

Meta-holograms

E. Wesly, Home + Studio of E. Wesly & Sons, 5318 South Neenah Avenue, Chicago, IL, USA
60638-1230

ABSTRACT

Meditations on the holographic process are immaterialized in the minimalistic Meta-Hologram series, holograms about holograms. The inimitable beauty of the spectrum, as the subject/object itself, is held up for study and contemplation.

Keywords: Meta-holograms, Benton Math, spectrum

1. INTRODUCTION

1.1 Raison d'être

"Fornicate verisimilitude" is the battle cry of my school of holographic artwork. Why bother with trying to reproduce objects, or a simulacrum via computer holography, when there are so many new and interesting images to be made by utilizing the medium in "the wrong way"? My recent meditations on the holographic process are immaterialized in the minimalistic Meta-Hologram series, holograms about holograms.

2. PREVIOUS WORK

2.1 HOE's

As noted in the liner notes of *Are You Experienced*, "Jimi Hendrix breaks the world into interesting fragments. Then reassembles it. You hear with new ears, after being Experienced."¹ Or with new eyes, after experiencing my Holographic Optical Embellishments. (HOE)

They begin life as transmission holograms of wrinkly glass, the type as found in stainless glass windows. If reconstructed with laser light, one would be tempted to say, "excellent hologram of wrinkly glass." However, when viewed with white instead of coherent light, possibly even displayed pseudoscopically, the images become holo-kinetic explosions of spectra! The trick is in the composition, not to use the effect just for its own sake, but to use them as a new palette that jumps off the surface of the canvas. My HOE compositions are based on recurring Cubo-Futuro-Constructivo-Neo-Plasticine designs that I find on my notepads, doodles, some sort of graphics bubbling up from the sub-conscious. Other times they are collaged with photographs, creating a new world, or incorporated into idiosyncratic sculptures. And sometimes light itself is the object.

Here are some of my greatest hits from that era:

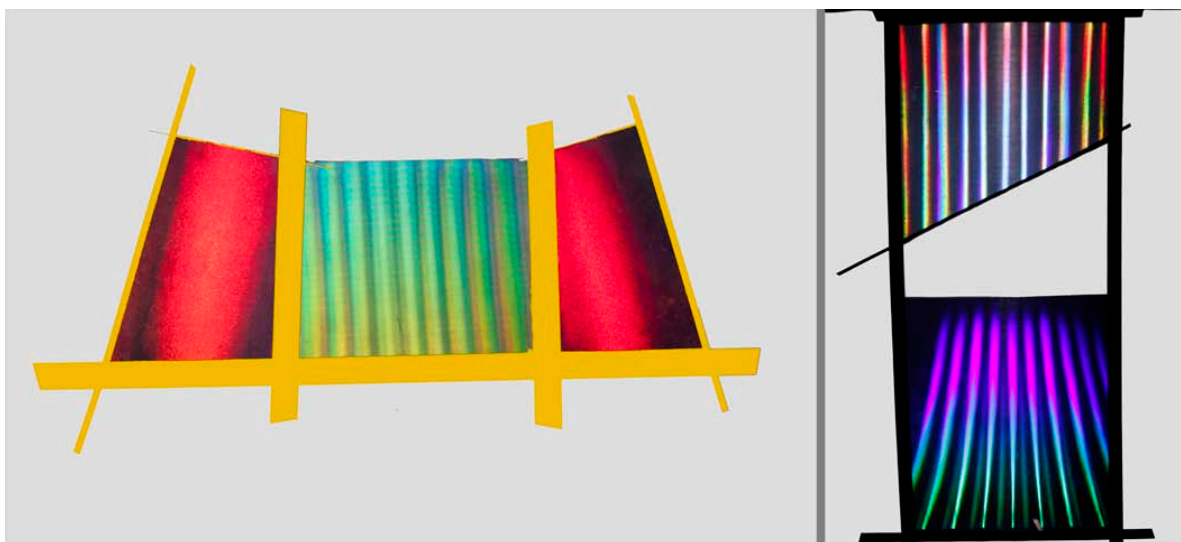


Figure 1: Doodles with HOE's. Left, "Cockpit", (2012), 16" by 20" collage with HOE's; right, "Golden Mean Guillotine", (1990), 60 by 40 cm collage with HOE's. White diffusers mimic the paper the designs were doodled on.



Figure 2: Photos with HOE's. Left, 40 by 50 cm B&W photograph of a deserted strip mall sign with HOE's replacing the abandoned store name, making a pretend "Truly Splendid Monument (for the First Great Minister of Culture" (who happens to be me); right, Jay's Closet", (1995), 28 by 35 cm B&W photograph of a storage space, the HOE's representing the aliens, angels, or demons that play in there.



Figure 3: Sculptures with HOE's. Left, "3-D TV Snow", what you see upon awakening after having passed out in front of your 3-D TV; center, detail of maquette of "Dear John Memorial", where the eternal flame is surrounded by diffraction gratings; "The Space Shuttle Memorial" (1985).²



Figure 4: Pure light. Left, "Coach Lamp A", diffraction gratings surround an incandescent bulb creating a cookie jar of spectra; "The O-tron", rainbows tag along for the ride on the spark of a Jacob's Ladder's surrounded by diffraction gratings; "Rainbow Projecting Transom". diffraction gratings in my front door on a sunny morning.

3. CURRENT PRACTICE: META-HOLOGRAMS

3.1 Origin of the title

The use of the prefix meta- was brought home to me while working on my Master's degree in Technology in Education, in a class called Cognitive Thinking. *Meta-cognition*, thinking about thinking, becoming part of the vocabulary. We even studied meta-surveys, which compiled the results of previous surveys on the same subject. And of course there is the meta-data that is attached to our image files. So the Meta-Holograms are holograms about holograms.

3.2 Inspiration

While pondering the equations in the Benton Math papers³, looking at his diagrams, drawing my own to solve the problem at hand, I thought how wonderful it would be to have a set of holograms that were recorded to illustrate the concepts presented in his diagrams, and to be able to manipulate the variables in vivo to see the seven deadly aberrations in action.

This follows Nils Abramson's style of pedagogy, "Suppose for a moment that holography produced not patterns but rather columns of digits bearing the information capacity. Surely people would in that case ask themselves what could be done with all these numbers? The goal would then necessarily be to design a graphical display which would transform the numbers into a type of map..."⁴

These test patterns turn out to visualize these equations beautifully!

4. METHODOLOGY

4.1 Table set up

A 30 by 40 cm film/plateholder was secured in place on the trusty old Modern Optics Table, with a reference source positioned one meter away, incident at 45°. A large piece of groundglass was placed in front of it, usually tilted backwards at 30 degrees from the normal of the holographic plate when the plate is viewed with an overhead reference beam. Behind the groundglass are stripe of light and point generators (cylinder lenses and diffraction gratings).

4.2 Recording materials

Holographic recording materials used were Ilford/Applied Holographics HoloPar, Agfa 8E75HD and 8E56HD or Ilford SP695T, depending on which color laser was being used. Processing chemistry included the appropriate developer for the material followed by a rehalogenating bleach.

5. EXPERIMENTS

5.1 #1: The height of the spectrum

The aberration that most interested me was chromatic, or dispersion, because of the beauty of its product, the rainbow. A consequence of the lambda focus equation is that the spectra increase in size the further the object point is from the hologram plane. A stripe of light from a raw beam encountering a cylindrical lens was projected on the tilted groundglass, which was practically touching the plate holder, so the z-axis dimension is almost zero, its vertical aspect being aligned with the centerline of the hologram.

Hold on to your hats, here comes some trigonometry, but don't close your eyes, as you will see the solution to dispersion as a function of distance in a holographic image.

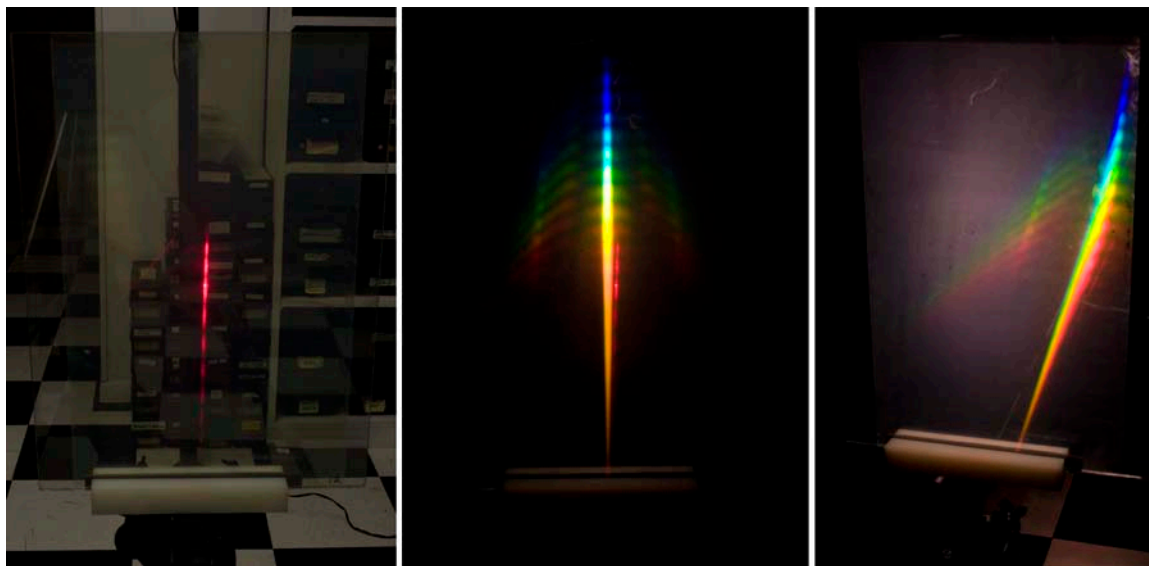


Figure 5: 3 views of the spectrum growing with increasing z distance.

On the left the hologram is illuminated with a laser, and a virtual image of the stripe of light as it appeared during recording is superimposed on reality. In the middle both the laser and white light are turned on with the room lights off, and the stripe appears as a line receding into the distance when viewing the hologram dead on. Shifting the viewpoint off-center reveals a wedge-shaped sculpture of spectrum, with the distance between the red and blue ends enlarging the deeper one looks.

5.2 #1a: Gilding the rainbow

After being amazed by the above Meta-Holo, what comes next? Double, or triple the pleasure with more rainbows! A diffraction grating was added after the cylinder lens, acting as a beam-multiplier. The higher orders hit the groundglass at a skew angle, so they tilt not only backward but inward, presenting their dispersions transversely during reconstruction. This image looks like holographic feathers on an arrow, or fins on a rocket, as evidenced in this mixed broadband plus 640 and 532 nm reconstruction.

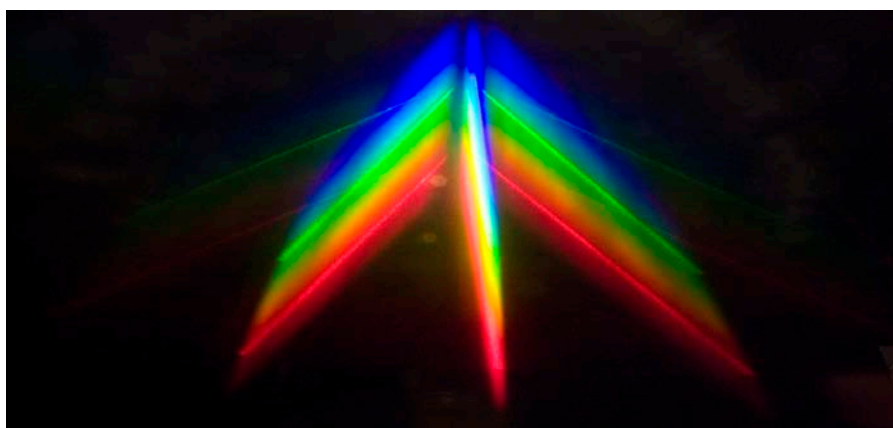


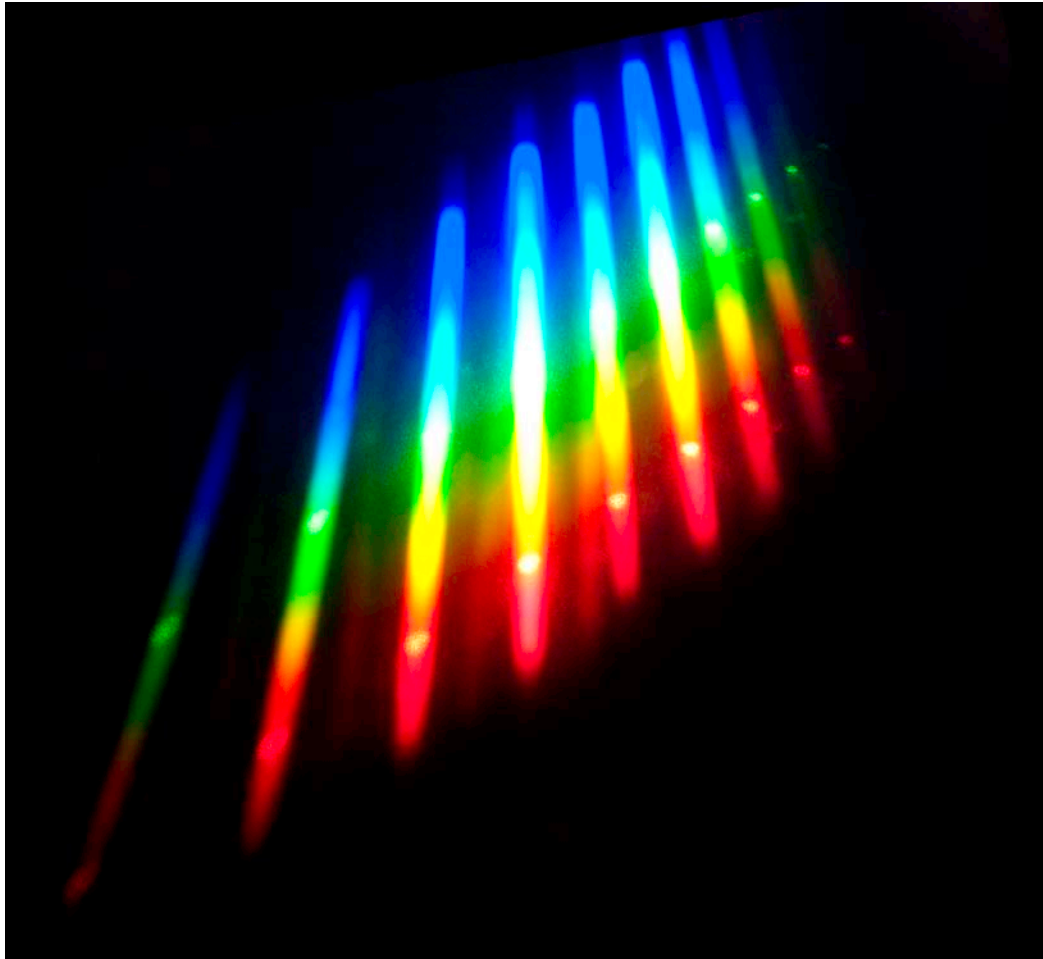
Figure 6: Multiple stripes at various orientations.

5.3 #2: The spectra point to the source

The alpha angle equation tells us that the dispersed spectrum of an object point points toward the replay point source. So I devised an experiment to visualize that.

The object points were diffracted spots from an undiverged beam passed through a low spatial frequency grating, diffracting the beam into umpteen orders, with the deepest dot on the groundglass directly "under" the spatial filter. The series of dots were not aligned vertically however; the nearest and deepest dots were to the left and right of the spatial filter's axis. And sure enough, the dispersions pointed to the white light replay light bulb!

I got smarter shooting the photo of this holo by replacing it in the plateholder on the table. The red and green laser beams were passing through the pinhole of the simultaneously, being part of a multi-wavelength team, and a piece of glass reflected the white light from an incandescent MR-16 bulb, aligned so that the filament is at the position of spatial filter's pinhole.



The photo above is the hologram replayed with white light and two laser wavelengths simultaneously. It was recorded at 640 nm, the bright red dots in the appropriate spot in the broadband spectrum, along with a 532 nm beam passing through the same spatial filter as the 640. The tilt backward of the spectra is steepest in the nearest, and arises the further back, becoming completely vertical at the deepest spectra, which is "under" the light source. The rotation of the spectra all point to the centerline of the hologram.

6. CONCLUSIONS

Science imitating art? Just by looking good? One stealing from the other? Or borrowing? If one hadn't heard of this body of work's scientific genesis, would it be considered art?

The inimitable beauty of the spectrum, held up for study as the thing itself, the purely sculptural possibility of holography, finally realized. Not unlike Edward Weston rapping about photography in 1924, "...should be used for the recording of *life*,, for rendering the very substance and quintessence of the *thing itself*, whether polished steel or palpitating flesh." And *light* might be substituted for life by photography's bastard child, holography.

REFERENCES

- [1] Hendrix, J., [Are You Experienced?], Reprise Records, Los Angeles, (1967).
- [2] Benton, S., "The Mathematical Optics of White Light Transmission Holograms, Proceedings of the First International Symposium on Display Holography, Lake Forest College Press, 5-14 (1982).
- [3] Abramson, N., [The Making and Evaluation of Holograms], Academic Press, London & New York, vi (1981).
- [4] Wesly, E., "A Proposal for a National Space Monument", Proceedings of the SPIE, Vol. 1600, 169-170, (1991).
- [5] Weston, E., [The Daybooks of Edward Weston], Aperture Press, Millerton, New York, 55 (1961).