it. If you practice this for years, for decades you develop a double personality. And reality becomes flexible.

The way we spoke: One was the official language, a huge elaborated wooden language (*the infamous langue de bois*), completely out of common usage, with ridiculous formulas (*for example one of the simplest form of addressing to the Dictator was "Highly-Esteemed and Highly-Beloved Comrade Wise Ruler, Magnificent Visionary, Creator of the Golden Times"*), one was the colloquial one. It was really a highly sophisticated way of saying things without really saying them, a meta-language understood by everyone, full of metaphoric flourish and other types of stylistic figure of speech, but also impossible to legally incriminate. The jokes were everywhere, said half-mouth, the forbidden books or music was circulating like a Gulf Stream. Invisible, but huge, warm and life-giver.

In my mind comes the image of an Arctic ice-shelf, or sea ice. Above, there is permanent frost, everything is icy and lifeless, a solid platform kept together just in the virtue of the never over zero temperatures. Below is an intense life, fish-packs are swarming and living in their schools. But the sea ice keeps them away from the sun light.

The communist system made some huge mistakes. Because they were originally illiterate people, they thought that one of the explanation of their failure in life (*Ceausescu⁶ himself, he was unable to graduate the shoemaker's apprenticeship*) it is because they didn't have access to education and culture.

In response, they made the books very cheap, so everyone can afford thousands of them.

The culture: i.e. theater, opera, cinema, shows were extremely affordable. Of course, everything was filtered by the system, the censorship was working. But the holes of the net were big; maybe the Securitate⁷ officers were too stupid (or too lazy, or they were permissive) to read so many books. Hundreds of good books, good films, were coming through.

They introduced the requirement for every student, starting very early – age of 7 or so, especially generations after the late 60's, to learn one or two foreign languages.

They prepared for two decades, generations of highly educated people, who were speaking at least one foreign language. Well, this people can see with their own eyes.

This was the end for the communists.

So, I spent a good part of my childhood reading thousands of books. Chaotically, eclectically, I read everything that came in front of my eyes; melodramas, classics, adventures, science fiction, history, musketeers and indians, science and Jules Verne and Moby Dick, Goethe and Shakespeare, they were dancing in my head, avid of knowledge, new experiences and information.

I saw the whole world through other people eyes and minds, without moving out from the prison what was my country. Actually, I think the prison was in our minds.

6 Nicolae Ceaușescu (26 January 1918– 25 December 1989) was a Romanian communist politician, hard line Stalinist, subject of an extensive and ubiquitous personality cult, promoter of nationalism, and leader of a repressive dictatorial regime in Romania.

7 colloquially term for the Departamentul Securității Statului (Dept. of State Security) – the secret police agency of Communist Romania, mostly acting as a political police.

I quote sir Peter Ustinov⁸ now:

“Once we are destined to live out our lives in the prison of our mind, our duty is to furnish it well.”⁹

This was another reality.

Learning foreign languages, the world was open to us, even the information was scarce, but it was coming directly to our understanding without any other filtering system.

The intensity of the eagerness for what is forbidden (information, culture) cannot be compared with any other feeling I experienced later in my life. We had endless debates about something or other things. I remember that we were 16 years old, working in a forced labor camp, in a harsh winter crushing stones with the big hammer, and debating the problem of subatomic particles of *quarks*. We didn't understand too much of it at that time, but we were talking about what we read, we were sharing any knowledge we had. And one of our favorite working songs those days (1983) was *Message in a Bottle* by *The Police*¹⁰.

In the memory of those times:

**“Three quarks for Muster Mark!
Sure he has not got much of a bark
And sure any he has it's all beside the mark.”**

James Joyce¹¹, *Finnegans Wake*¹² – 1939¹³

**“Walked out this morning
Don't believe what I saw
A hundred billion bottles
Washed up on the shore
Seems I'm not alone at being alone
A hundred billion castaways
Looking for a home
I'll send an SOS to the world
I'll send an SOS to the world
I hope that someone gets my
I hope that someone gets my
I hope that someone gets my
Message in a bottle”¹⁴**

The Police – *Message in a bottle* – *Regatta de Blanc* – 1979, label – A&M, writer- Sting¹⁵

8 Peter Ustinov - Sir Peter Alexander Ustinov, CBE (16 April 1921– 28 March 2004) was an English actor, writer, dramatist, renowned as a film-maker, theatre and opera director, stage designer, author, screenwriter, comedian, humorist, newspaper and magazine columnist, radio broadcaster and television presenter.

9 Source: - <http://quotationsbook.com/quote/33287/#sthash.0yvv7tE9.dpbs>

10 The Police - were an English rock band; active in 1977–1986, 2007–2008 (reunion: 2003); musical genres – rock, new wave, post-punk, reggae rock .

11 James Joyce - James Augustine Aloysius Joyce (2 February 1882 – 13 January 1941) was an Irish novelist and poet, considered to be one of the most influential writers in the modernist avant-garde of the early 20th century.

12 *Finnegans Wake* is a work of comic prose by Irish writer James Joyce, significant for its experimental style and resulting reputation as one of the most difficult works of fiction in the English language.

13 Source - http://www.telelib.com/authors/J/JoyceJames/prose/finneganswake/finneganswake_0204.html

14 Source - [http://www.policefans.org/Police_wiki/index.php?title=Message_In_A_Bottle_\(song\)](http://www.policefans.org/Police_wiki/index.php?title=Message_In_A_Bottle_(song))

15 Sting - Gordon Matthew Thomas Sumner CBE (born 2 October 1951), stage name Sting, is an English musician, singer-songwriter, multi- instrumentalist, activist, actor and philanthropist.

When the communist system collapsed, what I remember best is freedom; freedom of speech, mostly. We were talking continuously about everything. They were suddenly dozens of newspapers, dozens of media broadcasters and everyone was talking. The dam was broken and the river of words was flowing down as a redemption of thoughts. The ice-shelf melted away.

Addendum 1.

What is the reading process?

“Reading is the synthesis of a complex network of perceptual and cognitive acts along a continuum from word recognition and decoding skills to comprehension and integration. Beyond the printed page, a skilled reader draws conclusions and inferences from what he or she reads (...). Both oral language and the written context play a role in word recognition and in the ability to construct meaning from print (Gillam & Gorman, 2004). Comprehension emerges from the interaction of letter, sound, word meaning, grammatical and contextual processes, and a reader's prior knowledge.

The first step is decoding the print, which consists of breaking a word into its component sounds and then blending them together to form a recognizable word. Words are then interpreted based on grammar, word meanings, and context (...).

While phonological skills are essential for decoding, other areas of language - syntax, morphology, semantics, and pragmatics - are needed for comprehension (Nation & Norbury, 2005).

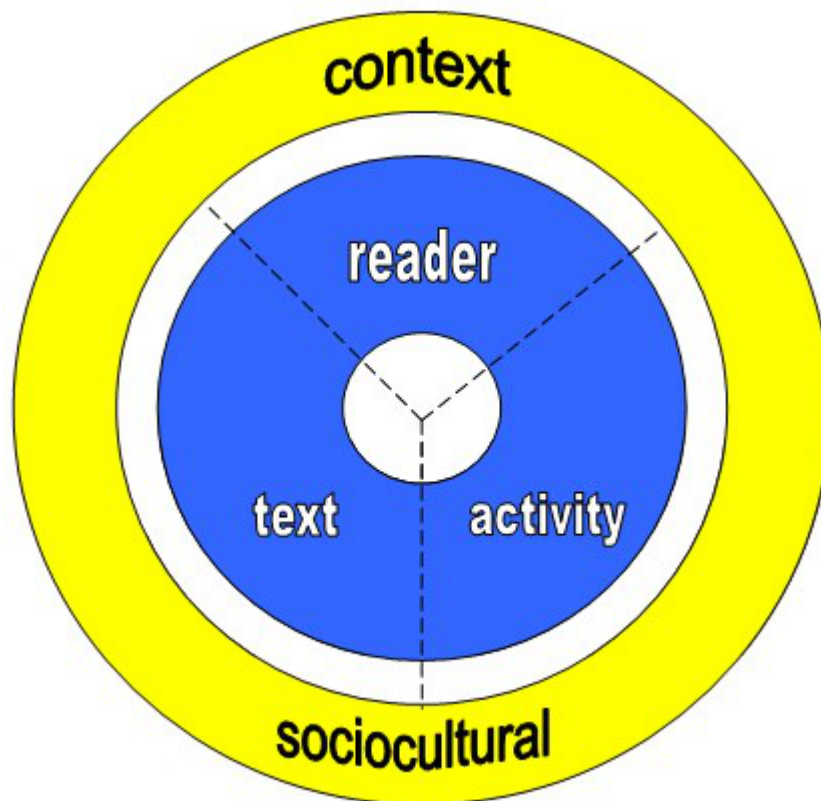
Comprehension require the active reader to be concerned with self-monitoring, semantic organization, summarization, interpretation, mental imagery, connection with prior knowledge, and metacognition of knowledge about knowledge, to name some of the skills involved.”¹⁶

Addendum 2.

Comprehension is a complex process which involves a mixture of elements depending on one another. It can be inferred from the diagram that comprehension in reading occurs as a relationship between the elements mentioned above and the

¹⁶ excerpts from article: “The Process of Reading” by R.E. Owens, jr. - Pearson Allyn Bacon Prentice Hall;
Source - <http://www.education.com/reference/article/process-reading/>

Fig. 1. - Source: Heuristic Thinking of Reading Comprehension by Rand Reading Study Group, (Snow 2002).



sociocultural context in which the reading act occurred. It leads us to the conclusion that a full comprehension may be achieved if all these parts are interwoven. It may mean that a reader should take an active part in the process by interacting with a text and also reacting and responding to it in a multifarious way. Hence, it seems to be reasonable to agree with that a text interpretation may be varied depending on readers' processing abilities and personal background knowledge(...).¹⁷

Addendum 3.

What is happening when we listen music? (and we like it)

“Does our enjoyment of music—our ability to find a sequence of sounds emotionally affecting - have some neurological basis? (...)

Dale Purves, a professor at Duke University, studied this question with his colleagues David Schwartz and Catherine Howe, and they think they might have some answers. They discovered that the sonic

¹⁷ excerpts from article: Contemporary Understanding of the Reading Process and Reading Strategies Used, by ESOL Learners While Reading a Written Discourse, by Jacek Wasilewski, Humanising Language Teaching - Year 11; Issue 4; August 2009, ISSN 1755-9715 - <http://www.hltmag.co.uk/aug09/mart02.htm>

range that matters and interests us the most is identical to the range of sounds we ourselves produce. Our ears and our brains have evolved to catch subtle nuances mainly within that range, and we hear less, or often nothing at all, outside of it. (...)

The Purves group also added to this the assumption that periodic sounds - sounds that repeat regularly - are generally indicative of living things, and are therefore more interesting to us. A sound that occurs over and over could be something to be wary of, or it could lead to a friend, or a source of food or water. We can see how these parameters and regions of interest narrow down toward an area of sounds similar to what we call music.(...)

The UCLA study proposed that our appreciation and feeling for music are deeply dependent on mirror neurons. When you watch, or even just hear, someone play an instrument, the neurons associated with the muscles required to play that instrument fire. Listening to a piano, we “feel” those hand and arm movements, and as any air guitarist will tell you, when you hear or see a scorching solo, you are “playing” it, too. (...) So, playing air guitar isn’t as weird as it sometimes seems. The UCLA group contends that all of our means of communication - auditory, musical, linguistic, visual - have motor and muscular activities at their root.”¹⁸

2.2. Anatomic – Physiological – Physical

2.2.1 The Eye and The Camera.

Eyes are organs that detect light and convert it into electro-chemical impulses in neurons.

The eye is a complex optical system which collects light from the surrounding environment. The intensity of light is regulated by a diaphragm. The eye makes the focus through an adjustable assembly of lenses and muscles. The light passes through the pupil, a hole in the diaphragm, and the result is an inverted image of the surroundings, projected on the retina, the photosensitive part of the eye. The retina converts this image into a set of electrical signals, and transmits these signals to the brain through complex neural pathways that connect the eye via the optic nerve to the visual cortex and other areas of the brain.

The camera, whatever type it is, pinhole camera, single reflex camera, digital camera or your phone camera, they follow the same principle of the eye. The light is coming into the camera, through a lens, a diaphragm and the resulting image, an inverted image of the surroundings will be recorded by the photosensitive chemical layer, or it will impress the photosensitive electronic device of a sensor.

¹⁸ excerpted from the article: “How Do Our Brains Process Music?” By David Byrne, Smithsonian magazine, October 2012 Source - <http://www.smithsonianmag.com/arts-culture/How-Do-Our-Brains-Process-Music-169360476.html#ixzz2UKF8atlB>

In my opinion, this organ, the eye, and this optical mechanical device, the camera, are the only objective components of our body, corresponding in my experiment to the camera obscura part of the installation.

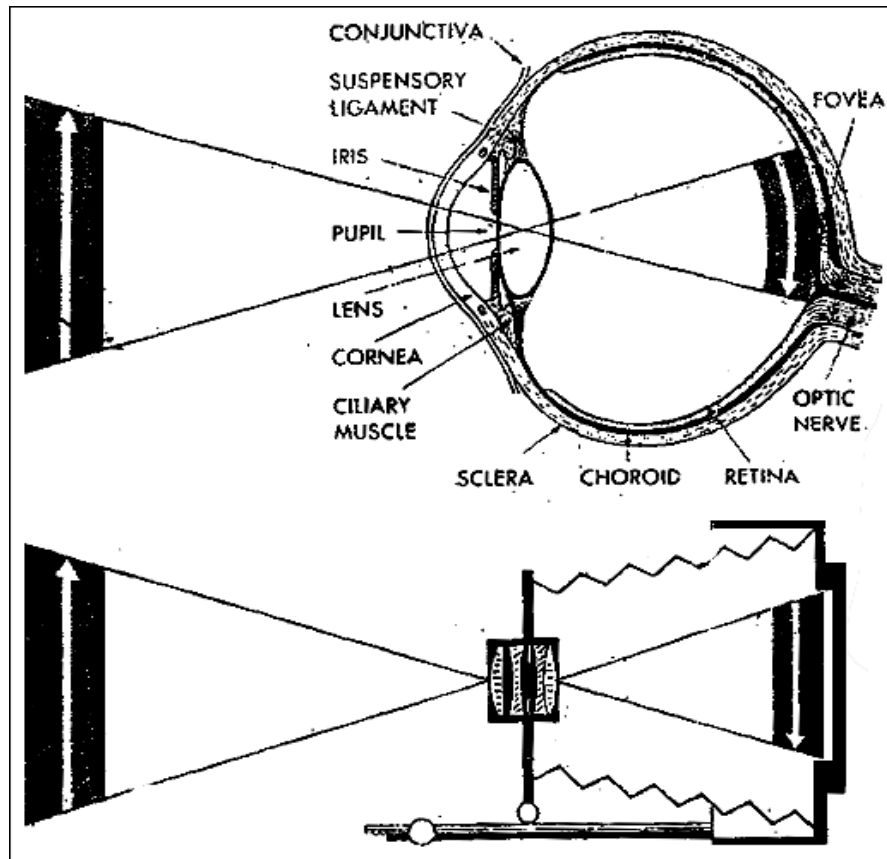


Fig. 2. The structure of the eye compared to the camera
taken from Wald, George (1953) 'Eye and Camera' in Scientific American Reader, New York, Simon and Schuster.

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Clearly, there is a similarity between the human eye, and its mechano - optical copy, the camera.

The image which impress the retina, or the sensitive chemical or electronic layer of the camera, is further interpreted by the light-sensitive layer of tissue and transformed in electrical impulses; in case of the camera it starts a chemical reaction or, in the same manner it is transformed in electrical impulses. Since this stage, we enter the territory of variables and uncertainty regarding the objectivity of information.

Nevertheless, the camera became - in a development process which took more than 2 millennia - an huge enhancement of our eyes, a prolongation of our senses, of our sight going way beyond our physical possibilities to investigate our environment, from the tiniest particles to the most distant corners of our Universe.

In terms of acquiring substance for the unknown, and giving knowledge in every imaginable aspect of our research, there is no other major contribution to Science more magnificent then this simple, humble device: the camera.

From its inception, photography has mainly been an instrument of depicting reality, as we see it. It helped to demolish the classical arts, being far more precise and faster than any painter or sketcher. This technical ability and being an inanimate object have attracted over it the anathema of many art makers or lovers. The photographer and photography were not considered artists and art. It took a long time, until the burst of the avant-garde artists of the last century womb to make its accepted entrance, along its animate sister, the cinematography, into the Arts Pantheon.

We hear over and over the question as to whether photography can be considered as its own form of Art. And we see numerous arguments that it is and that it isn't. The main objection seems to be that it is primarily a mechanical process that handles most of the work— that the photographer has nothing further to do with it, other than some technical manipulation.

I stop here with these considerations. I will continue later wishing here only to point out that photography and cinematography, as inheritors of the humble camera obscura, are today proud members, legit contributors of Science, full members of the Art exclusive club and by far the biggest disseminator of Arts, culture and information ever.

I would like to depict some of the most famous analogies between the eye and the camera.



Fig. 3. The superimposed eye, *Song 1*(1964), Stan Brakhage,

Source: <http://publishing.cdlib.org/ucpressebooks/view?docId=ft438nb2fr;chunk.id=0;doc.view=print>

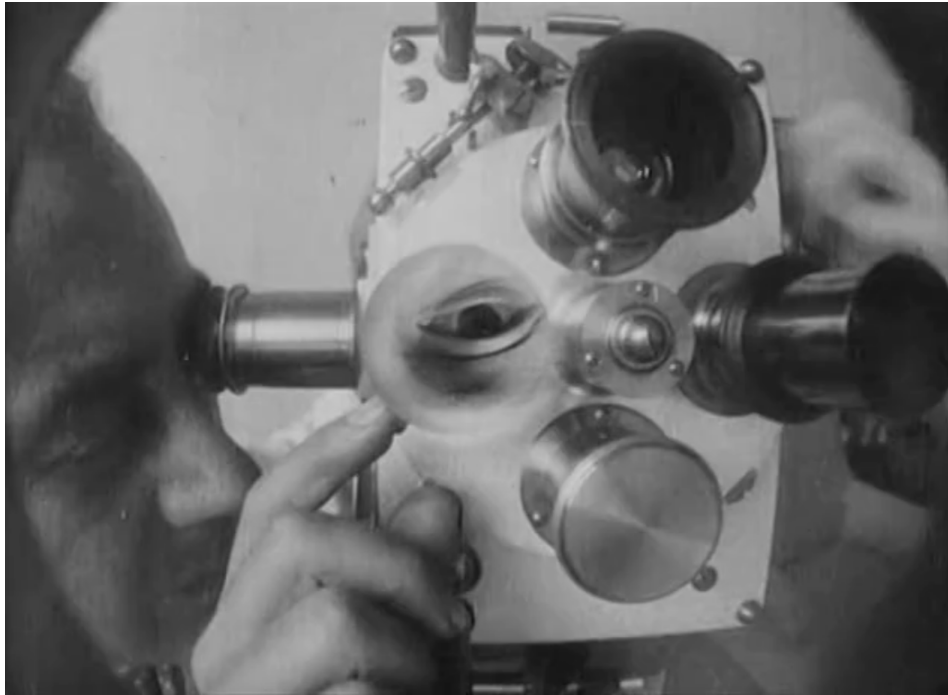


Fig. 4. The eye replaces the lens in *Emak Bakia* (1926) by Man Ray

20 21

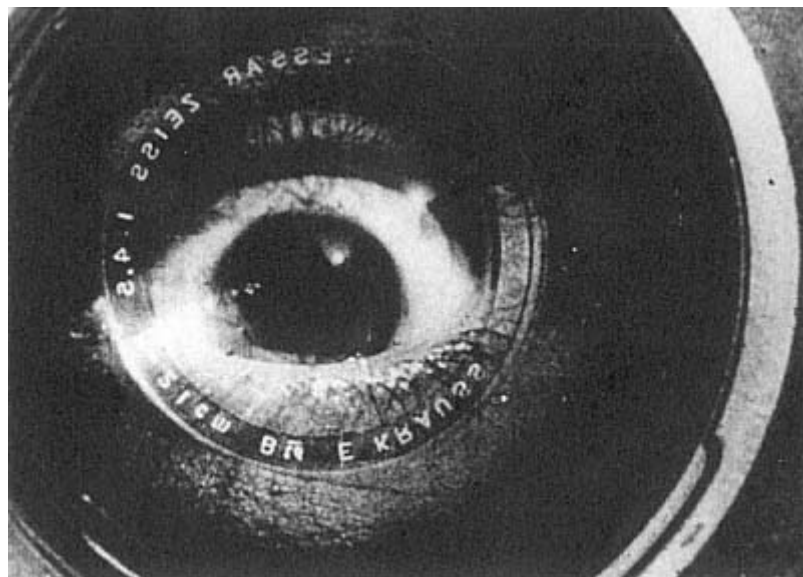


Fig. 5. The eye superimposed on lens, *Man with a movie camera* (1929) by Dziga Vertov

22 23

20 Source: <http://blackunicorn.bandcamp.com/track/emak-bakia>

21 Man Ray - Emmanuel Radnitzky, (August 27, 1890 – November 18, 1976) was an American modernist artist, main contributor to Dada and Surrealist movements, painter, avant-garde photographer, fashion and portrait photographer.

22 Dziga Vertov - David Abelevich Kaufman (2 January 1896 – 12 February 1954) Soviet pioneer documentary film, newsreel director and cinema theorist.

23 Source - <http://www.medienkunstnetz.de/works/der-mann-mit-derkamera/>

A metaphor for the power of investigation and also to the intrusive and intimacy threatening character of the camera, its power is beautifully revealed in these pictures.



Fig. 6. *Le Sang d'un Poète* (1930) ^{24 25}
Jean Cocteau

A symbolic sacrifice of the eye, the instrument of truth, the revealer, the gate to consciousness, in the surrealist film of Luis Buñuel and Salvador Dalí, *Un chien andalou*.

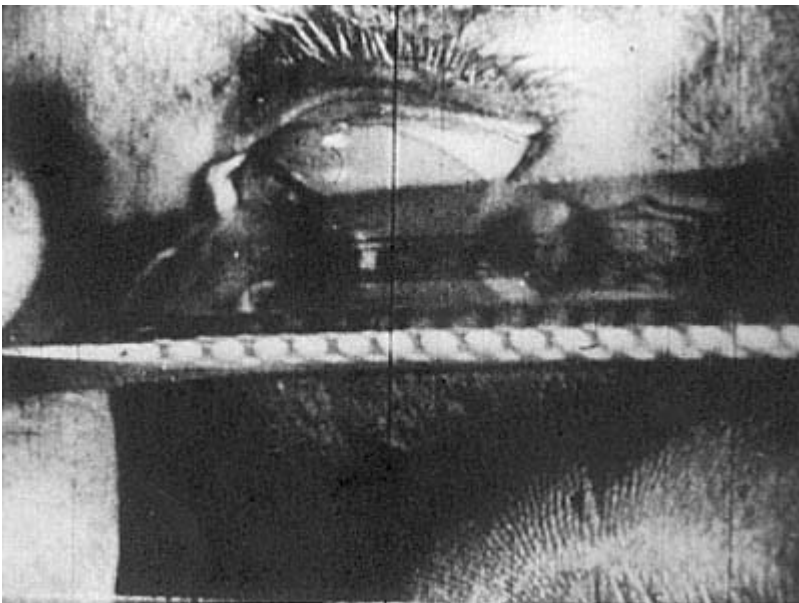


Fig. 7. *Un chien andalou* (1929) Luis ^{26 27 28}
Buñuel, Salvador Dalí

²⁴ Jean Cocteau - Jean Maurice Eugène Clément Cocteau (5 July 1889 – 11 October 1963) was a French poet, novelist, dramatist, designer, playwright, artist and filmmaker.

²⁵ Source - http://www.dvdbeaver.com/film/dvdreviews15/orphic_trilogy_dvd_review.htm

²⁶ Luis Buñuel - Luis Buñuel Portolés (22 February 1900 – 29 July 1983) was Spanish-born Mexican, French, US film-maker

²⁷ Salvador Dalí - Salvador Domingo Felipe Jacinto Dalí i Domènech, 1st Marqués de Dalí de Púbol (May 11, 1904 – January 23, 1989) prominent Spanish surrealist painter, photographer, film-maker

²⁸ Source - <http://deleuzecinemaproject1.blogspot.com/2010/05/out-vile-jelly-luis-bunuel-un-chien.html>

A short history of the lens and the camera obscura.

Addendum 4. The Lens.

“Lenses were no doubt being made soon after the art of glass-making was discovered, before about 2000 BC.

In 1998, Archaeologists discovered clear quartz discs at²⁹ Viking settlement in Sweden, dating from 700-1000 AD. These were at first thought to be jewelery, but optics specialists led by Olaf Schmidt of the University of Applied Science in Aalen, Germany, have discovered that they are, in fact, sophisticated lenses. Their shapes closely match an ellipse. The optical properties of some of them are comparable to modern lenses. Hence Vikings were making lenses hundreds of years earlier than first thought. Schmidt believes the lenses were made on a simple lathe and used for focusing sunlight to cauterise wounds and light fires.

It is interesting to note that the book 'Ancient Inventions' by Peter James and Nick Thorpe, published by Ballantine Books in 1994 contains the following information:

"Two lenses of optical quality are on display at the Heraklion Museum of Ancient Cretan Civilization. As many as fifty were reported as having been found [by Heinrich Schliemann³⁰] in the excavations of Troy, though only a handful have been properly published. Some lenses from these sites have impressive magnifying powers. One lens, probably of the fifth century BC, found in Crete, can magnify with perfect clarity up to seven times. If it is held farther away from the object viewed, it will actually magnify up to twenty times, though with considerable distortion". The earliest lenses, which were magnifying lenses of a sort, were known to the Greeks and Romans. These were glass bowls filled with water which were used as burning glasses; but their effect in showing up details was well recognized, as can be seen from a reference in Seneca³¹. The great comic dramatist, Aristophanes³², in 424 BC, mentions a similar burning glass in Act II of "Comedy of the Clouds:

STREPSIADES:

Have you ever seen a beautiful, transparent stone at the druggist's, with which you may kindle fire?

SOCRATES: You mean a crystal lens.

29 <http://news.bbc.co.uk/1/hi/sci/tech/702478.stm>

30 Heinrich Schliemann - (6 January 1822 – 26 December 1890), German businessman and a pioneer of field archaeology, the discoverer of the presumed site of ancient Troy.

31 Seneca - Lucius Annaeus Seneca (ca. 4 BC – AD 65) was a Roman Stoic philosopher, statesman, dramatist, and in one work humorist.

32 Aristophanes - (ca. 446 BC – ca. 386 BC), was a comic playwright of ancient Athens.

STREPSIADES: That's right. Well, now if I placed myself with this stone in the sun and a long way off from the clerk, while he was writing out the conviction, I could make all the wax, upon which the words were written, melt.

True glass lenses were not known in classical times; they were probably first manufactured at the end of the 13th century in Europe, and Roger Bacon's³³ name is associated with this. Bacon discussed the use of segments of spheres and showed that letters and small objects on which they are placed appear to be magnified. He commented,

"For this reason such an instrument is useful to old persons and to those with weak sight, for they can see any letter, however small, if magnified enough."

Although it has been claimed that Bacon actually invented spectacles this seems to be a myth.

The equations governing the optical properties of lenses are thought to have been devised by the French philosopher and mathematician René Descartes³⁴ in the 17th Century. But he could not find anyone skillful enough to make one.

In the 17th Century, the best manufacturers of lenses in the world were in Holland. Foremost amongst these was Anton van Leeuwenhoek (1632-1723) who made his own simple microscopes using only one lens. He became expert at making tiny lenses with strong magnifying power. Objects were mounted on the point of a pin and brought into focus of the lens by adjusting screws to the pin. Leeuwenhoek later added a second lens to produce simple 'compound microscopes' so that he has become known as the 'father of microscopy'. He was the first person able to see and describe cells and micro-organisms.

Later on, in Britain, Robert Hooke (1605-1703) improved Leeuwenhoek's design by adding a third lens behind the original two.

The technological advance in improving glass composition enabled the spectacle-maker, John Dolland (1706-1761) to manufacture small 'achromatic' telescopes. Along with the efforts of a Swiss glass-maker, Pierre Guinand (1748-1824) that allowed a significant improvement to occur. Guinand devised a process for stirring the glass whilst it was molten, and so removed the bubbles and unevenness in the mixture. This was so successful that he applied his method to the manufacture of all optical glass, and during the 19th Century he set up a works at Benediktbeuren, in Bavaria, together with a German manufacturer whose manager was Joseph von Fraunhofer

33 Roger Bacon - O.F.M. (c. 1214–1294) (scholastic accolade Doctor Mirabilis), was an English philosopher and Franciscan friar who placed considerable emphasis on the study of nature through empirical methods. He is sometimes credited, as one of the earliest advocates of the modern scientific method.

34 René Descartes - (31 March 1596 – 11 February 1650) was a French philosopher, mathematician, physicist, "father" of Modern Philosophy and analytical geometry, crucial to the discovery of infinitesimal calculus and analysis.

(1787-1826). Here, excellent optical glass was made and Fraunhofer produced, not only optical lenses, but also the facility for mounting them.

The processes used in lens manufacture have not changed essentially since the Middle Ages, except for the utilization of pitch as a polishing medium, introduced by Isaac Newton^{35 36}.

Addendum 5. Camera Obscura.

Go into a very dark room on a bright day. Make a small hole in a window cover and look at the opposite wall. What do you see? Magic! There in full colour and movement will be the world outside the window - upside down! This magic is explained by a simple law of the physical world. Light travels in a straight line and when some of the rays reflected from a bright subject pass through a small hole in thin material they do not scatter but cross and reform as an upside down image on a flat surface held parallel to the hole. This law of optics was known in ancient times.

The earliest mention of this type of device was by the Chinese philosopher Mo-Di³⁷. He formally recorded the creation of an inverted image formed by light rays passing through a pinhole into a darkened room. He called this darkened room a "collecting place" or the "locked treasure room."



Fig. 8. A picture of a sun eclipse where it can be seen the camera obscura effect due to the tree leaves

Source: [en.wikipedia.org/wiki/](https://en.wikipedia.org/wiki/File:IMG_1650_zonsverduistering_Malta)

File:IMG_1650_zonsverduistering_Malta

Aristotle³⁸ understood the optical principle of the camera obscura. He viewed the crescent shape of a partially eclipsed sun projected on the ground through the holes in a sieve, and the gaps between leaves of a plane tree.

³⁵ Isaac Newton - Sir Isaac Newton PRS MP (25 December 1642 – 20 March 1727) was an English physicist and mathematician who is widely regarded as one of the most influential scientists of all time and as a key figure in the scientific revolution.

³⁶ Excerpts and interpretation from the "The Ages of Science", Colin A. Ronan. Harrap, London (1966)

³⁷ Mo Di (pinyin: Mòzǐ; Wade-Giles system: Mo Tzu, Lat. as Micus, ca. 470 BC – ca. 391 BC), original name Mo Di, was a Chinese philosopher during the Hundred Schools of Thought period

³⁸ Aristotle - (384 B – 322 BC) was a Greek philosopher and polymath. His writings cover many subjects, including physics, metaphysics, poetry, theater, music, logic, rhetoric, linguistics, politics, government, ethics, biology, and zoology. Aristotle is one of the most important founding figures in Western philosophy.

The Islamic scholar and scientist Alhazen³⁹ gave a full account of the principle including experiments with five lanterns outside a room with a small hole.

In 1490 Leonardo Da Vinci⁴⁰ gave two clear descriptions of the camera obscura in his notebooks. Many of the first camera obscuras were large rooms like that illustrated by the Dutch scientist Reinerus Gemma-Frisius⁴¹ in 1544 for use in observing a solar eclipse.

The image quality was improved with the addition of a convex lens into the aperture in the 16th century and the later addition of a mirror to reflect the image down onto a viewing surface. Giovanni Battista Della Porta⁴² in his 1558 book *Magiae Naturalis* recommended the use of this device as an aid for drawing for artists.

The term "camera obscura" was first used by the German astronomer Johannes Kepler⁴³ in the early 17th century. He used it for astronomical applications and had a portable tent camera for surveying in Upper Austria.

The development of the camera obscura took two tracks.

One track became the camera obscura room, a combination of education, entertainment and a safe way to observe sun eclipses.

The other one led to the portable box device that was a drawing tool. In the 17th and 18th century many artists were aided by the use of the camera obscura. Jan Vermeer⁴⁴ or Canaletto⁴⁵ are representative of this group. By the beginning of the 19th century the camera obscura was ready with little or no modification to accept a sheet of light sensitive material to become the photographic camera.

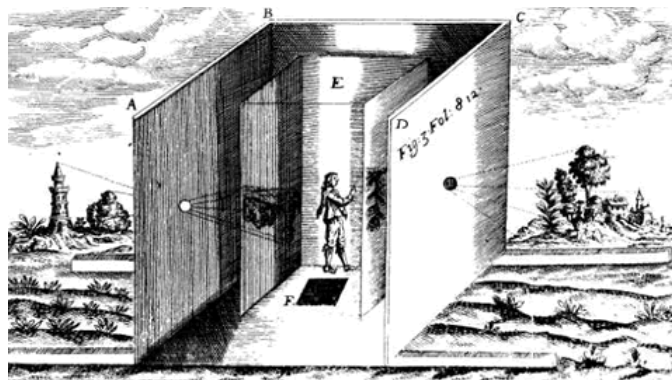


Fig. 9. Example of the usage of Camera Obscura

Source:
<http://thelightsofseeing.blogspot.co.at/2010/10/pinhole-photography-and-camera-obscura.html>

39 Abū 'Alī al-Ḥasan ibn al-Ḥasan ibn al-Haytham - Latinized: Alhacen or Alhazen (965 – 1040 in Cairo) was a Muslim scientist, polymath, mathematician, astronomer and philosopher

40 Leonardo di ser Piero da Vinci (April 15, 1452 – May 2, 1519) was an Italian Renaissance polymath: painter, sculptor, architect, musician, mathematician, engineer, inventor, anatomist, geologist, cartographer, botanist, and writer

41 Gemma Frisius - (Jemme Reinerszoon – Dec. 9, 1508 – May 25, 1555), was a physician, mathematician, cartographer, philosopher, and instrument maker

42 Giambattista della Porta - (1535?– 4 February 1615), was an Italian scholar, polymath and playwright

43 Johannes Kepler - (December 27, 1571 – November 15, 1630) was a German mathematician, astronomer and astrologer.

44 Jan Vermeer - (1632 – December 1675) was of the greatest painter of the Baroque Dutch Golden Age.

45 Giovanni Antonio Canal (17 or 18 October 1697 – 19 April 1768) - Italian painter of landscapes of Venice, also a printmaker in etching.

“It is impossible to express the beauty in words. The art of painting is dead,
for this is life itself, or something higher, if we could find a word for it.”

*Constantijn Huygens*⁴⁶, after seeing an image in a camera obscura (1622).

2.2.2 The Retina. The sensor.

In this sub-chapter I will try to explain the similarities between the twophysical parts of the eye, respectively the camera. There are huge differences besides the analogies.

Retina is a light-sensitive layer of tissue, lining the inner surface of the eye. The optics of the eye create an image of the visual world on the retina, which serves much the same function as the film or digital sensor in a camera. Light striking the retina initiates a cascade of chemical and electrical events that ultimately trigger nerve impulses. These are sent to various visual centers of the brain through the fibers of the optic nerve. Further on I will refer only to the digital sensor of a modern camera. This is much closer to the way retina works than film.

To understand the complexity of retina, beyond this simple description, I cite Prof. Dr. rer. nat. Thomas Euler, one of the researchers in retinal physiology, from the Institute of Ophthalmic Research of University of Tübingen, pioneers of, by short, electronic chip subretineal implant:

“Visual information processing occupies a substantial part of our brain. It starts in the retina, which not only converts the incoming stream of photons into electrical signals, but also performs a first analysis of the observed scene. The retina extracts information such as contrast, brightness and „colour”, as well as more complex stimulus features, including edges, motion and its direction. Even some initial clues about object segregation may be computed in the retina. In short, the retina is a sophisticated image processor. The retina’s processing capabilities depend on about 70 types of neurons organized in various microcircuits.(...)”⁴⁷

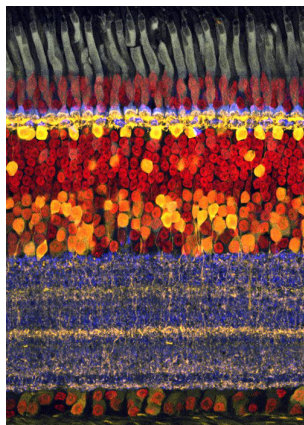


Fig. 10. Vertical section of a chick retina 400x

<http://mypretypinkpearl.blogspot.co.at/2009/04/small-world-competition.html>

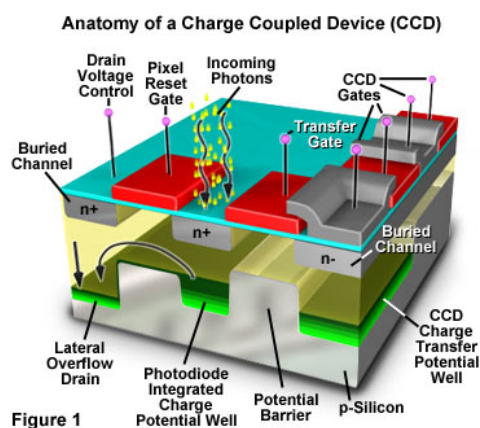


Fig. 11.

Source: <http://www.olympusmicro.com/primer/digitalimaging/concepts/ccdanatomy.html>

⁴⁶ Constantijn Huygens, Jr. - (1628–1697) was a Dutch statesman also known for his work on scientific instruments (sometimes in conjunction with his younger brother Christiaan Huygens)

⁴⁷ Source: <http://www.eyn.uni-tuebingen.de/ophthalmic-research-group>

An image sensor is a device that converts an optical image into an electronic signal. It is used mostly in digital cameras, camera modules and other imaging devices. Today, the most currently used sensors are *digital charge-coupled device* (CCD) or *complementary metal–oxide–semiconductor* (CMOS) active pixel sensors. Each cell of an CCD image sensor is an analogue device. When light strikes the chip it is held as a small electrical charge in each photo sensor. The charges are converted to voltage one pixel at a time as they are read from the chip. Additional circuitry in the camera converts the voltage into digital information. A CMOS imaging chip is a type of active pixel sensor made using the CMOS semiconductor process. Extra circuitry next to each photo sensor converts the light energy to a voltage. Additional circuitry on the chip may be included to convert the voltage to digital data. Neither technology has a clear advantage in image quality.

But also there are similarities, at least superficially:

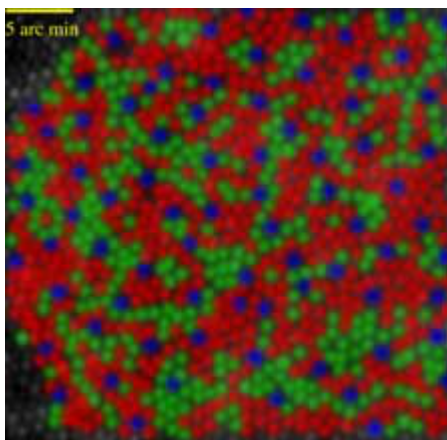


Fig. 12. Distribution of cones in a primate retina

Source: <http://metamerist.blogspot.co.at/2008/05/retina-vs-ccd.html>

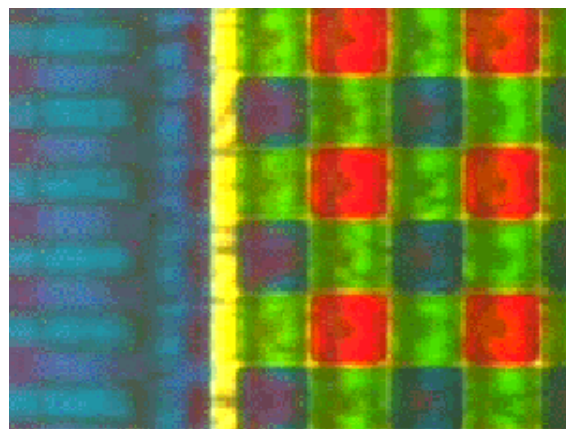


Fig. 13. CCD image sensor Bayer pattern

Source: <http://www.siliconimaging.com/RGB%20Bayer.htm>

Continuing with the comparison between a human eye and a camera, in this case a photographic camera, I do not wish to go further without analysing two aspects which are very common to any photographer, especially today, when the “pixel war” is in full development. They are the resolution power of the human eye and which is the “normal” focal length of a lens: 35 mm or 50 mm?

Actually this problem of the “normal” focal length is very related to the theme of this work. The “normal” focal length is supposed to deliver photographs which are closest to the reality as we perceive it.

According to the *Magill's Medical Guide Revised Edition*; (Brain. Salem Press, 1998: 608), the human eye measures about 24.5 mm from the front to back. So all the light that enters the human eye, has less than 24.5mm to converge to a focus. That is, parallel light rays, have less than 24.5mm to converge to a point. So the human eye's focal length, has to be less than, or equal to, 24.5mm⁴⁸.

48 Survey of optical systems - University of Virginia - <http://galileo.phys.virginia.edu/classes/531.cas8m.fall04/111.pdf>

To understand the focal length, we must first understand what the diopter value of the eye is.

Diopter value refers to the refractive power of a lens. The refractive power of a lens, ability of a material to bend light, depends on the curvature of the lens.

A “1 diopter lens” will focus (parallel) light from infinity at a distance of 1 meter behind the lens.

$$\text{Diopter} = 1 \text{ meter} / (\text{Focal Length})$$

or

$$\text{Focal Length} = 1 \text{ meter} / \text{Diopter Value}$$

The human eye generally has a diopter value of 58 or 59.

$$\text{Focal length} = 1 \text{ meter} / 58 = 1000\text{mm} / 58 = 17,24\text{mm}$$

If the diopter value was 59,

$$\text{Focal length} = 1 \text{ meter} / 59 = 1000\text{mm} / 59 = 16,9\text{mm}$$

Since we know the approximate focal length and the diameter of the pupil, its relatively easy to calculate the aperture (f-stop) of the eye. Given a 17mm focal length and an 8mm pupil the eyeball should function as an f/2.1 lens. If we use the 24mm focal length and 8mm pupil, it should be f/3.5. There have actually been a number of studies done in astronomy to actually measure the f-stop of the human eye, and the measured number comes out to be f/3.2 to f/3.5⁴⁹.

The f stop is denoted as f/(diameter), where f is the focal length.

If the pupil has the maximum diameter of 8 mm

$$f\text{ratio} = 24,5/8 = 3,1$$

If the pupil has the minimum aperture of 2

$$f\text{ratio} = 24,5/2 = 12,25$$

So, our human eye f stop corresponds to an opening (in photographic terms) between 1/3,5 – 1/11.

If the focal length of the eye is 17 or 24mm, why is everyone arguing about whether 35mm or 50mm lenses are the same field of view as the human eye?

The reason is that the the measured focal length of the eye isn't what determines the angle of view of human vision. The area of main vision is called the cone of visual attention, the rest of what we see is “peripheral vision”. The cone of visual attention is found to be about 55 degrees wide⁵⁰. On a 35mm full frame camera, a 43mm lens provides an angle of view of 55 degrees, so that focal length provides exactly the same angle of view that we humans have.

So, the actual “normal” lens on a 35mmSLR is neither 35mm nor 50mm, its halfway in between. Like always, the truth is always somewhere in between!

49 Middleton, Vision Through the Atmosphere, U. Toronto Press, Toronto, 1958

50 <http://www.photosig.com/articles/585/article>

The retina is almost the same size (32mm in diameter) as the sensor on a full frame camera (35mm in diameter). After that, though, almost everything is different.

The first difference between the retina and your camera's sensor is rather obvious – the retina is curved along the back surface of the eyeball, not flat like the silicone sensor in the camera. The curvature has an obvious advantage: the edges of the retina are about the same distance from the lens as the centre. On a flat sensor the edges are further away from the lens, and the centre closer. Advantage retina, it should have better “corner sharpness”.

The human eye also has a lot more pixels than your camera, about 130 million pixels⁵¹. However, only about 6 million of the eye's pixels are cones (which see color), the remaining 124 million just see black and white. But if we look further the differences become even more pronounced.

On a camera sensor each pixel is set out in a regular grid pattern. Every square millimetre of the sensor has exactly the same number and pattern of pixels. On the retina there's a small central area, about 6mm across (the macula) that contains the densest concentration of photo receptors in the eye. The central portion of the macula (the fovea) is densely packed with only cone (colour sensing) cells. The rest of the macula around this central “colour only” area contains both rods and cones. The macula contains about 150,000 “pixels” in each 1mm square and provides our “central vision”. Anyway, the central part of our visual field has far more resolving ability than even the best camera.

A comparison with a camera with the same resolution would be with *PowerPhase FX/FX+* which is a line scanner. This scanner is a tethered digital scan back. Its sensor is 12,600 steps x 10,500 pixels size, which gives it a resolution of 132 Mpx. Its speed is up to 240MB/minute! Our eye is receiving and our brain process much more than that in a continuous manner dozens of times per second, hour by hour, year by year, decades by decades!

I will continue in the next chapter discussing what happens with the impulses from the retina, but in the previous phrase we just realized that the human eye cannot be compared fully with a photo camera, just anatomically, because our eye actually acts like a movie camera, or better saying like a TV camera in a continuous broadcast.

2.3. 2D. 3D.

2D, as we know, is a bi-dimensional space. We can call it a geometric model of the planar projection of the physical universe in which we live. It has only the two dimensions which commonly are called length and width. Both directions lie in the same plane. This is the territory of photographic pictures, paints, cinematography, and so on, any type of media which is based on a screen or a projection or a piece of paper.

3D means three-dimensional, as we all know, and this acronym has become nowadays a word in itself (I will use this term mainly further on) something that has width, height and depth (length). Our physical environment is three-dimensional and we move around in 3D every day.

Humans are able to perceive the spatial relationship between objects just by looking at them because we have a so-called 3D perception, also known as depth perception. As we look around, the retina in each eye forms a 2D (two-dimensional) image of our surroundings and our brain processes these two images into a stereoscopic visual experience. Actually, there is a long debate about if we, the humans, really see 3D or not. I will explain briefly the main tendencies in considering the three dimensionality of human view.

51 <http://webvision.med.utah.edu/>

However it is important to note that having vision in both eyes (stereoscopic or binocular vision) is not the only way to see in 3D. People who can only see with one eye (stereo-blindness) can still perceive the world in 3D, and may even be unaware that they are stereo blind. They are simply missing one of the tools to see in 3D, so they rely on others without thinking about it.

Stereo-blindness is the inability to see in 3D using stereo vision, resulting in an inability to perceive stereoscopic depth, by combining and comparing images from the two eyes.

This is my case, as I explained previously, I can't see concomitant with my both eyes, my brain is choosing which one of the view is more important for its purposes.

Addendum 6.

It has been suggested that Dutch Master Rembrandt may have been stereo blind, which would have aided him in flattening what he saw for the production of 2D works. Scientists have suggested that more artists seem to have stereo-blindness when compared with a sample of people with stereo-acuteness (normal stereo vision).⁵²

Addendum 7.

Here under is a simple test in the form of a black circle you have to focus on:

The test



1. The above black circle displayed on the paper (right angle to the eye)

⁵² Excerpts from the article <http://en.wikipedia.org/wiki/Stereoblindness>

some 60 cm from your nose, one finger, and both of your eyes!

2. Place the finger vertically at half distance between your eyes and the black circle;
3. Focus on the circle. What you see should be similar to picture 1 here under;
4. Then focus on your finger. What you see should be similar to picture 2 here under.

If you perceive both situations as described, your stereo vision is OK. If not, then you are stereo-blind.

In case of bad or absent depth perception, you see only one of the two fingers in the first case and/or one of the two circles in the second case. Sometimes, you just feel a blur change on the silhouette of the finger or the edges of the circle but you don't perceive a really visible difference between both situations. Anyway, stereo-blindness is not always impossible to cure.⁵³



Fig. 14. picture 1



Fig. 15. picture 2

Addendum 8.

Three views about the debate if we have or not a 3D vision

Issue 1: Humans do not have 3D vision

We have 2 eyes both of which see a 2D image. The combination of two lenses a marginal distance apart gives us depth perception; this gives us an illusion of 3D vision; if we had true 3D vision then we could see the "back" of the object we were looking at.

Issue 2: Humans absolutely do have 3D vision and the fact that they have 2 eyes has no bearing on 2D vs. 3D.

Humans can see three separate dimensions, length, width, and depth (though they infer this depth from the dissonance between the other two

⁵³ <http://www.stereoscopynews.com/hotnews/3d-technology/physiological-effects/2275-are-you-stereo-blind.html>

images). Depth perception occurs at about 6 months of age (sometimes sooner). If you are looking into a room, you can see the back of the room as well as the L x W dimensions. And yes, we can see the back of an object as long as the surface is transparent or translucent.

Issue 3: Humans do not have 3D vision.

Seeing in 3D does not mean you can see the back of an object. If you were to have 3D vision then you would be able to know the length of how far back something goes without using any of the attributes given off of 3D objects (shadows, seeing the curvature due to each eye having a different type of lens, etc.). For example look at the closest wall to you, without any other knowledge but what comes from looking at it, how far back does it go? What if it is transparent? Go to a glass box, sit down next to it, and without using information given from the attributes given off by 3D objects figure out how far back it goes. You can't.

All your seeing is an image produced by signals in your brain. It's like a TV that allow you to see things in "3D" because they have both types of lenses your eyes have. It looks 3D, but take the picture, and then look at the screen, is the image on the screen 2D or 3D? 2D, that is exactly how humans see things.⁵⁴

2.4. The interpreter.

I am not a specialist, nor a scientist in any of these fields, so I give credits to the shared knowledge of the real scientists. It's really interesting the way how images are formed in our brain. They "take shape" in a very elaborate process.

2.4.1 The physiology of seeing.

As a reminder, eyes are organs that detect light and convert it into electric-chemical impulses in neurons. The eye is a complex optical system which collects light from the surrounding environment, regulates its intensity through a diaphragm, focuses it through an adjustable assembly of lenses to form an image, converts this image into a set of electrical signals, and transmits these signals to the brain through complex neural pathways that connect the eye via the optic nerve to the visual cortex and other areas of the brain.

What about the camera? By now, we realize that is only a not so perfect copy of our sight organ, the eye. The camera collects the images, but also has to do something with them. In the case of chemical processes, the analogue film – the most used until now, either we are talking about still or moving photographs, the process of decision making it is in the hands of the human manipulator. He have to decide the type of film, the sensitivity, even the speed of filming for example. But what about

⁵⁴ Excerpts from the article http://wiki.answers.com/Q/Do_humans_have_2D_or_3D_vision

the digital cameras, because this is our subject of comparison? Well, this domain is really a mystery, the companies have not much information to share with the general public about the processes which take place in their cameras. We know, generally, that cameras have small processors which are the brains of these machines, and are the container for the secrets of the image-making. Their software make decisions regarding exposure, aperture, sensitivity, colours and all the other ingredients which combined give result to images.

I make again a comparison: they seem to be acting like the automatic systems which govern our own sense of sight, when our *lateral geniculate nucleus*, for example, takes decisions out of our consciousness.

Each time you take a picture millions of calculations have to be made in just a few seconds. It's these calculations that make it possible for the camera to interpolate, preview, capture, compress, filter, store, transfer, and display the image. All of these calculations are performed in the camera by an image processor that's similar to the one in your desktop computer, but dedicated to this single task. How well your processor performs its functions is critical to the quality of your images but it's hard to evaluate advertising claims about these devices. To most of us these processors are mysterious black boxes about which advertisers can say anything they want.

The proof is in the pictures.

Cameras with the latest programmable digital media processors can perform functions that camera companies program them for. Currently these functions include in-camera photo editing and special effects such as red-eye removal, image enhancement, picture borders, stitching together panoramas, removing blur caused by camera shake, and much more.⁵⁵

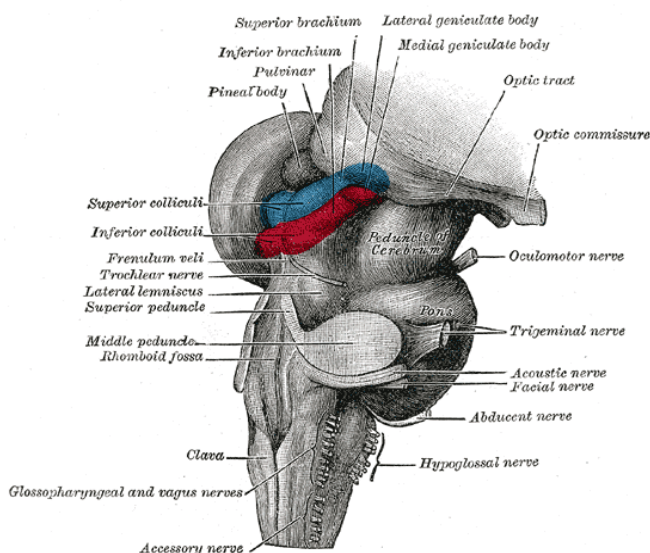


Fig. 16. Lateral geniculate nucleus

Source: <https://sites.google.com/site/etr929/lateralgeniculatenucleus>



Fig. 17. Camera processor

Source: <http://www.reddotphoto.com.sg/content.php/274>

⁵⁵ Excerpts from University of Connecticut article <http://www.gifted.uconn.edu/siegle/honorseminar/howworks.html>

The advantages of the human eye compared to the camera get reduced a bit as we leave the retina and travel back toward the brain. The camera sends every pixel's data from the sensor to a computer chip for processing into an image. The eye has 130 million sensors in the retina, but the optic nerve that carries those sensor's signals to the brain has only 1.2 million fibers, so less than 10% of the retina's data is passed on to the brain at any given instant. (Partly this is because the chemical light sensors in the retina take a while to "recharge" after being stimulated. Partly because the brain couldn't process that much information anyway).

The brain processes the signals differently than a photography camera. The eye is sending the brain a constant feed video which is being processed into what we see. The *lateral geniculate nucleus* compares the signals from both eyes, assembles the most important parts into 3D images, and sends them on to the conscious part of the brain for image recognition and further processing. The subconscious brain also sends signals to the eye, moving the eyeball slightly in a scanning pattern so that the sharp vision of the macula moves across an object of interest. Over a few split seconds the eye actually sends multiple images, and the brain processes them into a more complete and detailed image.

The subconscious brain also rejects a lot of the incoming data sending only a small fraction of it on to the conscious brain.

The brain isn't done when the image has reached the conscious part (visual cortex). This area connects strongly with the memory portions of the brain allowing you to "recognize" objects in the image. We've all experienced that moment when we see something, but don't recognize what it is for a second or two. After we've recognized it, we wonder why it wasn't obvious immediately. Its because it took the brain a split second to access the memory files for image recognition.

In reality (and this is very obvious) human vision is video, not photography. Even when staring at a photograph, the brain is taking multiple 'snapshots' as it moves the centre of focus over the picture, stacking and assembling them into the final image we perceive. Look at a photograph for a few minutes and you'll realize that subconsciously your eye has drifted over the picture, getting an overview of the image, focusing in on details here and there, after a few seconds realizing some things about it that weren't obvious at first glance.⁵⁶

2.4.2 Vision. Cognition.

Visual perception is the ability to interpret the surrounding environment by processing information that is contained in visible light. The resulting perception is also known as eyesight, sight, or vision.

Conscious visual experience is thought to be based on activity in visual areas of cerebral cortex, which receive input from the retina. Perception is actually much more complex than a simple topographical representation of the visual world. Its primary goal is to recover the features of external objects - a process termed unconscious inference by von Helmholtz⁵⁷. What we see is actually more than what is imaged on the retina. For example, we perceive a three-dimensional world full of objects despite the fact that there is a simple two-dimensional image on each retina. In general, a particular retinal image may correspond to more than one object. For example, a circular patch of light on the retina

⁵⁶ Excerpts from the article <http://www.lensrentals.com/blog/2009/03/the-camera-vs-the-eye>

⁵⁷ von Helmholtz H(1909/1910) *Handbuch der Physiologische Optik* (Leipzig, Hamburg, Germany) ; Southall J P C, ed(1962) *Helmholtz' Treatise on Physiological Optics* (Dover, New York).

could result from viewing a cylinder on end or a round ball from any perspective. Thus perception is inevitably an ambiguity-solving process. The perceptual system generally reaches the most plausible global interpretation of the retinal input by integrating local cues.⁵⁸

Addendum 9.

(...) mental images themselves had many of the properties of visual stimuli—and in particular that they possessed metrical spatial properties, such as size and inter-object distances.

The consensus that soon emerged was that mental images were very similar to real visual stimuli, except that they were generated by the mind instead of by stimulation of the retina. One influential view took the form of a “Cathode Ray Tube” (or CRT) metaphor, in which an image was assumed to be projected onto a mental “display” that was then perceived by the visual system (Kosslyn, Pinker, Smith, & Shwartz, 1979).

Another view suggested that imaginal memory could “feed into” the visual system at various levels - from the earliest stages of vision to later conceptual stages (Finke, 1980).

Yet a third suggested that because imagery and vision use some of the same mechanisms, imaging bears a “second order isomorphism” to the similarity of patterns arising from vision (Shepard and Chipman, 1970). A common recurring theme is that cognition can draw a “picture” that it can then “re-perceive” —(...) it is assumed that imagery and vision use the same inner display.⁵⁹

Addendum 10.

“What does it mean, to see? The plain man's answer (and Aristotle's too) would be, to know what is where by looking. In other words, vision is the process of discovering from images what is present in the world, and where it is.

Vision is therefore, first and foremost, an information-processing task, but we cannot think of it just as a process. For if we are capable of knowing what is where in the world, our brains must somehow be capable of representing this information. In its all profusion of color and form, beauty, motion and detail. The study of vision must therefore include not only the study how to extract from images the various aspects of the world that are useful to us, but

58 From What visual perception tells us about mind and brain, by Shinsuke Shimojo, Michael Paradiso, and Ichiro Fujita; Proceedings of National Academy of Sciences of the United States of America - <http://www.pnas.org/content/98/22/12340.full>

59 excerpts from article: Pylyshyn: Mental Imagery (Entry in The Oxford Companion to the Mind, Second Edition - Source: <http://rucss.rutgers.edu/faculty/pylyshyn/ocm.pdf>

also an inquiry into the nature of the internal representations by which we capture this information and thus make it available as a basis for decisions about our thoughts and actions. This duality —the representation and the processing of information —lies at the heart of most information —processing task.

The need to understand information-processing tasks and machines had arisen only quite recently. Until people began to dream of and then to build such machines, there was no very pressing need to think deeply about them.(...) Most of the phenomena that are central to us as human beings —the mysteries of life and evolution, of perception and feeling and thought —are primarily phenomena of information processing, and if we are ever to understand them fully, our thinking about them must include this perspective(...).

The fundamental point of view is that in order to understand a device that performs an information processing task, one needs many different kinds of explanations.(...)

To understand a computer (any machine, a camera, for example, n.r.) one has to study that computer. To understand an information processing task, one has to study that information-processing task. To understand fully a particular machine carrying out a particular information-processing task, one has to do both. Neither alone will suffice.”⁶⁰

2.4.3 Filters of reality

Sensors, Filters, and the Source of Reality⁶¹

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⁶⁰ Marr, David, *Vision: A Computational Investigation into the Human Representation and Processing of Visual Information*, pp 3-5, Henry Holt and Co., Inc. New York, NY, USA ©1982 ISBN:0716715678

⁶¹ *Journal of Scientific Exploration*, Vol. 18, No. 4, pp. 547–570, 2004 0892-3310/04, R. G. Jahn & B. J. Dunne, *Sensors, Filters, and the Source of Reality*, pp 547-550.

“... *Celestial light,*

Shine inward, and the mind through all her powers

Irradiate; there plant eyes; all mist from thence

Purge and disperse, that I may see and tell

Of things invisible to mortal sight.”

John Milton^{62 63}

(...)At birth, that tiny portion of the boundless, timeless spirit of all existence that defines our personal identity takes residence for one mortal span in a physical corpus we call the human body, which is given to us to experience, explore, and influence a sensible surround we call the world. That corpus, like the spacecraft and submersible vehicles with which we explore the physical environments of space and sea, has locomotive and manipulative capacities, and is equipped with an array of physiological sensors that can acquire specific forms of information about the environment in which it is functioning. It also possesses a neurological grid and control center, called the brain, which can be trained to interpret the signals generated by these sensors, and to activate there from appropriate responses. It is primarily via these channels of experience and response that we endeavour to infer, either intuitively or analytically, composite functional models of our world and of ourselves on which to base our subsequent behaviour.

The biophysical architectures and the neurological and biochemical processes by which these sensors and channels execute their respective functions have been broadly and deeply studied, and are sufficiently well understood that their maintenance, protection, healing, and enhancement can be profitably practiced, but considerably less insight has been achieved regarding their roles in establishing the subjective qualities of life. It is well recognized that these

physiological sensors have limited ranges of sensitivity, and thus ignore major segments of their corresponding stimulation spectra. Human eyes perceive only the narrow band of electromagnetic radiation from 400 to 700 nanometers in wavelength, and are oblivious to the much more extensive infrared and ultraviolet domains that border it. Our ears respond only to a similarly narrow range of acoustic frequencies, beyond which lie

62 Milton, J. (1909–14). *Paradise Lost: The Third Book*. The Harvard Classics.

63 John Milton (9 December 1608 – 8 November 1674) was an English poet, polemicist, a scholarly man of letters, and a civil servant for the Commonwealth of England under Oliver Cromwell.

imperceptible infrasonic and ultrasonic realms of the same form of physical oscillations. Our taste, smell, and sense of touch likewise are sensitive only to tiny portions of their potential physical or chemical informants. Whereas we have become technically adept at artificially extending these ranges of information access via a host of optical, electrical, and mechanical devices, our brains must then translate their outputs into extrapolations of our physiological sensitivities to effectuate their utility.

We also have developed an armamentarium of equipment to amplify and refine the incoming signals for both the natural and artificially extended sensory capacities: telescopes, microscopes, hearing aids, photographic facilities, radio and television technologies, seismographs, etc. While all serve to enhance our experience of the physical world, here again our brains must execute additional steps of recognition and logic if we are to benefit from them.

More salient to our thesis here, however, is the acknowledgment that other, more subtle mechanisms for acquisition of information, such as intuition, instinct, inspiration, and various other psychical modalities, also can enhance the flux of incoming information. Although commonly experienced, these channels involve less readily identifiable sensors and therefore are less susceptible to orderly reasoning, and they are correspondingly less respected and utilized in modern scientific practice, traditional education, and contemporary social activity. In the extreme materialistic view, this imbalance extends to total dismissal of these subtler capacities, thus restricting experience to the five primary sensory capabilities and their technological extensions alone.

Consequently, the inferred models of reality are limited to those substances, processes, and sources of information that constitute conventional contemporary science.

(...) there exists a much deeper and more extensive source of reality, which is largely insulated from direct human experience, representation, or even comprehension.

It is a domain that has long been posited and contemplated by metaphysicians and theologians, Jungian and Jamesian psychologists, philosophers of science, and a few contemporary progressive theoretical physicists, all struggling to grasp and to represent its essence and its function. A variety of provincial labels have been applied, such as "Tao," "Qi," "prana," "void," "Akashic record," "Unus Mundi," "unknowable substratum," "terra incognita," "archetypal field," "hidden order,"

“aboriginal sensible muchness,” “implicate order,” “zero-point vacuum,” “ontic (or ontological) level,” “undivided timeless primordial reality,” among many others, none of which fully captures the sublimely elusive nature of this domain. (...) for our present purposes we shall henceforth refer to it simply as the “Source.”

In similar spirit, we also reject the popular presumption that all modes of human information processing are completely executed within the physiological brain, and that all experiential sensations are epiphenomena of the biophysical and biochemical states thereof. Rather, we shall regard the brain as a neurologically localized utility that serves a much more extended “mind,” or “psyche,” or “consciousness” that far transcends the brain in its capacity, range, endurance, and subtlety of operation, and that is far more sophisticated than a mere antenna for information acquisition, or a silo for its storage. In fact, we shall contend that it is the ultimate organizing principle of the universe, creating reality through its ongoing dialogue with the unstructured potentiality of the Source. In short, we subscribe to the assertion of Arthur Eddington nearly a century ago:

“Not once in the dim past, but continuously, by conscious mind is the miracle of the Creation wrought”.

By whatever names we label these two primary poles of the information dialogue, it is our contention that the highly selective group of experiential channels based in our five physiological senses allows only very limited communication between them, so that via these narrow, cloudy windows in our Source-faring capsule consciousness can obtain only petty glimpses of the grand complexity and scope of its ultimate environment, and correspondingly petty reflections of itself. Like the fabled blind men examining the elephant, our experience of the world and of ourselves is severely circumscribed by our observational inadequacies, yet it is on the basis of these shallow specifications that we presume to construct correspondingly limited models of our environment and of our cogent minds. Worse yet, these impoverished models, their concepts and terminology,) are then allowed to constrict further our channels of incoming information, by constraining our experiential data, their interpretations, and our responses, to conform to such authoritarian constructs of “reality” and the expectations they engender. This composite dilution of experience we shall henceforth refer to as “filters.” (Figure 18 displays one of several possible geometrical representations of this conceptual situation.)

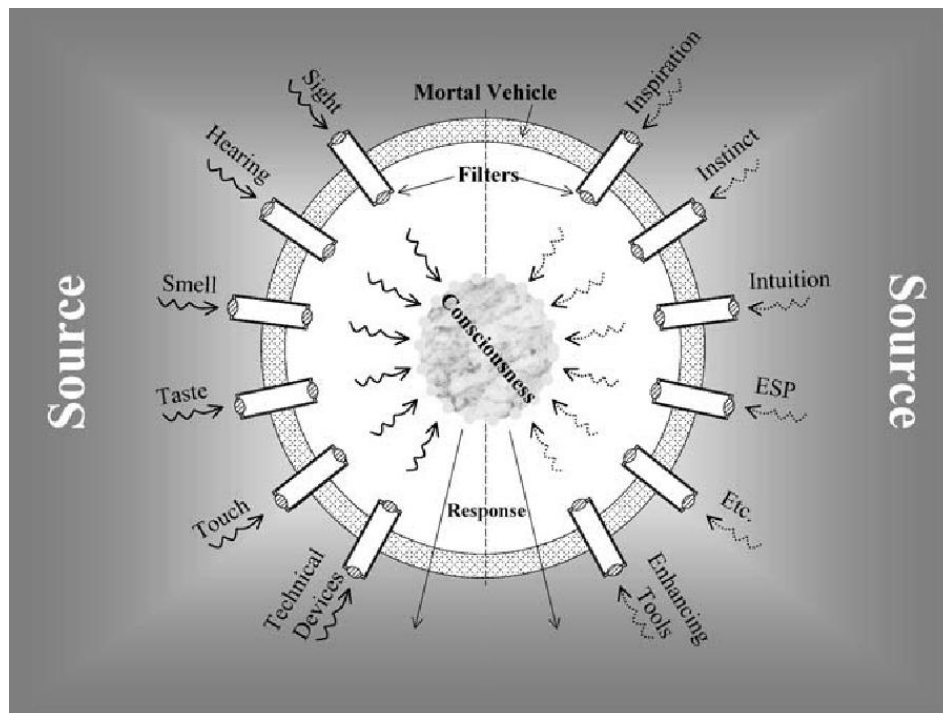


Fig. 18.

Schematic cartoon of information exchange between Consciousness and its Source: On the left, physiological sensory channels, conditioned by various physical, psychological, and cultural filters, acquire limited information from the Source, and transmit it to the Consciousness for organization into palpable experience and reaction thereto. On the right, other less well-comprehended subjective channels, also conditioned by pertinent attitudinal filters, supplement the information flux with an assortment of intuitive, instinctive, and inspirational sensations that may also influence the Consciousness response.

2.5. The magic and the evil of the mechanical eye.

People act differently than their usual behavior in the presence of a photo or video camera. Their senses get alert, they prepare for the act of being photographed/filmed. Very often they don't recognize themselves in the resulted image. Their own image about themselves is very often different than the image captured in a photograph/video. Being observed through this objects is a very intimate act. Many subjects feel stripped of their clothes.

On the other hand, this mechanical object is inanimate without the intervention of the photographer, the prolongation of our senses, and in a hand of a skilful user or artist, a mediator between the creative imagination and subject.

Often, the camera transcends the status of an useful object and achieves human prerogatives, becoming a human enhancement.

I made this sub-chapter under the influence of the recent experiment, where my subjects were free to pose, to act, as they liked it to do, free of any indications.

Here are some reflections about the role of the camera, told by some of the greatest artists of still or moving pictures, and in relation with the world what we explore and our consciousness:

- *“The photograph itself doesn't interest me. I want only to capture a minute part of reality.”*
- *“The creative act lasts but a brief moment, a lightning instant of give-and-take, just long enough for you to level the camera and to trap the fleeting prey in your little box.”*
- *“Photography is nothing - it's life that interests me.”*

Henri Cartier-Bresson⁶⁴

- *“It is part of the photographer's job to see more intensely than most people do.”*

Bill Brandt⁶⁵

- *“...to photograph is to frame, and to frame is to exclude.”*
- *“Photographs really are experience captured, and the camera is the ideal arm of consciousness in its acquisitive mood.”*
- *“The painter constructs, the photographer discloses.”*
- *“By furnishing this already crowded world with a duplicate one of images, photography makes us feel that the world is more available than it really is.”*
- *“To photograph people is to violate them, by seeing them as they never see themselves, by having knowledge of them that they can never have; it turns people into objects that can be symbolically possessed. Just as a camera is a sublimation of the gun, to photograph someone is a subliminal murder - a soft murder, appropriate to a sad, frightened time.”*

Susan Sontag⁶⁶

- *“I hate cameras. They are so much more sure than I am about everything.”*

John Steinbeck⁶⁷

- *“I have always been very interested in photography. I have looked at far more photographs than I have paintings. Because their reality is stronger than reality itself.”*

Francis Bacon⁶⁸

- *“We regard the photograph, the picture on our wall, as the object itself (the man, landscape, and so on) depicted there.”*

Ludwig Wittgenstein⁶⁹

- *“When I'm ready to make a photograph, I think I quite obviously see in my mind's eye something that is not literally there in the true meaning of the word. I'm interested in something which is built up from within, rather than just extracted from without.”*

64 Henri Cartier-Bresson (August 22, 1908 – August 3, 2004) was a French photographer considered to be the father of modern photojournalism.

65 Bill Brandt (born Hermann Wilhelm Brandt, 2 May 1904 – 20 December 1983), was a German-British photographer and photojournalist.

66 Susan Sontag (January 16, 1933 – December 28, 2004) was an American writer and filmmaker, professor, literary icon, and political activist.

67 John Ernst Steinbeck, Jr. (February 27, 1902 – December 20, 1968) was an American writer, recipient of 3 Pulitzer Prizes and Nobel Prize (1962)

68 Francis Bacon (28 October 1909 – 28 April 1992) was an Irish-born British figurative painter

69 Ludwig Josef Johann Wittgenstein (26 April 1889 – 29 April 1951) was an Austrian-British philosopher

- *"You don't make a photograph just with a camera. You bring to the act of photography all the pictures you have seen, the books you have read, the music you have heard, the people you have loved."*
*Ansel Adams*⁷⁰
- *"A picture is a secret about a secret, the more it tells you the less you know."*
*Diane Arbus*⁷¹
- *"The camera is an instrument that teaches people how to see without a camera."*
*Dorothea Lange*⁷²
- *"I believe in equality for everyone, except reporters and photographers."*
*Mahatma Gandhi*⁷³
- *"A photograph is the illusion of a literal description of how the camera 'saw' a piece of time and space."*
- *"Photography is not about the thing photographed. It is about how that thing looks photographed."*
*Garry Winogrand*⁷⁴
- For Stan Brakhage⁷⁵ the camera is *"the limitation, the original liar"*, but also praise its: *"speed for receptivity which can slow the fastest motion for detailed study, or its ability to create a continuity for time compression, increasing the slowest motion to a comprehensibility. I am praising its cyclopean penetration of haze, its infra-red visual ability in darkness, its just developed 360-degree view, its prismatic revelation of rainbows, its zooming potential for exploding space and its telephotic compression of same to flatten perspective, its micro- and macro-scopic revelations."*
- Jean Epstein⁷⁶'s praise of the camera's *"nonhuman analytical properties"* which prevent it from being *"weighted down by likings and dislikings, by habits and considerations [which we] can no longer perceive."*
- Germaine Dulac⁷⁷ described the camera as *"an eye more powerful than our own and which sees things we cannot see."*
- Dziga Vertov pronounced the camera *"more perfect than the human eye for the exploration of the chaos of visual phenomena that fills space."*

⁷⁰ Ansel Easton Adams (February 20, 1902 – April 22, 1984) was an American photographer and environmentalist

⁷¹ Diane Arbus (March 14, 1923 – July 26, 1971) was an American photographer and writer

⁷² Dorothea Lange (May 26, 1895 – October 11, 1965) was an influential American documentary photographer and photojournalist

⁷³ Mohandas Karamchand Gandhi (2 October 1869 – 30 January 1948) - Mahatma Gandhi, was the preeminent leader of Indian nationalism in British-ruled India.

⁷⁴ Garry Winogrand (14 January 1928, NY City – 19 March 1984, Tijuana) was a street photographer known for his portrayal of America in the mid-20th century.

⁷⁵ James Stanley Brakhage (January 14, 1933 – March 9, 2003) was an American non-narrative and experimental filmmaker.

⁷⁶ Jean Epstein (March 25, 1897 – April 2, 1953) was a French filmmaker, film theorist, literary critic, and novelist

⁷⁷ Germaine Dulac (17 November 1882 – 20 July 1942) was a French filmmaker, film theorist, journalist and critic.

2.6. The Truth of the Captured Reality

When photography was first introduced more than 150 years ago, it was seen as the perfect documentary medium because the mechanical nature of the medium ensured unadulterated, exact replicas of the subject matter. The technological advances of cameras and the subsequent development of photojournalism led to clearer, more realistic photos. For instance, rather than the stiff poses required by early, long-exposure cameras, lighter, transportable cameras allowed photojournalists to take unrehearsed snapshots. Historian Judith Gutman claims that, *“for the first time the public saw photographs of bored ministers, ungainly postures, and cunning smiles behind cigar-smoking officials.”*⁷⁸

Because photographs could expose the facts of life behind the façade, the public decided photographs were credible witnesses of reality. Photos told “the truth” by exposing people in an unrehearsed and candid manner. Ralph Waldo Emerson claimed enthusiastically, *“Photography is distinguished by its immediacy, its authenticity, and the remarkable fact that its eye sees more than the human eye. The camera shows everything.”*⁷⁹.

Photography created a record of events that even courts of law embraced as indisputable fact.

Besides the evident technical character of the photography and the inherent subjectivity of the means necessary to produce the photograph one type of manipulation occurs during the picture-taking process. In creating a photograph, the photographer chooses the subject matter, composes the scene, and uses filters and other such tools to change the nature of the photograph. Art critic Geoffrey Batchen, while claiming that photography inherently involves the absence of truth, describes how the normal processes of preparing a news photograph for publication involves a great deal of manipulation:

*“Traditional photographs - the ones our culture has always put so much trust in - have never been “true” in the first place. Photographers intervene in every photograph they make, whether by orchestrating or directly interfering in the scene being imaged; by selecting, cropping, excluding, and in other ways making pictorial choices as they take the photograph; by enhancing, suppressing, and cropping the finished print in the darkroom; and, finally, by adding captions and other contextual elements to their image to anchor some potential meanings and discourage others”*⁸⁰

So a photograph, although professing to depict truth, actually involves manipulation of both object and message.

As John Tagg writes in *The Burden of Representation*,:

“The value and fascination of such mechanically produced portraits seemed to lie in their unprecedented accuracy. The mechanization of production guaranteed not only their cheapness and ready availability, but also, so it seemed, their authenticity. When the technology of the camera first became

⁷⁸Judith Mara Gutman, “The Twin-Fired Engine: Photography’s First 150 Years,” *Gannett Center Journal* 4(1990): 58.

⁷⁹Qtd. in *In Our Time: The World as Seen by Magnum Photographers*, Ed. William Manchester (New York: American Federation of the Arts in association with WW Norton & Co., 1989) 14.

⁸⁰ Geoffrey Batchen, “Phantasm: Digital Imaging and the Death of Photography,” *Aperture* 136 (1994): 48.

available, there was a great deal of concern about the accuracy of a photographic representation. Because we are pre-programmed to accept a photograph as “truth” and due to new technologies such as facebook, this concern is still relevant today.”⁸¹

Diane Arbus, a 60's photographer, explores the truth-claim of photography and the ability of the camera to reveal what she described as the “gap between intention and effect”.

An excellent example is her photograph, “Child with Toy Hand Grenade”. When viewed in tandem with her contact sheet, it is clear that Arbus chose to represent the boy as crazy even though he appears to be a completely normal child in all the other photos.⁸²



Fig. 19. Child with Toy Hand Grenade in Central Park, New York City, USA (1962) , Diane Arbus

Source: <http://phattire.blogspot.co.at/2010/04/child-with-toy-hand-grenade-in-central.html>

81 From Simulation to Iconification: Portrayals of the Self and the Other in News Media . Photographs from the 2003 War in Iraq., by Alanna MacLellan-Mansell BA, St. Mary's University, 2004, pp. 8 - https://dspace.library.uvic.ca:8443/bitstream/handle/1828/3458/MacLellan-Mansell_Alanna_MA_2011.pdf?sequence=1
82 Diane Arbus: exploring the truth claim of photography, by schne20r, December 17, 2012 <http://victorianvisualculture.com/2012/12/17/diane-arbus-exploring-the-truth-claim-of-photography/>



Fig. 20. Contact sheet, Diane Arbus, Central Park, New York City, USA (1962)

Source: <http://www.feralpost.com/wp-content/uploads/2010/11/diane-arbus-planche-contact-12295419911.jpg>

Computer technology has been applied to photography, creating digital imaging and a new realm of ethical qualms. Because digital images can be seamlessly altered, there has been a great deal of hand wringing about the “evils” of practicing this type of photography. In truth, digital imaging has simply forced everyone to acknowledge the inherently manipulative nature of photography and to understand that it never represented “truth” in the first place. Digital images are composed of discrete pixels. The images are encoded by dividing the picture into a Cartesian grid of cells. A limited range of integers determines the color or intensity of each cell. Fine details and curves are approximated to fit the square pattern of the grid cells, and tonal variations have definite values of gradation.

Digital images with precise gradients of spatial and tonal resolution have fixed amounts of information. Enlargement of a digital image will ultimately reveal the grid, the microstructure of the image. Nothing new is revealed by further enlargement of a digital image – the pixels simply become larger squares of color.

There are an amazing variety of ways to manipulate digital images, and as computer programs become cheaper and more widespread, manipulation of images will become more common. Judgments about what is an acceptable degree of manipulation shift with changes in technology, and in photographer’s purpose in creating a manipulation. There will always be those willing to distort visual images in hopes of distorting the truth.

"In the electronic age, I am sure that scanning techniques will be developed to achieve prints of extraordinary subtlety from the original negative scores. If I could return in twenty years or so I would hope to see astounding interpretations of my most expressive images. It is true no one could print my negatives as I did, but they might well get more out of them by electronic means. Image quality is not the product of a machine but of the person who directs the machine, and there are no limits to imagination and expression."

Ansel Adams, An Autobiography, 1985.83

Chapter3. The Experiment.

3.1. What we see.

The metaphor of the camera-eye is constructed of synecdoches. That is to say, the eye and the camera are parts standing for the whole of their respective visual apparatuses. Vision is no more a product of the eye alone than pictures (especially the "moving pictures" of cinema) are made by the camera alone. In each case, what we see is the result of complex processes that only begin in the eye and the camera. They are the outermost extensions of visual systems whose other structures and functions are hidden inside the skull and inside film labs, computer software editing, editing rooms, and projection booths. Even the crucial light-receptors of each system (the retina and the sensor) are hidden from view. An analysis of the camera-eye metaphor may properly begin with the eye and the camera *per se*, but if it is to demonstrate the metaphor's relevance to the visual perception, visual interpretation, aesthetics, it must go on to seek other realms of understanding the reality.

As R.M. Boynton says in *Handbook of Perception*: "Cameras must be aimed by someone; the eye is part of a grand scheme which does its own aiming." The camera-eye metaphor should remind us that the camera, too, is "part of a grand scheme" that controls the way it is "aimed" at the world.

Metaphorically, it is like the eye in its own "grand scheme" of muscles, tissues, nerves, brain cells, and the all other aspects of the personality of the viewer.

But, not all visual activity is initiated by light falling on retina. Much can be seen when the eyes are closed. Dreams and visions are seen as vividly as "real" images.

"Why does the eye see a thing more clearly in dreams than the imagination when awake?"

Leonardo da Vinci

Because light rays entering our eyes cross at the pupil, they produce a retinal image that is upside down and backwards, relative to the visual world as we perceive it. Because the eye moves the retinal image is fluid and unstable; yet we normally perceive a solid and stable visual world. The retinal image spreads across a curved, two-dimensional surface; whereas, the visual world fills three-dimensional space. These transformations of retinal image into visual world are products of the eye's neural network in the brain. There, in front of our eyes, the visual world is the product of the "internal logic" of the brain's visual system, a system based on collecting, comparing, and drawing conclusions from data that is both "stored" in the brain and constantly arriving for the first time via the retinal image.

Scientists of vision are careful to distinguish between what we see and the sources of our seeing. What we see is actually an internal representation of the brain.⁸⁴

3.2. Installation.

Continuing with this metaphor of the visual perception of the world, my installation contains an objective optical mechanism of "seeing"- the pinhole camera, an interpreter – the automatic video camera, similar to the uncontrollable decision of some parts of the brain, so it's not possible to intervene in the way how they interpret the image, similar to the thalamus in human brain. They were doing the exposure, the aperture, the color interpretation, the white balance and the ISO sensitivity.

⁸⁴ Data collected and interpreted from "Light Moving in Time", Studies in the Visual Aesthetics of Avant-Garde Film, William C. Wees, UNIVERSITY OF CALIFORNIA PRESS, Berkeley · Los Angeles · Oxford, © 1992 The Regents of the University of California

The video projection of the resulted image - mimic the “image” which comes, filtered, on the visual cortex, and the unknown – the subject of its own decision, the visitor, which can be assimilate with the interpretation done by the mind corresponding to the brain, containing the whole history of knowledge, beliefs, culture an other infinite subtle elements which make our personalities.

The photographic result of this experiment intended to be an excerpt of the installation reality. It contains the product of the perceived and interpreted reality of the exterior world and also contains the visitor, each one different from an other, with his attitude, appearance, size and colour.

Like a brain EEG, an experiment of some neuro-scientists or psychologists who are giving stimuli to a brain trying to find out what's happening with the mind, or vice-verse.

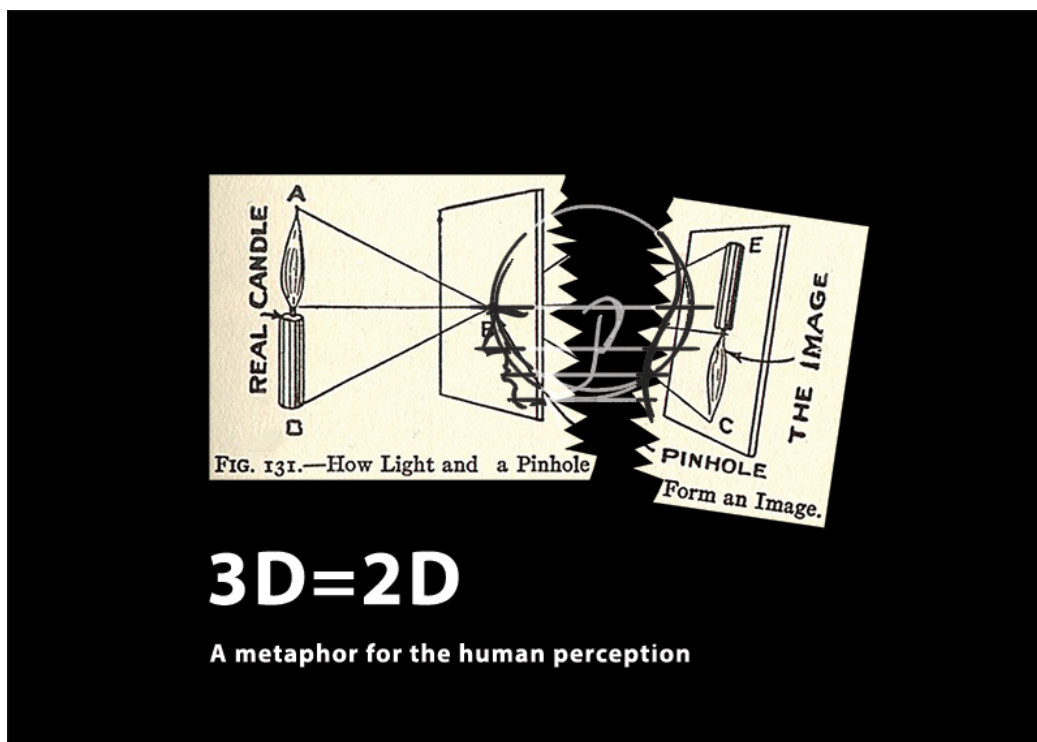


Fig.21. Advertising flyer for the exhibition

“The exhibition / installation intend to be a re-creation of the interpreted reality by a processor fitted with a software for encoding and recoding the data/stimuli which comes form the surrounding environment.

The visitor is invited to be an active part of this exhibition/installation, being a central part of the projected outside reality, posing for a photograph which contains the surrounding elements of a certain time an place reality. Also, the visitor is invited to have a reflection and to share his/her view with the other visitors about self-observation of the reality.”

This was my announcement, launched prior with a month, in the attempt to lure visitors. I have a slight regret that I have the feeling that noone was aware that this is an on-going

experiment, installation. I explain to each visitor which is the purpose of this installation. Either I don't know to communicate well or the pressure of the photographic camera was to big.

People tend to be nervous when they have to impersonate themselves. They are tensed and they try to adopt an unnatural attitude in order to achieve a better self-image of themselves. The starting hour of the exhibition wasn't the best: it was 6 PM, and the natural light was fading rapidly. So, in a way of speaking my installation which depends on natural light was not functioning properly. And, the cherry on the cake, it was cloudy. Nevertheless, the next day, was a beautiful spring day, and even the visitors was scarce, I enjoyed a extremely pleasant day in the half-light of the box, admiring the images projected by the 3 pinhole cameras-video cameras-beamers installation.

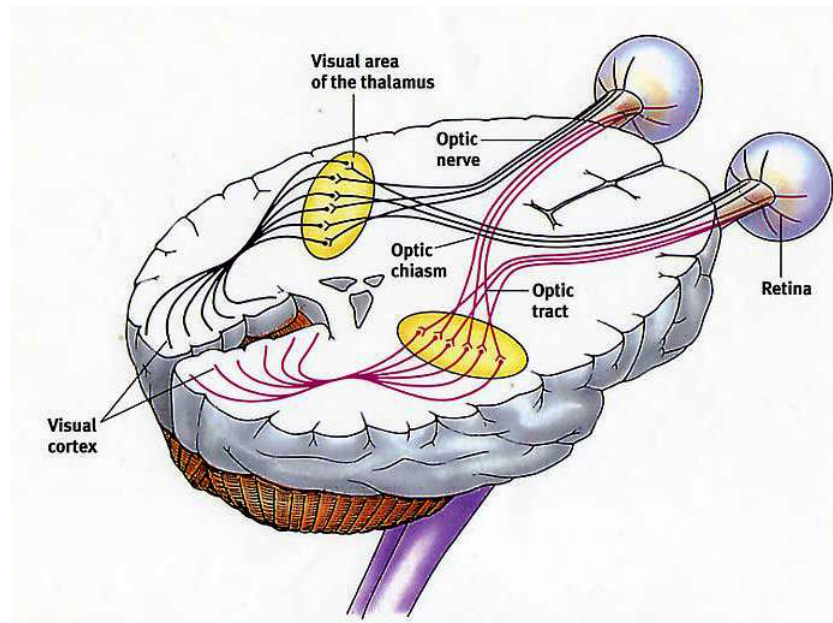


Fig.22. Relationship between view, eyes, optic nerves and the visual cortex area.

Source: <http://www.mediacollege.com/3d/depth-perception/images/OpticNerve.jpg>

This is the simplistic model of the visual system of the human brain. As you can intuit there are the receivers – the eye and the sensors - retina, the decision maker – the thalamus and the visual cortex – the big interpreter who give us the final result of a very complicated process.

My installation mimic physically this arrangement.

The whole installation was installed in a box in the Aula of the Universität für angewandte Kunst, a special place destined for exhibition under the tutelage of student's organization Hufak. One of my task in order to improve the visibility of the projection was to be sure that the interior was as less as possible lighten. So, I covered the top with a textile material, I mounted a door and I installed a black, thick drape at the other entrance. Also, I sealed with duct tape any other light leakage.

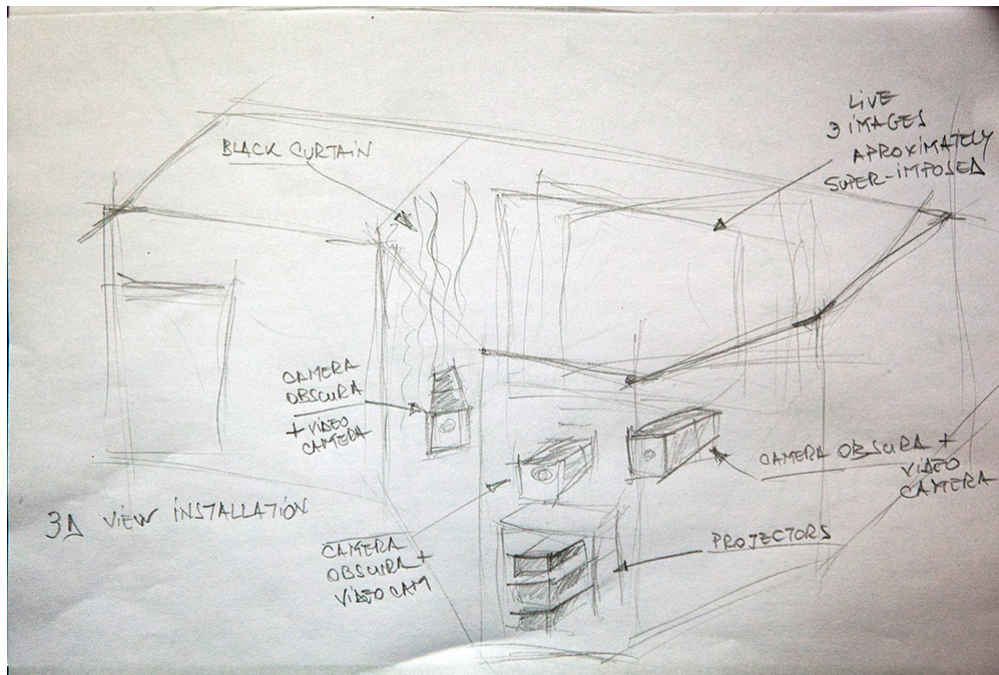


Fig. 22. A hand drawn scheme of the installation

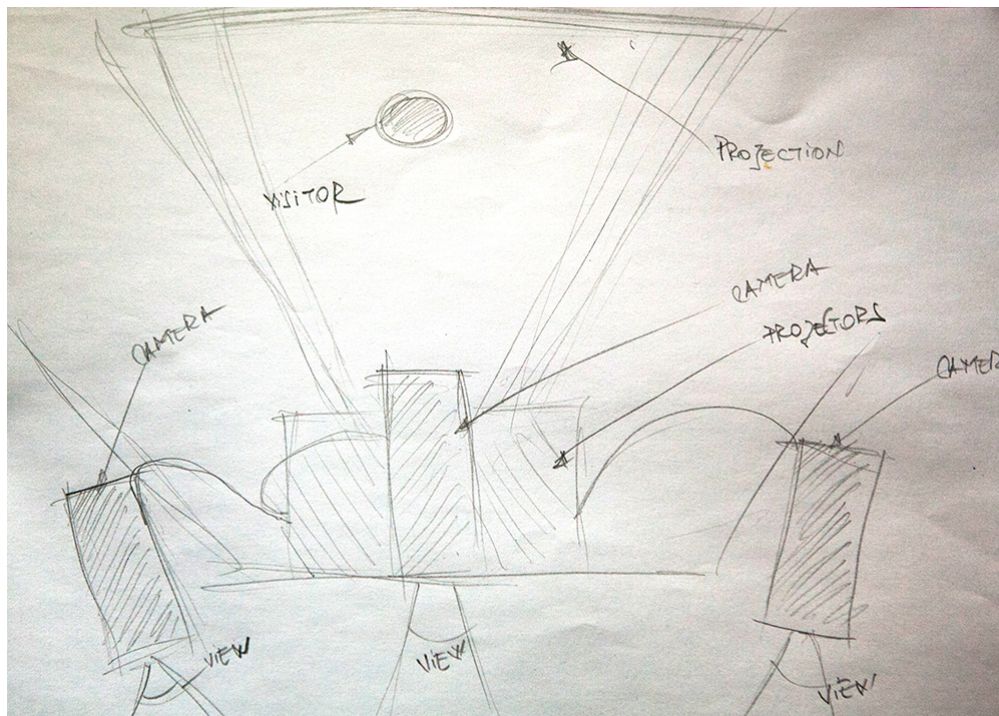


Fig. 23. A hand drawn scheme of the installation – Top view

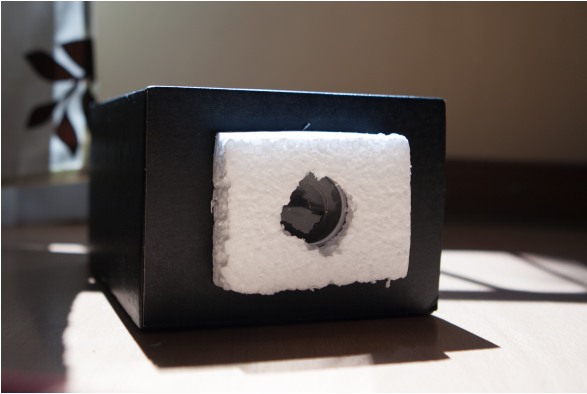


Fig. 24. Front of the pinhole camera with a simple lens



Fig. 25. Interior of the pinhole camera

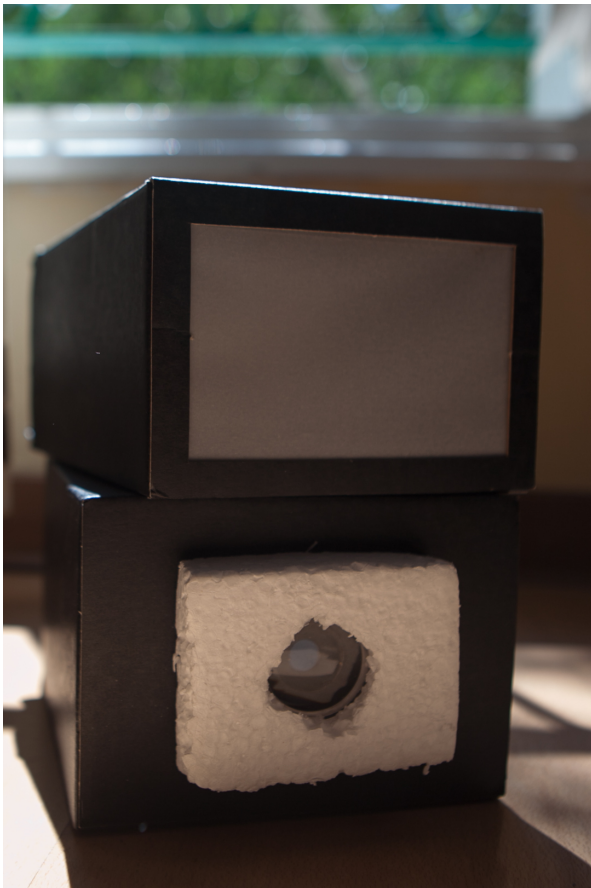


Fig. 26. The sliding part from exterior, the recipient of the video camera, it can be seen the matte paper screen.

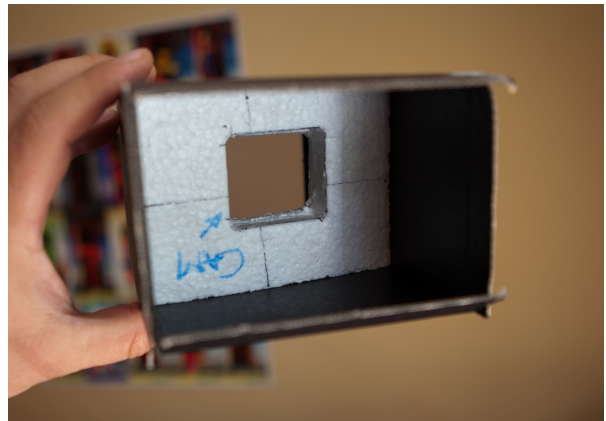


Fig. 27. The sliding part, from interior, the recipient of the video camera, the fixing frame.



Fig. 28. The interior slides forth and back in regard to the pinhole. Out of focus

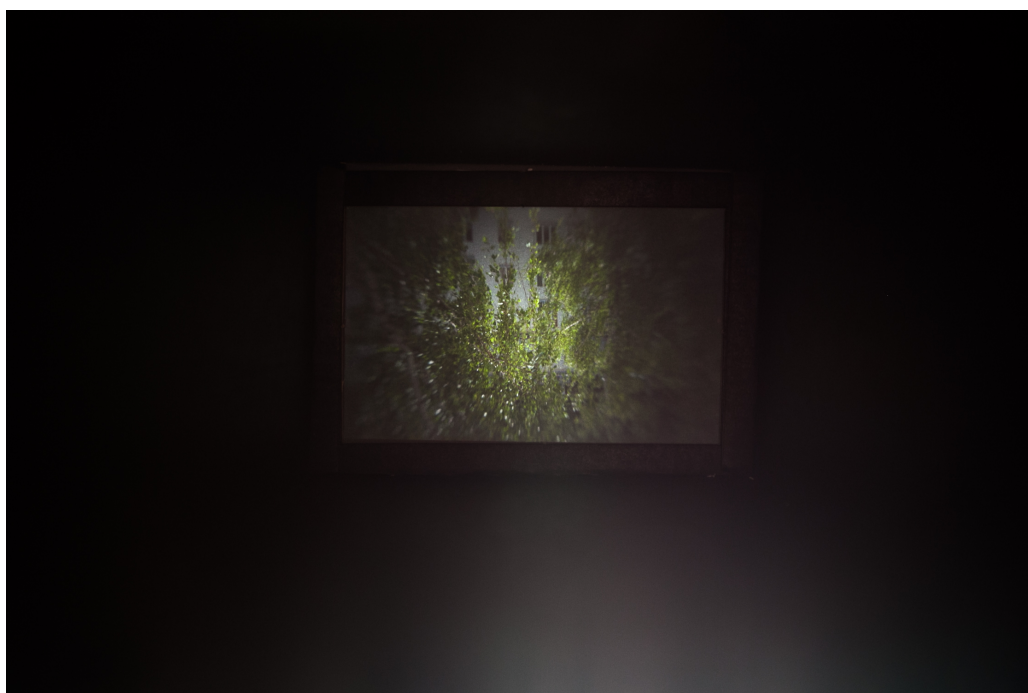


Fig. 29. The interior slides forth and back in regard to the pinhole, In focus



Fig. 30. The image on the matte paper is sharp in center, inverted, with geometrical aberration as we look farther from the center, the intensity of light is dimming from center towards the corners; somehow resembles with the cone of attention what we present in human vision, but also we understand, why retina is a hemispherical surface and not a planar one.



Fig. 31. The installation. On the right wall are the projectors and one of the camera obscura pointing out through a hole in the wall. On the left is the projection. Outside the box there are the other two pinhole cameras. They communicate with the projectors via cables.

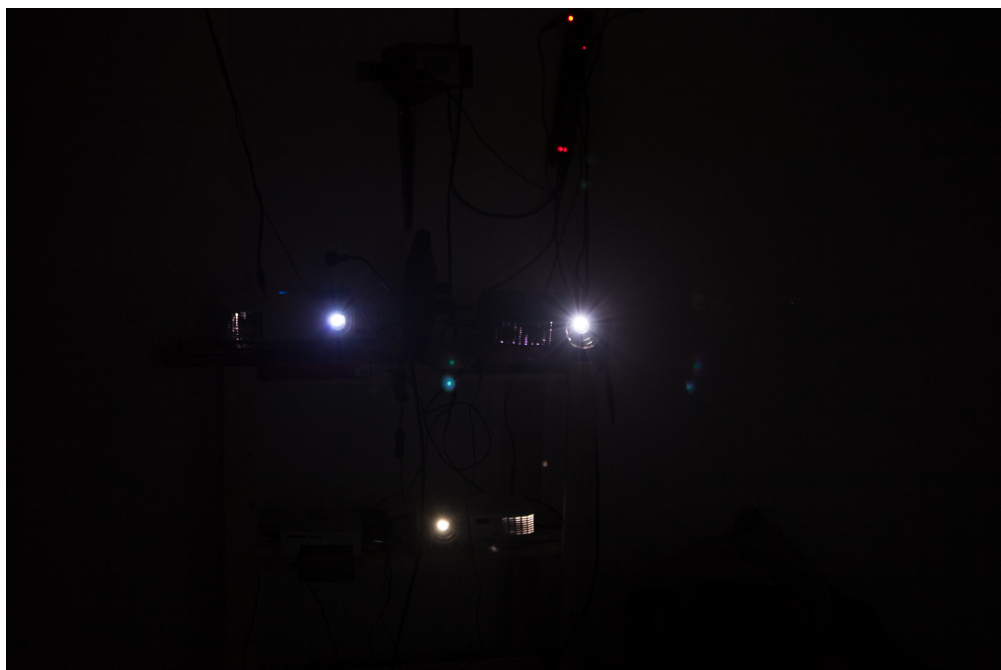


Fig. 32. The projectors

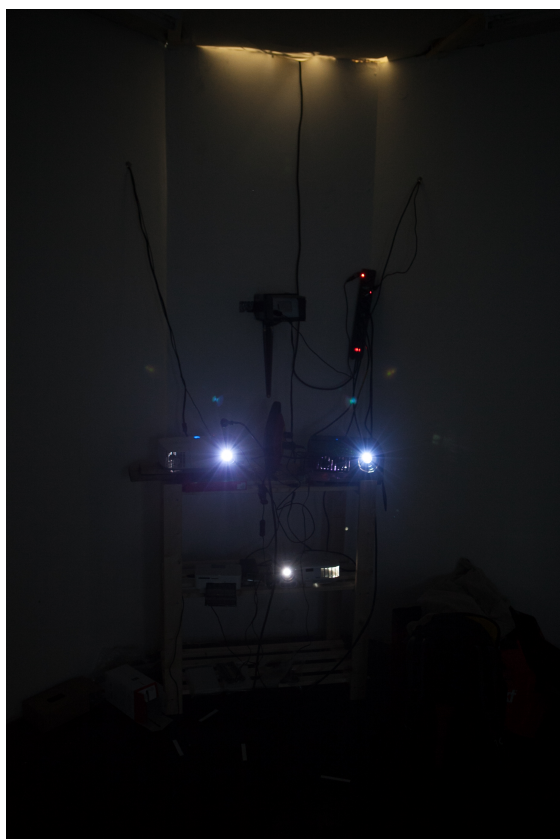


Fig. 34. The first image

Fig. 33. The projectors, one of the camera obscura, the connecting cables with the other two pinhole cameras.

3.3. The Experiment.

I will make short comments to each subject.



V.H. - my help in constructing the installation, so first one to be subject of being photographed. The light is still good, even is cloudy, the projections are colorful. The interpretation of the images formed on the matte paper, by the small cameras, is somehow deceiving, but finally I realize that this is actually the point. The software, the way how it treats the information which is coming quite sharp on the paper matte, all those automatic processes, resembles with the way how our pre-visual cortex works, in an uncontrollable way. Both, the thalamus and the software deliver information to our consciousness, somehow... what they consider it's important for our understanding.



C.S. - he was in a hurry. I think he wasn't listening really what I am telling him, so he just play a role to please me. He was smiling before I put my hand on camera. So, this is the official face.



M.H. - A little bit of posing sad and misunderstood. Later, in the evening he was feeling much better. Anyway it's a reflective state, as I was asking for in the announcement.



A.S. - it's all the time good to smile to the camera!



B.K. - the only one who was aware about the meaning of my project. She came prepared to be out of common behavior and to let her joyful character to burst out! Or bubble out!



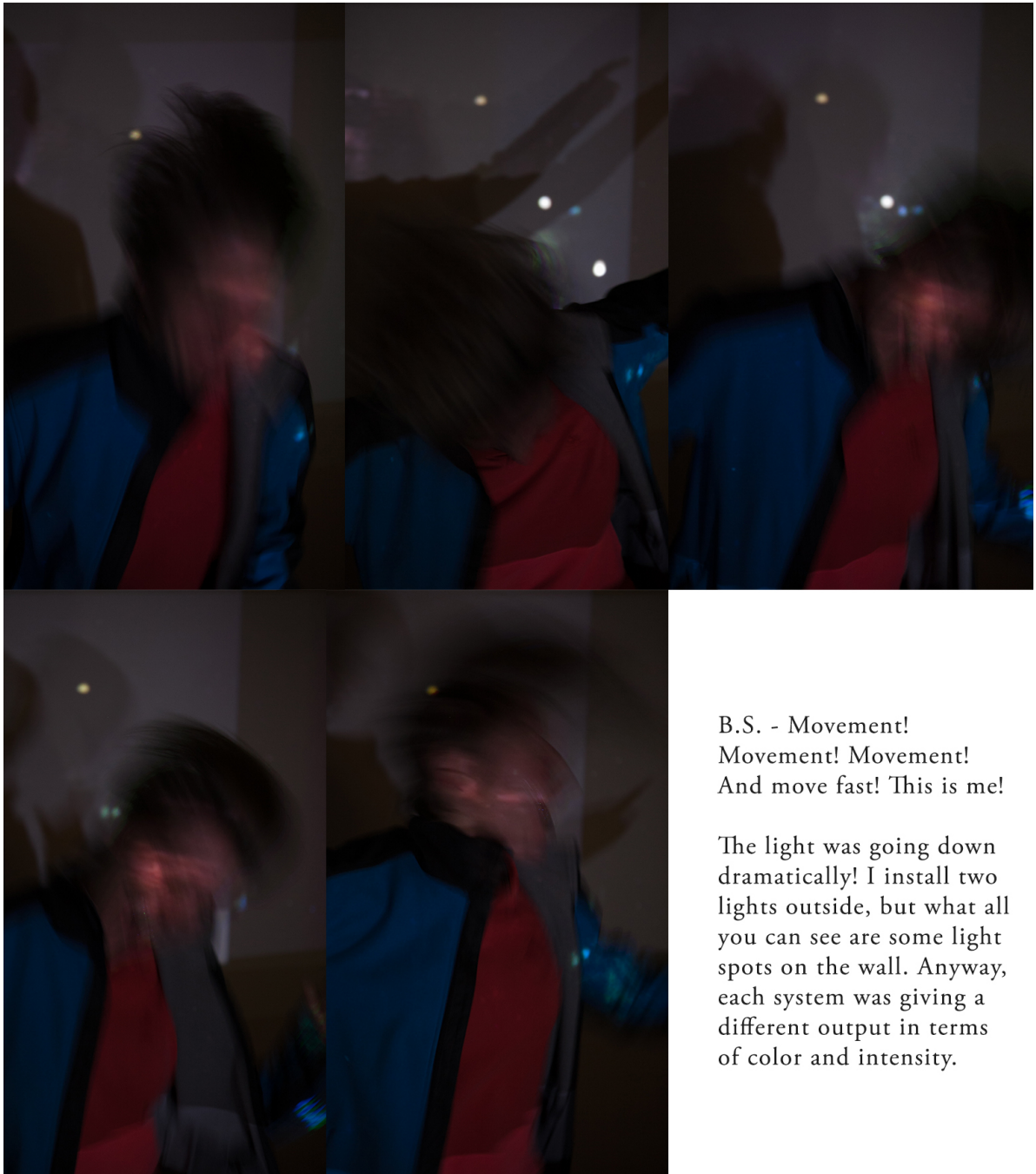
H.P. - The power of the camera lens is more than three projectors which are pointing to you.



A.F. - Trying to catch the light!



M.G. - Better I show you my back to the world!



B.S. - Movement!
Movement! Movement!
And move fast! This is me!

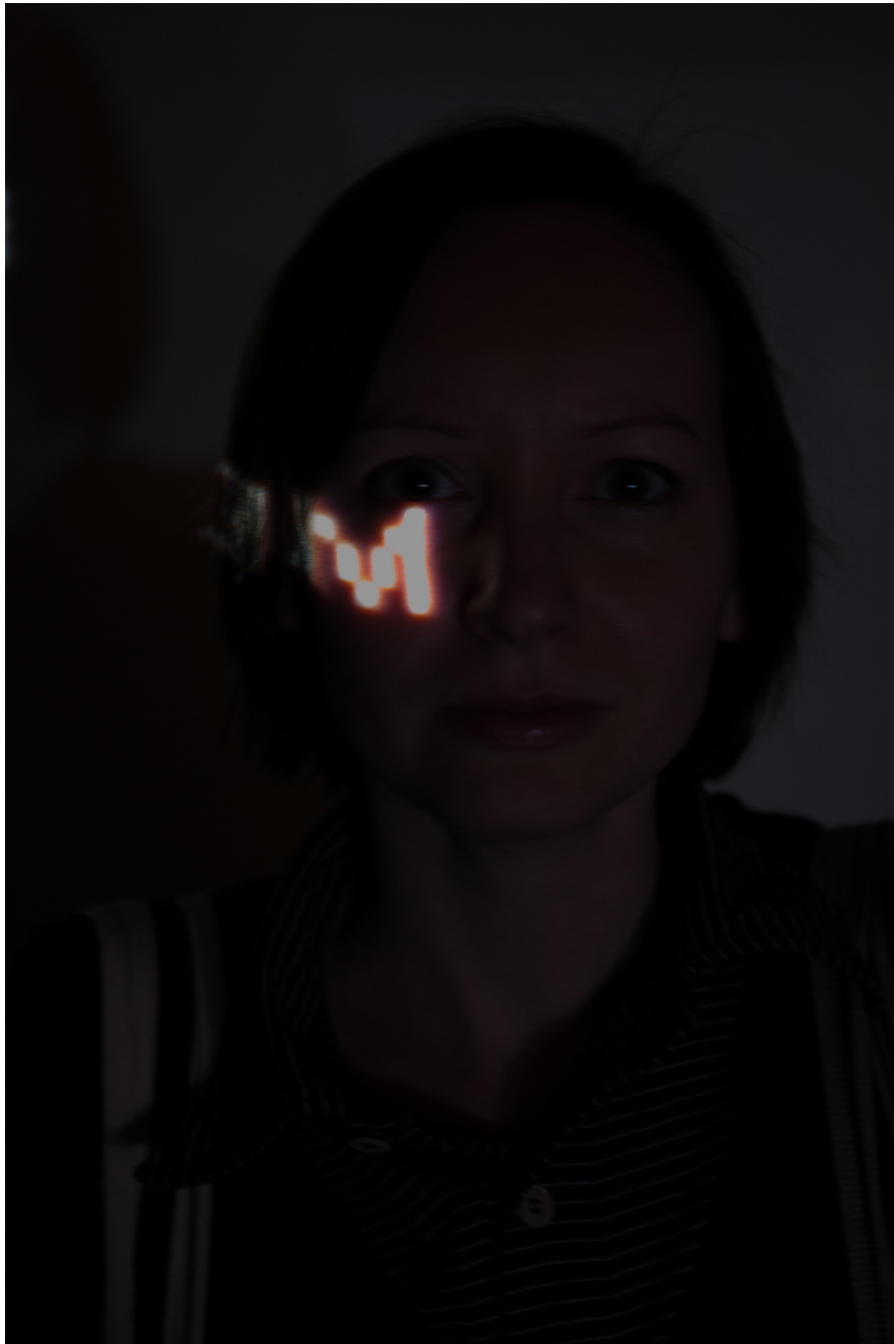
The light was going down dramatically! I install two lights outside, but what all you can see are some light spots on the wall. Anyway, each system was giving a different output in terms of color and intensity.



K.P. - Family portrait. Again the power of the lens. It's true that it was too dark to see something understandable. As we can see the automatic systems (the green signs) work around the clock, no matter what.



B.K. - Spots of knowledge in a see of uncertainty.



V.D. - Way to dark, but a glimpse of hope. The luminous section is an automatic generated sign-signal from one of the automatic cameras. They see nothing, only produce automatic signals.



P.O. - Next morning, was a shinny day. The richness of the colors was staggering in comparison with the previous cloudy day. Each system pinhole camera – video camera- projector was giving a totally different picture even they were pointing approximately to the same subject.



The colors are amazingly different! Even they interpret the somewhat objective reality coming from the cardboard eye – the pinhole camera in a very non accurate way, they produce a lively image, a painting in continuous movement.

In the lower picture it can be seen the technological limits of producing images. The pixels can be literally counted, if someone would like to do it. It's the limits of the automatic system to process unlimited data coming from the exterior.

And to deliver the same amount of data which comes from the environment.

This is a type of filter for sure.

If I continue with the comparison with our brain processes, the visual cortex it's working with the data delivered by the automatic system, the doorman.

Any objectivity is lost in the process of transmission!





M.K. - Just passing by.



Unknown. The most interested person about this experiment.
Nice pattern in the dark.



R.F. - Cogito, ergo sum!



Unknown – it's good to have a pass photo anytime! The colors are crazy beautiful!



Unknown – Nice attitude! The power of lens strike again.
Folded arms, forbidden territory, stay away!



S.F. - Last client! In the evening my colleague-assistant is waiting for me to go to our regular duties. A nice end!

Chapter4. Conclusion

The question I have to answer is: Can be the reality the summation of the congruent overlapping maps of our perception?

I used the same pattern for the instruments in capturing reality, but they are slightly different in details.

We have three functional systems the same as general construction, as we the humans we have the same general characteristics and construction. But we are different in any aspect of detail.

We are taller, or shorter, so I install the cameras at different heights. In regard to an event, which we watch concomitantly, for example a football match: one can be in the stadium, another one can be in the other side of the stadium and it has a completely different point of view over the event, one can watch the match at TV, and then there are many other filters between the event and his consciousness. So, the cameras are pointing, roughly to same subject, the environment of the installation, but from different Cartesian points.

The cameras are fitted with plastic lenses, but they are of different focal length, in the idea that in a 3-dimensional space we cannot occupy the same point, so we have different perspectives and view angles about the same event we watch.

This are the physics and spatial geometry, in order to differentiate the incoming data which have to go further to the consciousness.

In terms of data processing we have automatic filters which decide beyond our power of control what is necessary for our entity and what is not. It's a sanitary job, very helpful to keep all the systems of living in good condition without being overloaded. We simply don't need the whole data from the environment in order to follow the first rule of our being: to survive. So much for the myth of objective reality! To mimic this automatic processes, the cameras obscura are fitted with, yes, mini-cameras, but the similarities end here. They are from 2 different producers in 3 different models. They have each one their own modules of software which make decisions in a different way. Also the projectors are different models, one is brighter, other one produce a bigger image and so on. Let's analyze one of the overlapped projections resulted picture from my experiment.

I put the original image "upside down" so we can find our way into a more recognizable world. As it can be seen from the automatic generated signs, the images are somehow overlapped, not perfectly, which due to the diversity of utensils used would be virtually impossible.



We have three points of interest: the right-bottom part, somehow more white, where two persons can be seen talking; the yellowish upper left part, with a white spot in the middle, probably a reflection from some window; and only a few very green tree leaves in the center. Remember that they were pointing to the same subject, the inner garden of the building of “die angewandte”.

These three images which are depicting, one by one, the same environment, deliver results so different, almost beyond recognition of the subject. The resulted images are totally different in terms of information, quality of information and even quantity of information.

Let's see 2 pictures from the same angle taken in a different time of the day, different insolation, maybe different cloud filters, etc.



Do you see any difference? By the way this was the quality of the projection, I did not manipulate the photographs, or enhance the colors. I think that any comment would be redundant. I will allow the images to speak.

Now, after this experiment the main question of this work seems simple to answer.

I, as an artist, and not a scientist of any kind, can draw a conclusion in my terms.

There is no objective reality. There are so many subjective realities so many we are. Objective reality would require that we take into account all available data – something that human beings cannot do because our brain processes only a fraction of the incoming data, the rest is screened-out. All incoming data they are further more completed with other data which are coming from our memories, from our experiences, from our cultural, social, behavioral background. So, everyone has the correct map of reality - for themselves. And none of us have a completely accurate map of reality.

As we can see, the view over the world may show the same surrounding reality but only roughly. Everything else is different, in terms of quantity and quality.

But, when I was sitting silently in this box, completely alone, watching the projection, the changing colors and shapes, from this superimposed images was coming a beautiful dialectic between the elements. Being in the same real time, the colors and the shapes were dancing together on the same music and rhythm, even they were different in aspect. I realize that without being different we couldn't communicate to each other ever.

Our realities have to be different!

In this way we can go further, communicating and sharing our own realities. Being different could be the key to our survival and also could be the key for our further development as a species!

Another aspect that occurred to me is that if you want to see the beauty of the world and its diversity you have to keep your eyes wide open – for everything!

I end this work in an unusual manner, considering that I put this work under the motto of Descartes and because it is not my custom to quote from the Holy Bible, but I consider that this line is appropriate in this context and, of course, each one of us, will have different understanding and interpretation of it:

"The eye is the lamp of the body; so then if your eye is clear,
your whole body will be full of light."

Matthew 6:22

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Short Biography

- Born in Timisoara, Romania, 45 years ago in 1967.
- Normal stages of primary education,
- At 16 years old is drafted and sent to a forced labor camp along with some of his colleagues from highschool at the building site of the pharaonic project of Canal Dunarea-Marea Neagra (Danube-Black Sea channel) for 3 months. After graduating the highschool and completion of a 16 months army service works as a hard working labourer in a chemical factory for 3 years. After that continues with education in the Polytechnic University at the Faculty of Chemistry.
- The 1989 Revolution caught him on the streets among the demonstrators.
- Find a job in the newly emerged television stations and starts a 7 years carrier until 2000. In this period works as a sound engineer, video editor, director of broadcast, filmmaker and producer.
- Starts to collaborate with international documentary film teams. Works as a freelancer for various television stations from Austria, Germany, Japan.
- Starts his own business and is producing films, advertising, web sites. Works for multiple political campaigns. Works for a documentary film company based in Vienna, Austria.
- Continues his artistic education at the Faculty of Fine Arts in Timisoara, Romania.
- Since 2010, is attending the Master courses of Art & Science, University of Applied Arts, Vienna.



Exhibitions / Film premiere / Performances

- "K." -- Kafka-Kunst-Veranstaltung, premiere film abstract, music by Karl Heinz Essl; pictures by Cristoph Überhuber, 3. Juni 2013; Expeditihalle der ehem. Anker-Brotfabrik, Vienna.
- - #19, 3D = 2D / A metaphor of human perception, exhibition-installation-experiment, May 16 - May 20, 2013, 19:00h, Aula, University of Applied Arts Vienna.
- ART, SCIENCE AND SOCIETY / 12th ELIA Biennial Conference, Vienna, Exhibition, November 08, 2012 - November 10, 2012, MuseumsQuartier Vienna, Austria - group exhibition.
- VIENNA ART WEEK, "Things that talk", November 14, 2011 - November 20, 2011, Naturhistorisches Museum, Vienna, Austria - group exhibition.
- 20 Jahre Egon Schiele Zentrum, November 3, 2012, Krumlau, Czech Republic, group performance – "Rosa Teppich".
- Premiere film "Sensation Beton" - abstract film – October 14, 2011, Heiligenkreuzer Hof, Sala Terrena, Vienna, Austria.
- Parameter{world} - parameters for every or no thing – installation, March 29, 2011 - April 01, 2011, Vienna, Austria – group exhibition.
- premiere film "Es" - 15 July 2010, Timisoara, Romania.