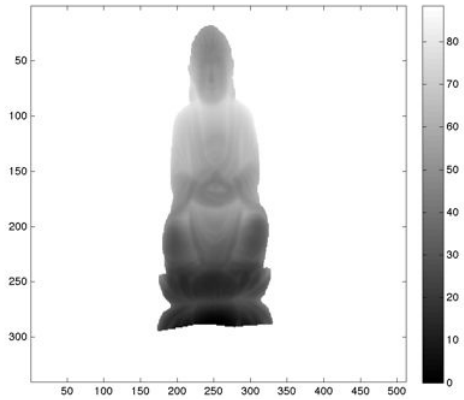
Thesis 25/03/2012

TRUE HOLOGRAM

Research working title:
z-buffering, an informal inventory of avant-garde imaginery of 20 and 21 century.



[1]

Z-buffer is an extra layer of a photographic image that contains a precise map of the three dimensional geometry of the scene. Is exactly what human stereopsis/binocular vision does. This document is driven by the research process of obtaining a *true hologram*, which we can widely defined as a 3D representation in photographic form.

[1] Photometric stereo, Jia Xu and Deepti Pachauri, Department of computer Sciences, University of Winconsin-Madison.

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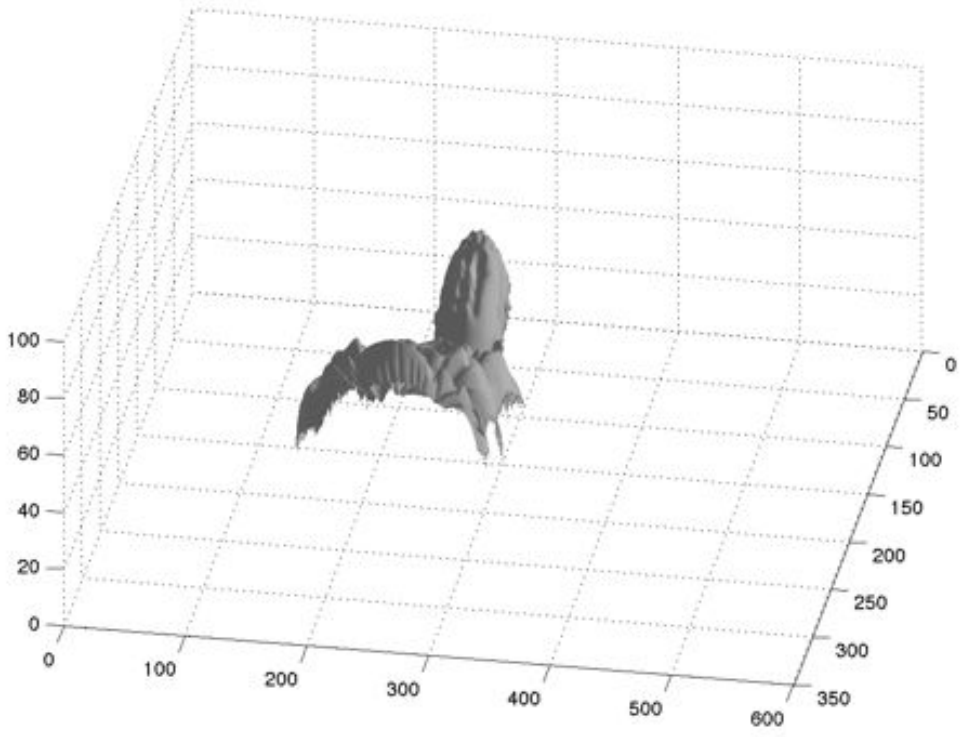
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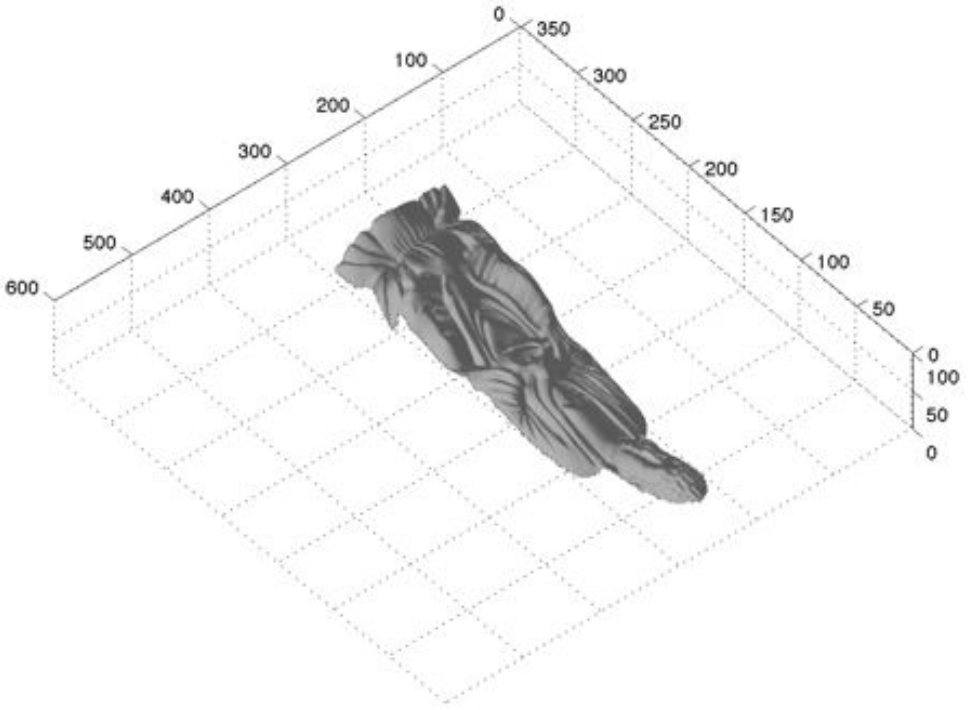
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PHOTOGRAPHIC AESTHETICS

The adjective *photographic* implies a realistic approach to imaginery. However the adjective photographic is understood in this document as any tool that can realistically record coordinates and reconstruct a projection of our world, which doesn't necessarily means that we can recognize the empiric appearance of our world on those projections. Due to the shape I want to give to this thesis I'd like to define and expand the proper terminology of it. *Photography* is commonly strictly referred to the specific lenses technology, I'd like to spread it to the correlative eye-subject-memory axis of communication, which is the self-statement of the medium.

We accept the photorealism of the lenses devices as the true testimony of our environment; the core of the photographic medium is the social contract within itself, constantly reshaping and feed-backing our perception as a mirror.[2] Photography is therefore any outcome that faithfully records and projects the 4 dimensions of a specific moment, subject, from a specific point of view, which defines the intention, author, audience and back again.

New approaches to reality depiction has been massively accepted, that means that our images inventory is nowadays embracing the digital era features. The above-mentioned social contract is now familiar with new keywords on images processing and new ways of data recording and visualization. The new interactive channel of broadcasting is gathering a new collection of visualization tools that will inevitably transcend our understanding of visual media.

As visual media developer I'd like to distinguish between two states of the whole visual phenomena. On one hand we have the intellectual approach to images; we use visual data for the unique purpose of mirror our concerns, both individually and socially. The mental state of visual phenomena is therefore the content of those images; the compromise with the medium will be defined by the self-statement of each person: an artist will actively interact with the medium, an ordinary citizen will use it for personal communication in a passive way. Consequently we can define two levels on images projection: the "realistic", ordinary people visual culture, and the

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[2] Krauss, Rosalind. *Video: The aesthetics of narcissism.*
Krauss, Rosalind. *The optical unconscious.*
Benjamin, Walter. *The Work of Art in the Age of Its Technological Reproducibility, and Other Writings on Media.*
Benjamin, Walter. *A Short History of Photography.*

“post-realistic”, which is the possibility of operate from inside the channel of communication and transcend it.

Nevertheless the “post-realistic” outcomes always try to legitimize themselves in order to be accepted as part of the “realistic” amalgam. For example, a visionary or futuristic image needs to be legitimized as realistically possible; if it leaves the social contract agreed content it automatically becomes non legible and meaningless. In that sense we can deduce an immutability state of outcomes as we need to be anchored in a specific space of ideas that could changes form but not content.

On the other hand we must deal with the physic state of visual phenomena. The human being perceives and conceives images based on the inherent stereopsis; all the images that depicts reality for others eyes could be consequently analyzed as optical phenomena as a lens mechanism is always involved in the process and the final outcomes will be perceived through our binocular vision.

Technology brings a new platform of *photographic* lecture in which the physic states are being amplified through the incorporation of electronic achievements in society intellectia; we can define it as “*transversal imaginery*” as it extends across the length of the medium in cross direction, multi-disciplinarly interacting with different features.

Z-buffering is my own keyword to define the coordinates of *transversal imaginery’s* aesthetics, in which *photography* and *stereopsis* are being augmented and *“realistically”* accepted in unexpected outcomes.

HOLOGRAMS

Widely defined by futuristic movies the true holographic medium is still a sacred place for imaginary communication systems. The true holographic medium, the “realistic” and legitimized hologram, is the one which projects a 3d object floating in the space, can be surrounded, can be touched and not is based on “after images” brain perception. Even if the last outcomes fully depicts a photorealistic 3d projections they cannot be touched; conceptually implies that they are caught in a certain ether or non-natural substance, therefore their presence cannot take place plenty in our dimensional coordinates.


[3]


[4]

In a sensitive level the best performance in holography is the parabolic mirror ghost, in which all the focal points converges from a form's reflection, therefore the 3d projection needs the presence of the physical subject. The presence of the object is precise enough to trick the mind and believe in the veracity of the 3d projection.

The physics of the holographic outcomes will help us in establish a quick catalogue of achievements. Holography is the process by which we could record the volume of any subject and then reproduce a 3D photographic representation of it. For many years the medium faced the unavoidable flat medium of screening; the volumetric images were formally a "multilayered photography", a flat screen able to show different angles of an image.


[5]


[6]


[7]

[3] USC's spinning mirror 3d display.
[4] Alexander McQueen's mirror hologram youtube footage.
[5] Parabolic mirror hologram youtube footage.
[6] M. R. Morrow, Professor Condensed Matter Physics, Light demonstration topics.
[7] The Kiss (II), 1974, by Lloyd Cross. Multiplex Moving Hologram. MIT Museum.

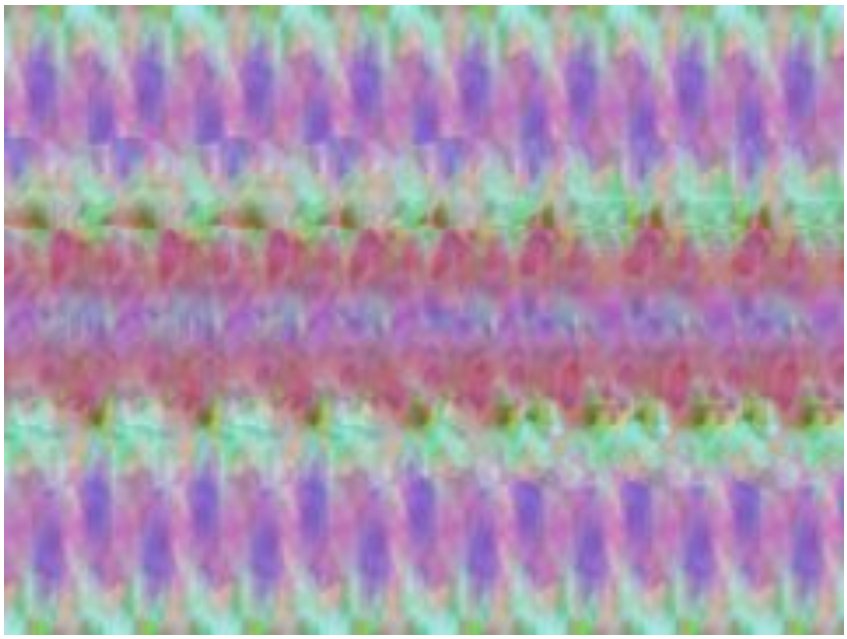
Conceptually and not depending of the source and projection device (laser, parallax barrier, lenticular vision, stereograms) the flat medium is still today the holographic 3D territory; the hologram itself is inevitably an illusion of parallax.

Apparently we can establish a common ground of all these disciplines: the source is inherently linked to the binocular vision, parallax is the key for a complete 3d experience as replica of our vision system . Curiously the stereoscopy as discipline is almost old as photography; the digital era lights up the fire.

Z-BUFFER, METADATA AND TRACKING.

Looking for the mental coordinates of aesthetics in the digital era I found intrinsic the concern of incorporating complex parameters related to the geometry of the space and time to our ordinary footage, adding layers of data (metadata) to the usual 4 dimension image aiming for an immersive experience. We can find complex digital imaging in any kind of media, which becomes augmented media as we can perceive further features on the reality projection or even real-time interaction with the content. All these outstanding outputs are basically an exhaustive “scan” of a specific experience in which we can modify every parameter of the 4d representation, actively or passively.

The parallax-based analysis of the space made possible for example hiperealistic CGI animation in perfect symbiosis with real footage or body detection interfaces.



Conceptually resumed here as z-buffer; the gray scale z-buffer has been used in CGI rendering, postproduction of still images (2.5 photo reconstruction), digital depth of field mapping, infrared stereoscopic cameras and interfaces and the mathematically generated stereograms, in which the 3d parallax of both eyes is codified by correlative points generated by an algorithm in a flat random pattern image. Almost artistically the content of the stereogram is the z-buffer itself, we have access to the metadata only when our vision and brain is trained for the binocular trickery. In that sense the stereograms propose a meditative zen-like exercise, which is, the less, remarkable

[8]

All these features that actually are becoming really close to us will define the future's capability of, further than depict motion and colors trough light, recognize and interact with shapes, places, people and go on. In a few years all these technologies will be amplified and face recognition, speech translation, movement tracking, real-time synchronization with other media, interaction with the environment, virtual reality, online communities, etc... will be more than real: a new and unexplored territory for the imaginery users.

[9]

If we synthesizes this imaginery as individual medium of art we can easily understand some outcomes as peaks of an outstanding and new visual culture. Personally I feel attracted by visual works that operates from inside a specific medium or circumstances, understanding therefore the inherent features of it as communication tool and being then the author a demiurge (to build a reality) of a specific event that happens inside that piece of time and space.

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[8] Meditation space, single channel artwork. Animated stereogram featuring a magic carpet. Tomas Navarro, Rotterdam 2012.

[9] Kinetic infrared stereoscopic camera space, shape and motion tracking.

[10]

In the video artwork “Centers”, Vito Acconci is trying to point the center of the screen, he’s almost touching him broadcasted persona in an artistic feedback performance. The human gesture is therefore propagated to the specific circumstances of the medium (video broadcasting) in a simple but joyfully way, open to many interpretations and experiences. The tools of a certain medium are understood and subjugated by the artist, which uses his potential to propose a credible statement of archetypical concern.

[11]

[10] Vito Acconci, Centers. 1971.
[11] A line made by walking, Richard Long, 1967. From “El arte ultimo del S.XX”, Anna Maria Guasch.

Is now my work to understand in which way the outstanding outcomes of modern imaginery will transcend the accepted ideology in order to define a revolutionary future's visual culture.

CONCEPT DESIGN OF A LENS-BASED HOLOGRAM

"[T]he invention of an hypothesis in order to explain a certain natural process, then the arranging of conditions under which that process may intentionally be brought about in accordance with the hypothesis, and finally, the justification or refutation of the hypothesis, depending on the outcome of the experiment".

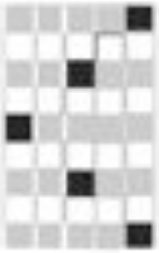
From Picatrix, regarding the scientific experiment method.

The hologram I'm aiming to build is therefore a true volume that floats in air and can be touched, an optical illusion that allows the audience to perceive a 3d representation in photographic form avoiding any surface of projection.

I should clarify that my research is not technological and will be executed as an artistic and intuitive investigation of new screening devices. I want to be able to set up original experiences in moving images, working with specific and self-invented methodologies. The goal is to push the audience and myself to an extraordinary and unexpectable experience in imaging due to the singularity of its inherent features. I want the audience watching an extraordinary object of which its main charestiricis its basis on basic natural physics.

My first idea was to work with a grid of concentrated-light pixels attached to a source of light in which each pixel, further than depict colors and luminance also describes the depth relative of those pixels onto space (z-buffering). Each light pixel is formally a tube, that actually works as simple collimation device, that also has a plano-convex lens in a specific distance from the source of light. In that way, the more is complex the grid, the more It'll be able to concentrate points of light following an specific order in the three Cartesian axis of the space (x,y,z).

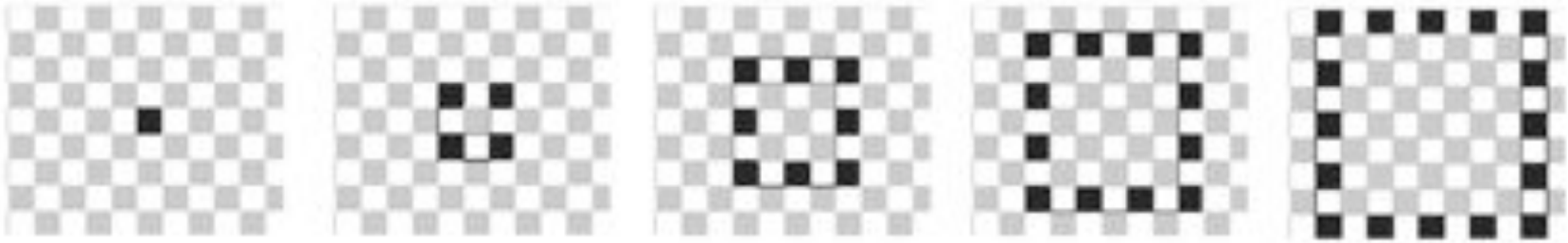
tester 1

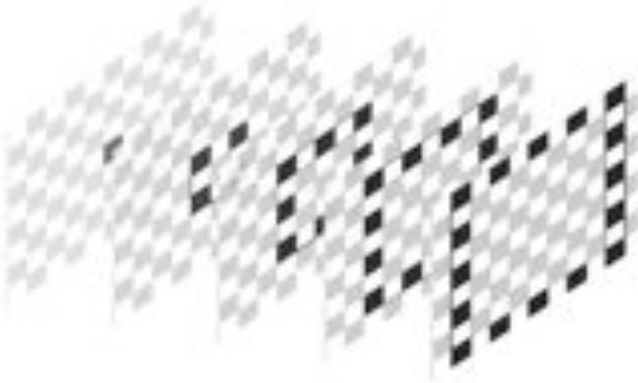


Source of light

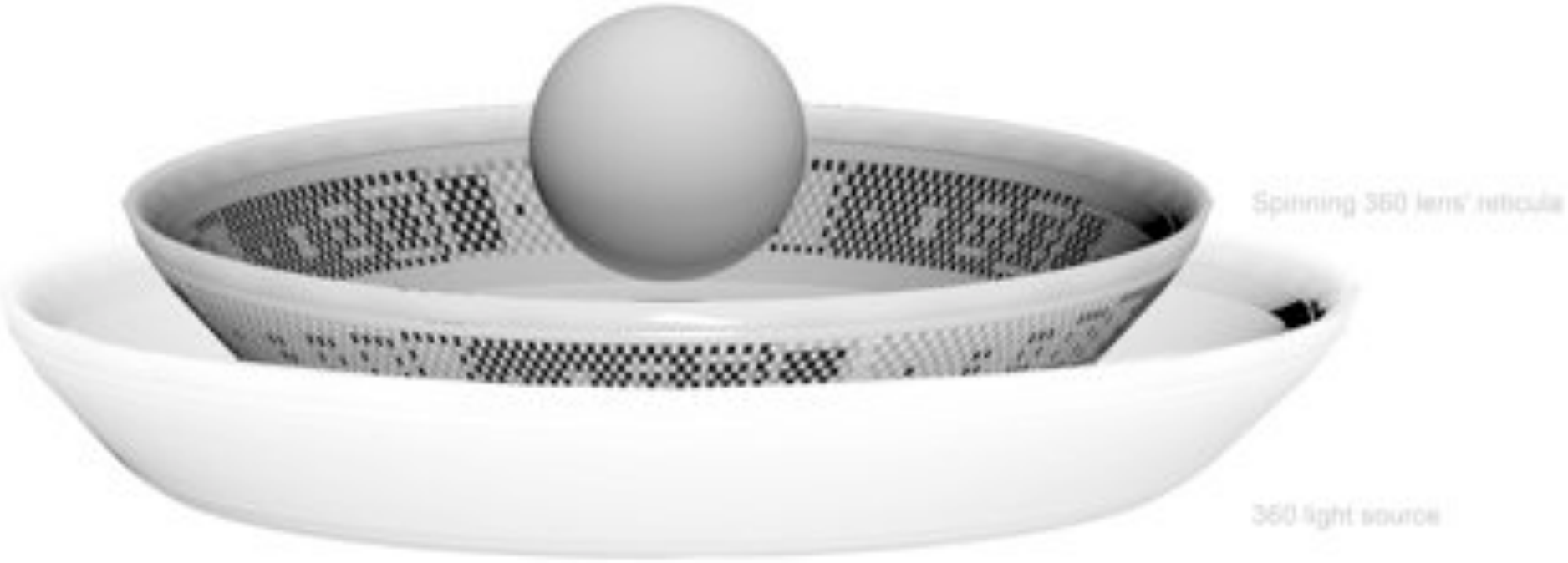
Lens based reticula

Volumetric semi-sphere/ condensed light

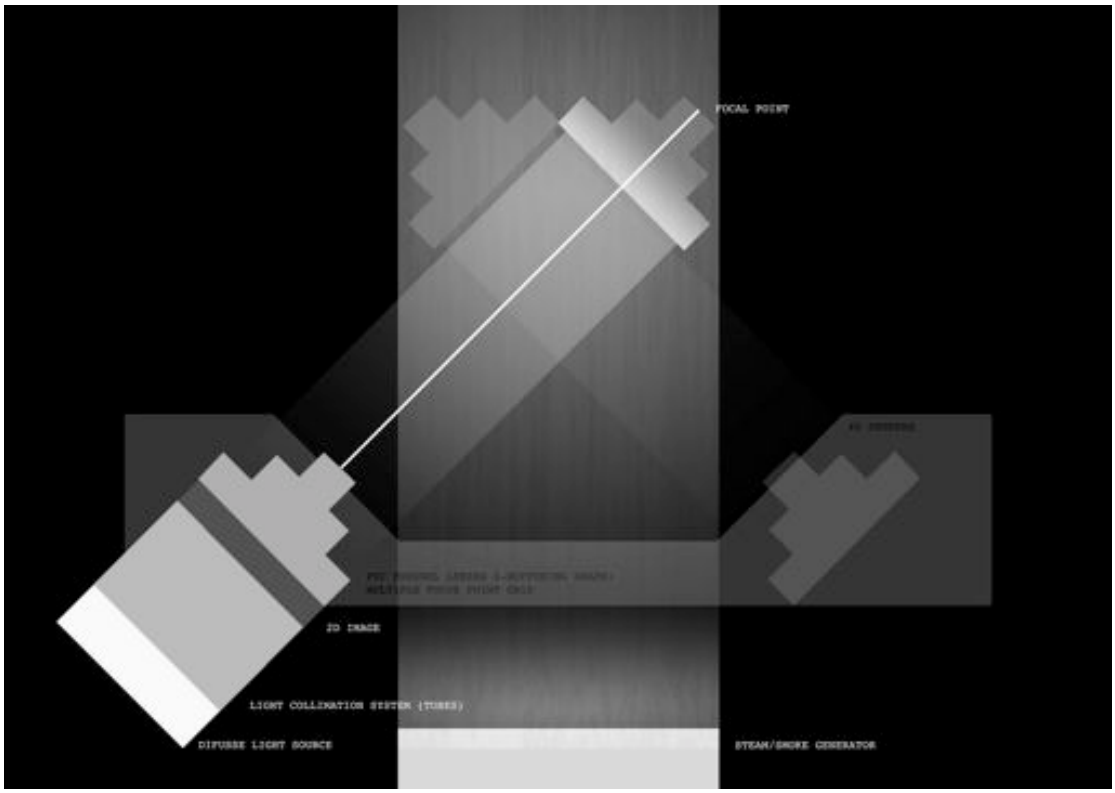


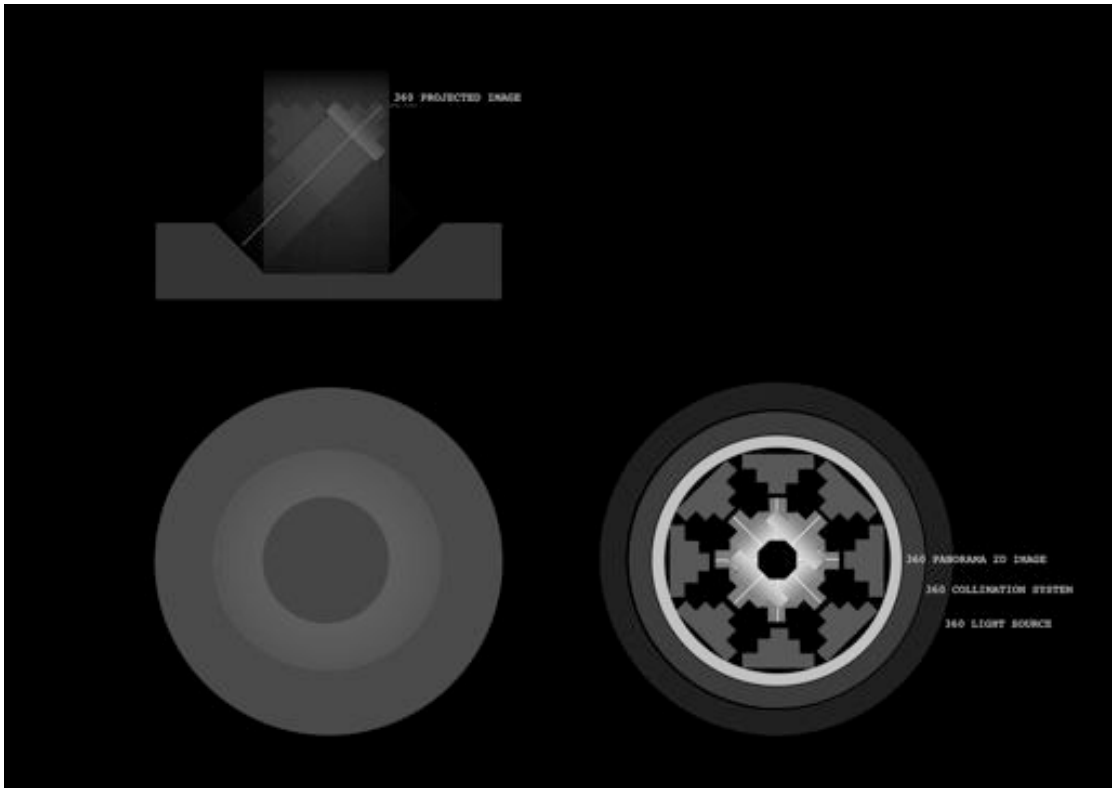


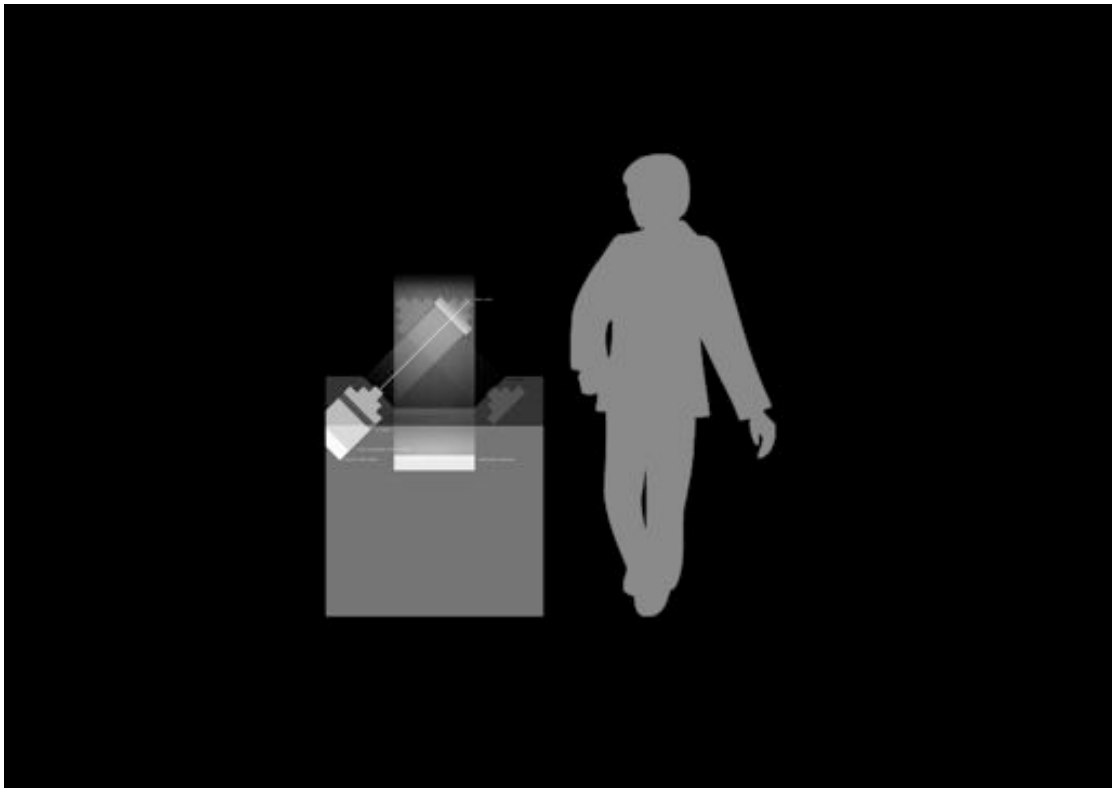
Tester 2



Through the sketches I’ve been working on the formal qualities of the device, being able to analyze all the elements involved before the materialization of it. The showed sketches, chronologically ordered, can express how I’ve been focusing my ideas from the concept design until the first real testers.




360 PROJECTED IMAGE
360 PANORAMA 2D IMAGE
360 COLLIMATION SYSTEM
360 LIGHT SOURCE



TEST 1
Still frame DIY projector, 2 units.

Once finished my research on affordable materials I decided to start building a prototype of the self-made beamers I want to use. As you can appreciate in the previous images I need multiples sources of images so consequently I developed a easy-to-do, replicate and transform cardboard functional model.

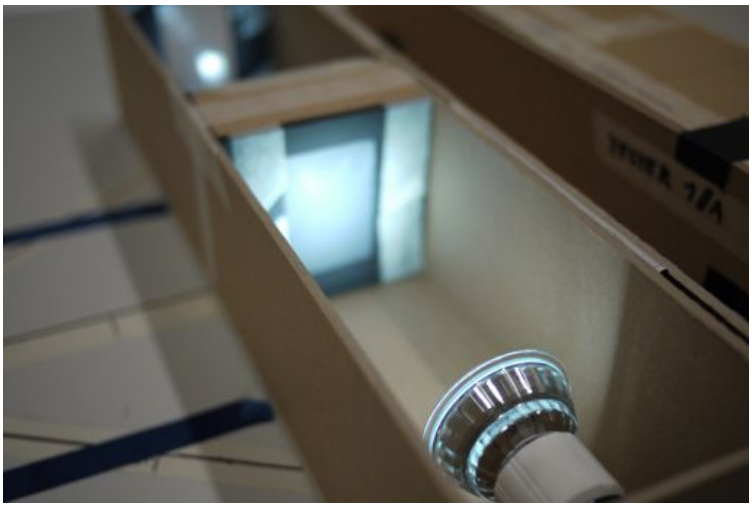
For my first test I didn't apply the depth map on images although the device is prepare to allow on it a multilayered film, which will be the core of the second test.

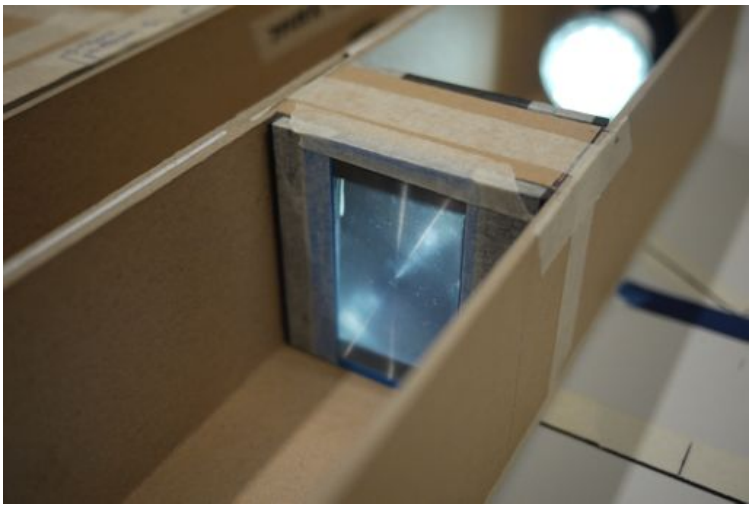
Curiously, built up my own projector shape some ideas regarding z-buffering in an unexpected and extremely positive way. Until the beginning of the experiments I always thought on depict the depth mask of my images by creating a grid of multiples Fresnel lenses displaced in relative distances along the z-axis. However, analyzing the qualities of my projector, is obvious that the depth should be depicted directly in a multilayered frame, that makes the object and the process much more affordable.

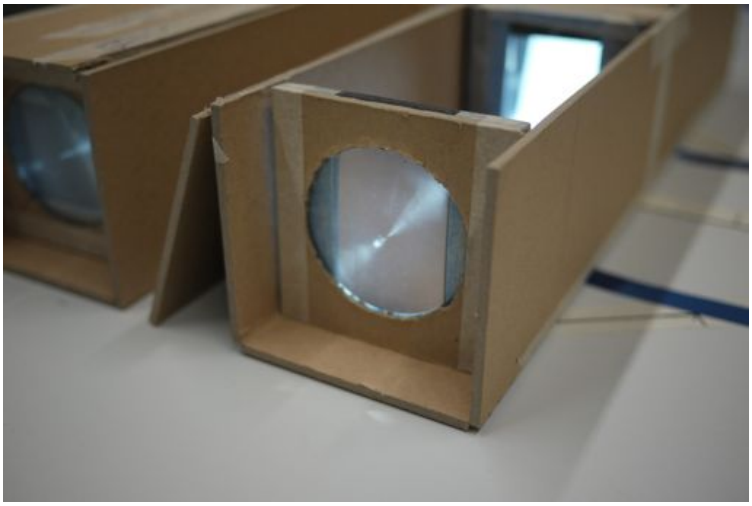
The bulb cast a beam of light onto a white diffusion frame, the diffused light incises on a Fresnel lens, which condense the light, through the frame that contains the image. The beam is finally projected due to a combination of a second Fresnel lens and a magnifying glass. I observed that a third Fresnel lens between the two optical elements is helpful in order to remove vignette effect and chromatic aberration (produced by low-quality lenses).

The basic materials are: a LED bulb, a white diffusion photofilter (paper), a magnifying glass and two pocketsize acrylic Fresnel lens. The body and frames are made by card board and foam board, the size of the device is conditioned by the lenses' size. No part has been glued; all the frames can very easily moved and fixed again.

Since my goal was to set up the basic elements on projecting flat images as quick as possible I didn't built on it the collimation system. However the inherent form of the device and the qualities of the Fresnel lenses made the light beams in a pretty straight way. For further experiences I'll add that, which is basically a grid of tiny tubes, in the space between the bulb and the white diffusion sheet. That space have been respected for that purpose and, after work with the features of LED bulb, I realized that a main white diffusion filter should be added before the light goes on the collimation system otherwise I'll get some gaps on light intensity and what I need is a constant casted light on all over the surface.





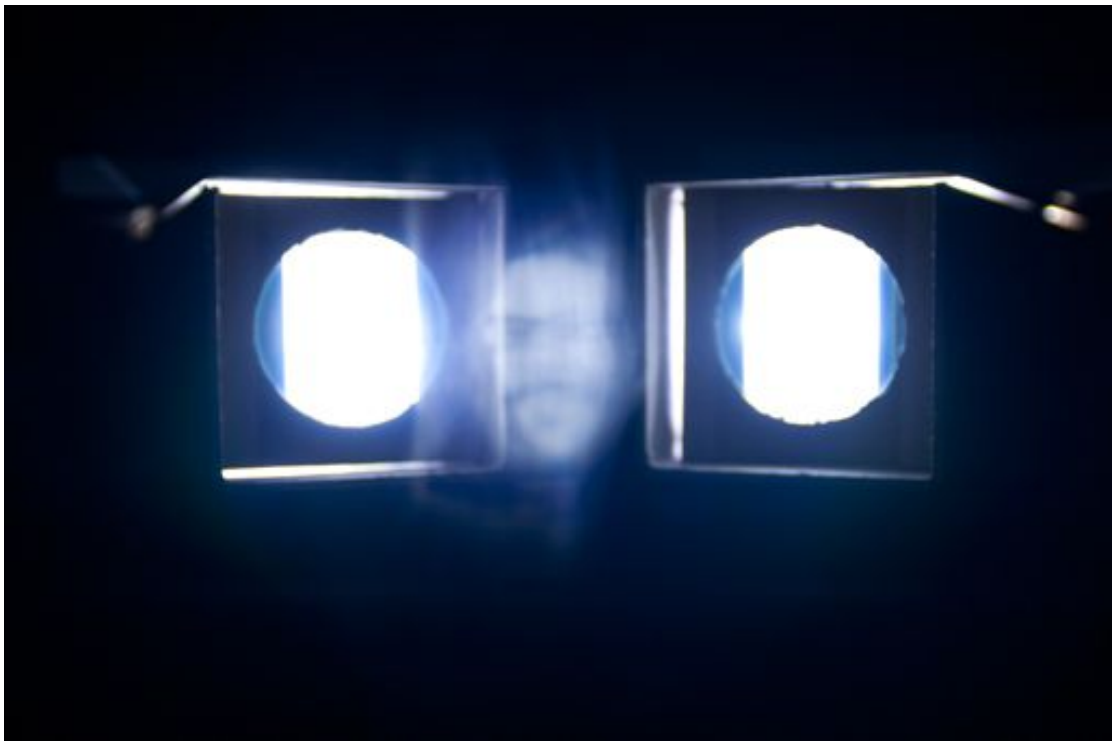


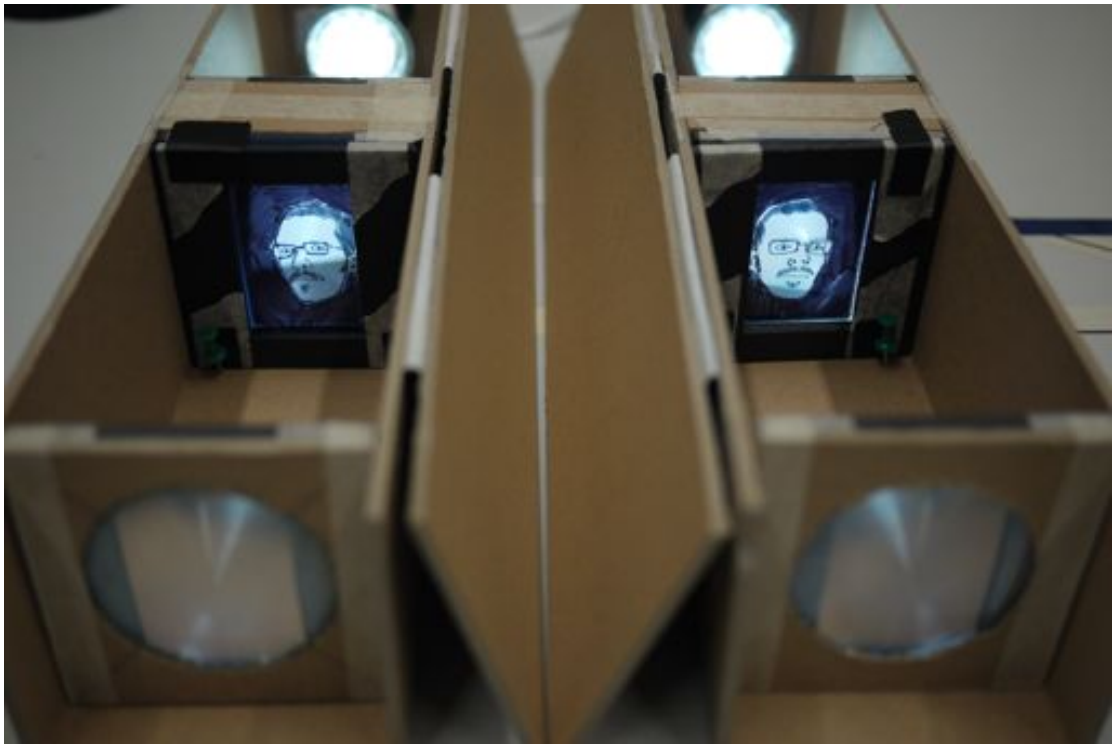
After finishing the two projectors I decided to engage myself in a simple test: project a dual angle image on a column of steam in order to achieve the illusion of parallax in the projected “stereographic” image.

As mentioned before that test doesn’t depicts depth mask properties yet as the goal is just perceive the parallax in a stand-alone projection by moving slightly around the projection space.

The focal plane is actually set at 16,5 cm; the size of the projected image is almost the same as the framed print (5,5 x 3,7). The selected image for the experience is a self-portrait “stereography” quickly achieved used a webcam and easily hand-painted in an acrylic sheet.

The ray of light extends on space, but both focal plain as condition of the smoke medium will create the illusion of a figure on air.





Although the experience was successful and the parallax perceived I want to move further and execute a second test improving the same parameters.

The main problems I want to fix are the instability of the smoke medium (is really difficult to appreciate the qualities of the images on a tiny and moving column of steam) and the roughness of the source image (hand painted acrylic). Also I realized that triangulating a stereography is not easy as I expected so a better approach for imaging should be done: the angles are wrong (too forced binocular disparity).

As conceptual deduction I should establish a discrepancy with others stereographic practices. Here's not involved any "brainy" process of gathering two images trough parallax but simply perceive the unified projection just moving to one angle to another. And definitively that's the main goal: a true holographic illusion in which the object is formally in front of you and could be touched. So, the stereopsis is relative, as I'm not using the binocular disparity but on the other hand those values of stereopsis are applied to the images sourcing process.
NEXT TEST

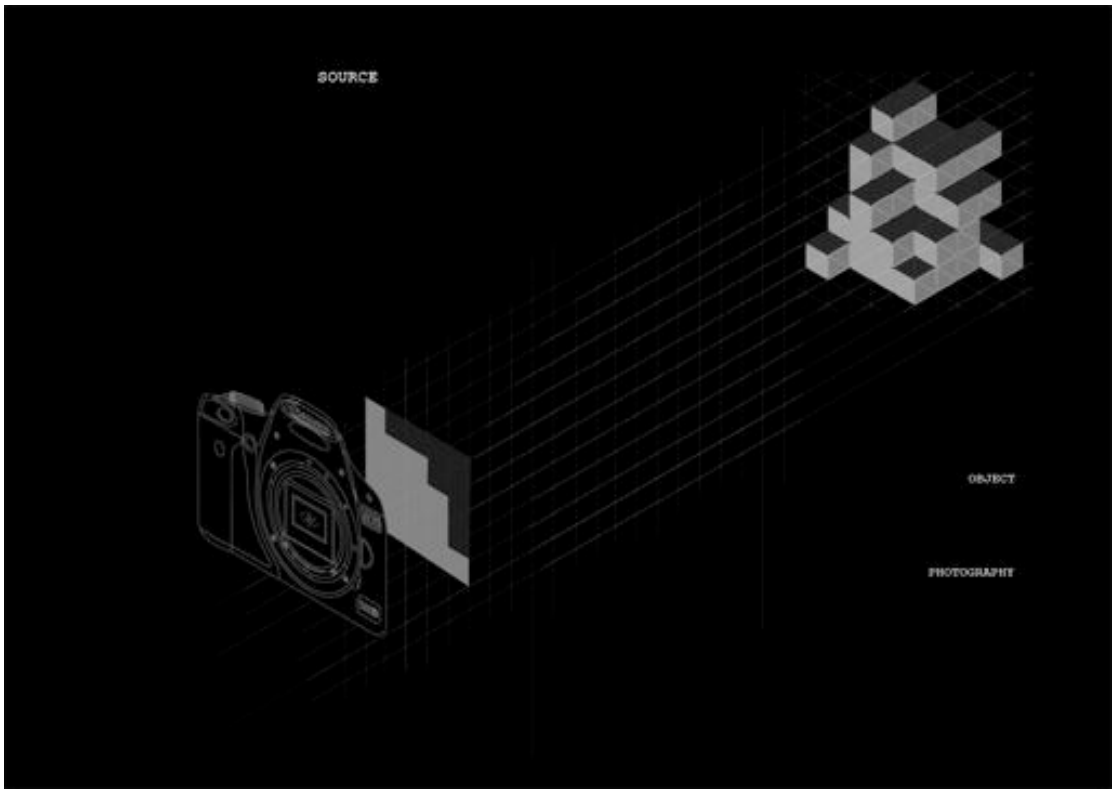
1. More projectors (total of 4-5 units). Each one has a cost of approximately 15 euros.

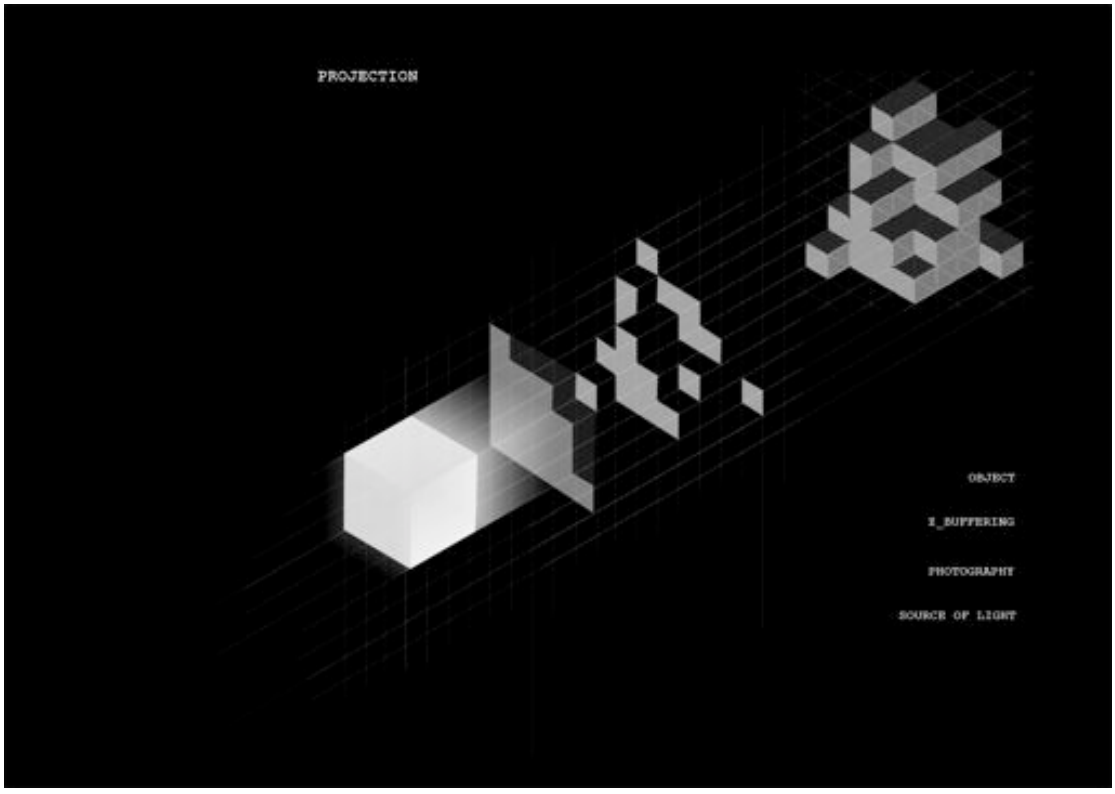
2. Improve the smoke medium. I've been doing research on it and I'll buy an ultrasonic humidifier, which basically atomize water using a high frequency vibration; the smoke that produces is dense and finally disappears in air, which is just perfect as I want to be able to control the shape it takes and work in a clean environment (trying to avoid traditional smoke machines and be obliged then to work in a foggy place).

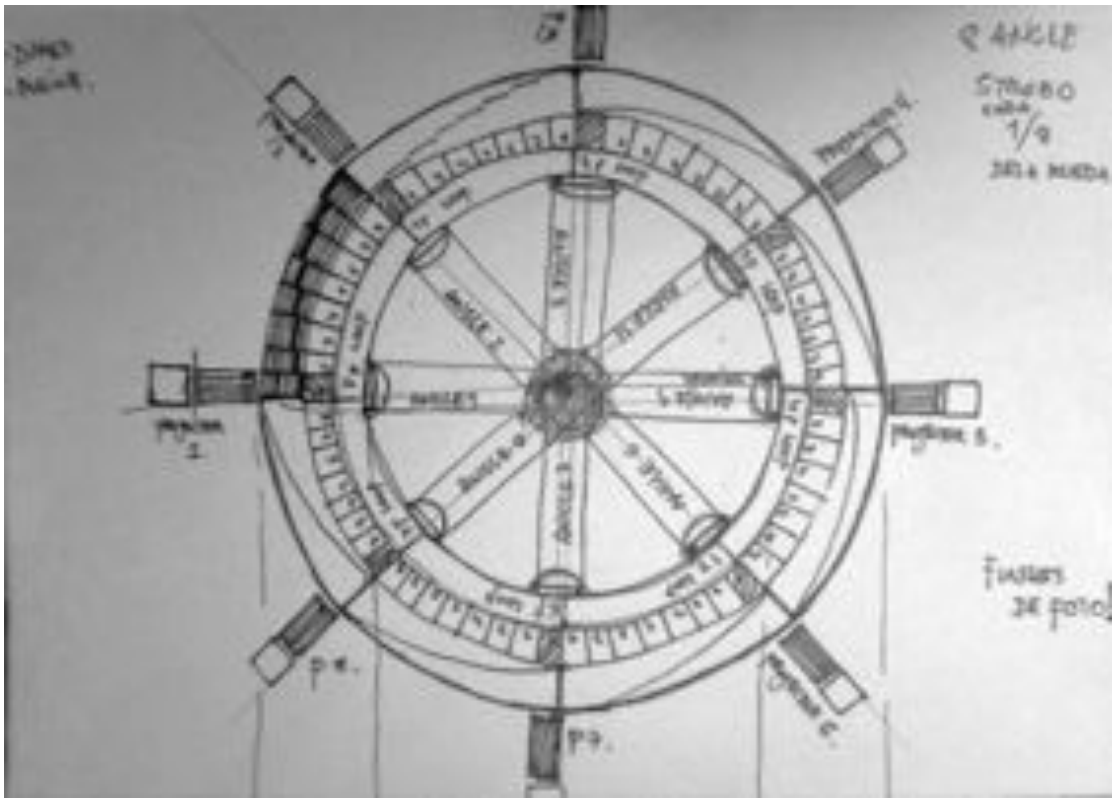
3. Keep the actual subject (self-portrait) but use color photos and better axis-angles values.

4. Develop the depth mask on each one of the images. The expected mask will be processed in Photoshop, cutting out planes on z-axis and isolating the data that is relative to those planes in different layers to be physically and sequentially over posed. The expected outcome is a progression of focal points on z-axis that could be noticeable in the saturated smoke medium. The qualities of the focus system on the device allows me to work with minimum distances so a bunch of acrylic films will be enough in order to move the focal point several centimeters in the projected image.

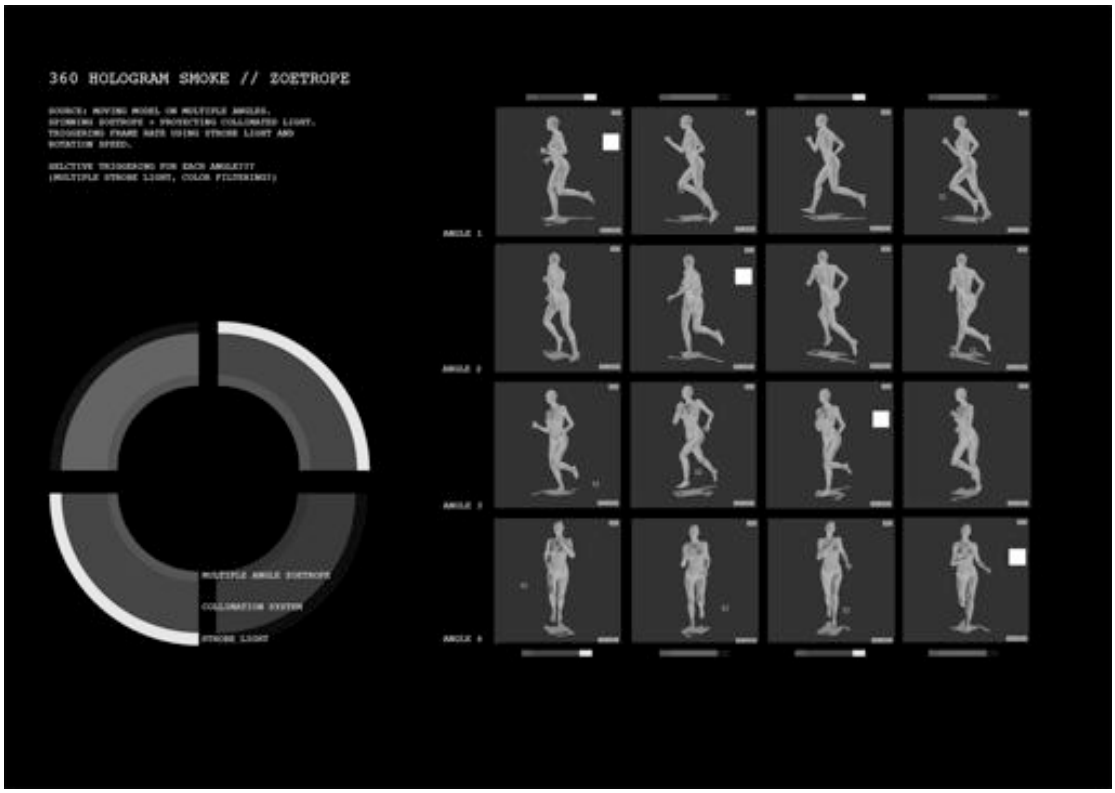
5. Study and sketch new and unexpected outcomes based on the first experience. As example I've been thinking on the possibility of a single channel projection, which force the audience to lay on the ground and have a cigarette. That means that the projector, installed as a lamp, beams a single multi-focal point landscape directly to the audience, which is, informally, the smoke generator and the trigger of the experience.


SOURCE
OBJECT
PHOTOGRAPHY


PROJECTION
OBJECT
Z_BUFFERING
PHOTOGRAPHY
SOURCE OF LIGHT



For final project I’m still thinking in a device that condense all the ideas and expectations in a 360 moving image holographic model. Still far away from it I want to show here my first sketches regarding it; I’m interested in apply to it the ideas related to the old zoetrope, but improved in a way that it’s able to project a multiple-angle animation loop.


360 HOLOGRAM SMOKE // ZOETROPE
SOURCE: MOVING MODEL OR MULTIPLE ANGLES.
SPINNING ZOETROPE + PROJECTING COLLIMATED LIGHT.
TRIGGERING FRAME RATE USING STROBE LIGHT AND
ROTATION SPEED.
SELCTIVE TRIGGERING FOR EACH ANGLE!!!
(MULTIPLE STROBE LIGHT, COLOR FILTERING!)
MULTIPLE ANGLE ZOETROPE
COLLIMATION SYSTEM
STROBE LIGHT
ANGLE 1
ANGLE 2
ANGLE 3
ANGLE 4


360 hologram + zoetrope
7 angle moving image
Triggering sequence
First frame 360 angle rotation loop
Second frame 360 angle rotation loop
ANGLE 1
ANGLE 2
ANGLE 3
ANGLE 4
ANGLE 5
ANGLE 6
ANGLE 7
Single angle animation loop progression