

WHAT IS A HOLOGRAM

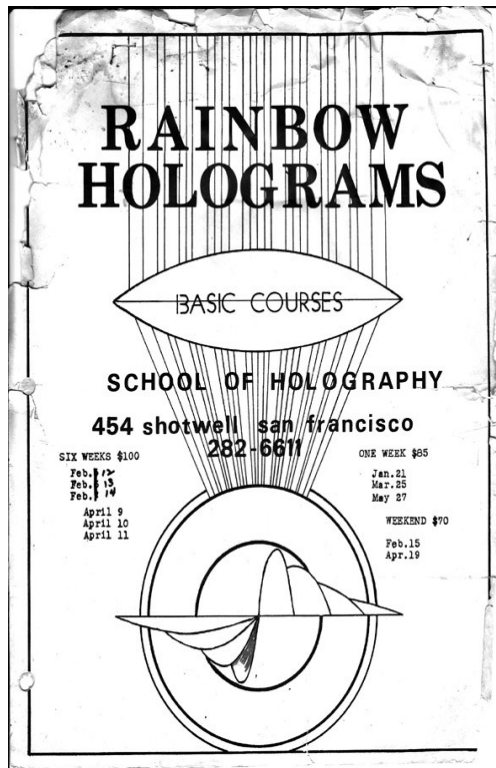
"Inside the museums, infinity goes on trial"

Visions of Johanna, Bob Dylan, 1966

In 2021, Al Razutis posed the question "What is a hologram?"

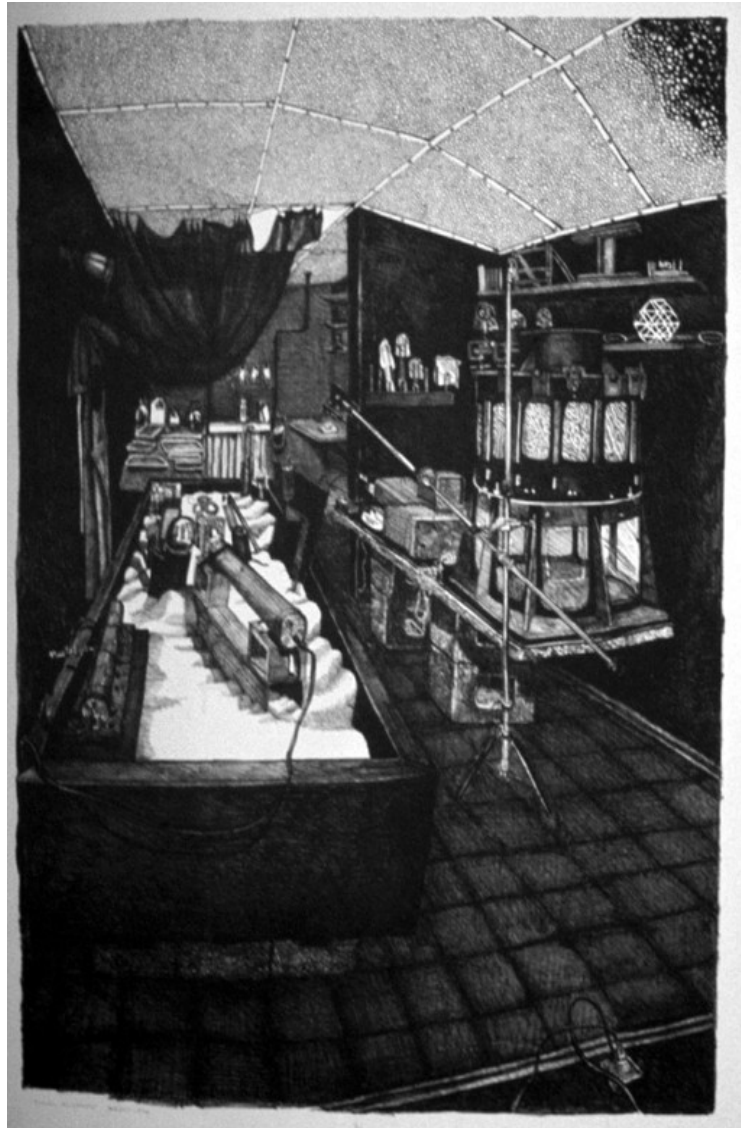
In the mid 1970s I worked as a lab assistant at *Visual Alchemy*, his creative media studio equipped for experimental film, audio and video synthesis, and holography. Later in the 1970s Gordon Kidd, Rick Gibson and others also assisted in creating holograms that Razutis incorporated into sculptural assemblages for exhibitions.

Before meeting Razutis in Vancouver, I had been experimenting with holography in a Toronto physics lab as well as training in a technique he wished to employ, invented by Jerry Pethick and Lloyd Cross, taught in California at the *San Francisco School of Holography* and at Lon Moore's *Celestial Holograms*. This "sandbox" method was more affordable and flexible than the science lab's rigid magnet board and micrometre adjusted optics.



I was introduced to Razutis by his colleague and soul mate Gary Lee-Nova, whose studio was in the same ramshackle building cluster, “The Grange”, in an industrial wasteland under the Granville Bridge in Vancouver, B.C. Razutis’ film *98.3 KHz: Bridge at Electrical Storm* (1973, *Amerika*) sparked a wish for an apprenticeship, stormy as it might be with this fuming burning bush character. I hadn’t seen such edgy artistry in Californian holography that was oriented more for a popular market.

Razutis and Lee-Nova collaborated with the nearby woodworker Allan Miller for construction of sculpture and studio fixtures. For anyone born after the Corporate Regime juggernaut’s recasting of everything to serve profit agenda’s spacetime=\$ formula, it may be a stretch to imagine art enterprise in low rent, derelict commercial premises with secret bed and bath, businesslike only in a wry Jonathon Swift spirit (eg. General Idea, Image Bank, N.E. Thing Company).





1974 Visual Alchemy view under Granville Bridge, Vancouver, B.C.

I tracked down Gary Lee-Nova after seeing a postcard he made in the 1960s with Stan Bevington at Coach House Press in Toronto, then a crucible of radical graphic and literary activity. The collage was so beguiling that I sought out the artist. In the mail art network at the time, it was an invitation to do so, a calling card, a tribal drum beat.

After I graduated in 1973 from York University's new fine arts program, Stan Bevington generously took me on as sorcerer's apprentice for his most obscure experiments, such as the production of a microfiche art book without specialist gear, using printing press equipment, in the spirit of "work-with-what-you've-got" cottage industry. We were taken aback by the information lost when 35 mm film and printed matter were converted to this low resolution, allegedly archival medium, then discarded.

Another experiment was offset printing of photographs using film grain as ink dot, with less data loss than conventional screening. Stan understood that I was intrigued by the dialectic of what is and is not captured by recording media.





I investigated holography after a foundation in academic arts and sciences, and a fine arts degree that included media studies and philosophical considerations. I had enough science lab and dark room skills to cope with the challenge of making holograms with tools at hand. From the start I was struck by the way that holography is radically unlike other modes of representation, differences that when internalized through practice have notable effects upon vision and cognition, just as use of current technology, phones and such, shapes the views and behaviour of people. As I will spell out below, this text is an example of conditioning by immersion in holography.

Since my experiments in the early 1970s then efforts to see exhibitions of holographic art in the 1980s, I did not keep up with the field, so mine is a blinkered, antediluvian perspective, without current technical expertise. I am qualified only to discuss the hologram in the way it most impressed me – as a “philosopher’s stone”, an elegant concept that through practical experience of its creation, conditions awareness in striking ways. Thus the transformative power of its subtle structure makes holography for me an “alchemical” medium – an activity the aim of which is as much to effect inner transformation as material goods, process as vital as product, a hermetic practice.¹

Popular misconceptions of the hologram as akin to stereoscopy, digital virtual reality and three dimensional spectacle suggest that simply seeing holograms does not have such a transmutative effect, perhaps in part accounting for the lacklustre response to the medium among art aficionados that has been perplexing to practitioners fired up by it.

I can offer a description of the transfiguration of the appearance of reality via immersive passage through the holography lab. I stand with the assertions of Karl Pribram and David Bohm that without the lenses of our eyes, telescopes and conventional presumptions, we would experience the world as holographic, in which seeming randomness is generated by implicate order in a paradigm that integrates consciousness and paradox. To understand the world as holographic requires that mind be incorporated in the model, which has not been the case since Kepler and the formulation of the empirical method that brackets the subjective dimension apart from objectivity. Such a reintegration, a Pansophia, is unlikely until there is consensus about a working definition of consciousness across scientific fields.² Until then, subjectivity is acknowledged and mapped in arts, and for brave hearts with antennas tuned to pattern recognition and twilight ambiguity, dark arts.

Again, without eyes and telescopes, the world would appear holographic. Our eyes construct a dualistic view that is blind to minds, cropped to a tiny patch by the camera frame. Still, we can visualize other models. Some do so mathematically, and when the possibility of the hologram arose in calculations, rigged a setup to test and demonstrate it. We also can internalize the system through hands-on lab experience, then notice it operative in life. In the way that even though the sun doggedly appears to move across the sky we know better, with cognitive corrective lenses we can be open to a wider range

1 This understanding of art was practiced and codified in Ancient Indian cultural theory in a context where, before the empirical method became the gold standard for establishing objective veracity, truth was realized subjectively, and conveyed by assembling the conditions for individual realization. Thus the arts were a means for transmitting truth and awakening to reality – a different essay (Dehejia 1997)

2 At present a search finds no consensus.

of possibilities than the conventional camera records and represents – the inseparable, reciprocally creative interdependency of consciousness and the world.

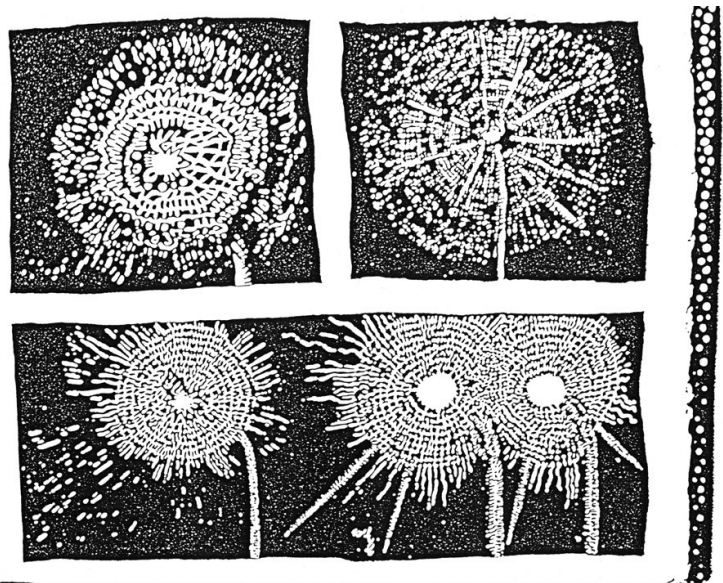
As I will outline below, an attribute of the holographic paradigm is that images do not reside as such in the mode of representation, and are configurations made possible by the construction of the system. Another key feature is that the uncertainty and randomness of events is only superficial, and reflects underlying symmetries, not just haphazardness – the appearance of developed holographic film an illegible blur until illuminated by light oriented like a beam in its production.

These ideas were developed by Karl H. Pribram and David Bohm, and relate to principles articulated in proposals by physicists that the appearances of phenomena depend upon detection, measurement, and observation determined by experimental apparatus (Ball 2018). They also feature in models of consciousness, in which phenomena are inseparably dependent related, so the only way things can exist is as illusory and imaginal – which is not dismissive, there being no other possible way to be.

In the view fostered by familiarity with the holographic paradigm, there is no independent artistic ego inventing original works; rather, art and everything is the outcome of cascading causes and conditions in a freefall flux of dynamic systematic construction. This understanding trended briefly in postmodern cultural theory, and for a while engendered playful neodada resistance to privileged “masters”. Alas, in the hands of pomo careerists, the idea was wielded as a club to beat down allegedly redundant Modernists, adversarial framing that snuffed its liberating potential. The idea also was employed to refute the existence of talent, privileging the conceptual aspect of fine art as a production of intellectual and academic literacy. Thus visual artists feel lacking in legitimacy and visibility unless written about, re-viewed in what Michel Foucault called the “graphic plasma” of a textual hegemony.

Setting aside such jabberwocky as inevitably artists do, only governable for so long, I can offer a narrowly subjective account of the cluster of factors that engendered my singular interest in holography, and the effect of the practice on subsequent activities, a trajectory through the lab. My holographic adventure ebulliently could fill a novel. About the objective state of the medium, I am unqualified to comment.

Before that saga, I will muse about a question stirred by the futurism that Felix Rapp noted in Al Razutis’ sculptural assemblages that integrate holograms. How did visions of ubiquitous holograms in popular culture and holographic arts never come to pass, while the home computer, developed at the same time, found its way into every home and even into individual palms?



1979 Street lights through contact lenses and window

1. WHAT IS A HOLOGRAM

Dictionary definition, (from Greek *holos*, whole; *graphein*, to write) :

hologram: A picture made by holography.

holography: A technique for producing a three-dimensional picture on photographic film using laser beams and without the aid of a camera.

Holography serves many purposes in engineering, physics, computer science, data storage and retrieval, security, popular entertainment spectacle, marketing, commercial and fine art.

I define holography as a medium that conditions perception and cognition by organizing information about 3-dimensional space in such a way that the whole is encoded in and can be reconstructed and viewed from any part of a representation.

Thinking of a definition as identifying a phenomenon's function and nature, terminology can vary across contexts in which holography serves different aims, identifying features that distinguish the hologram from other modes of representation.

Drawing, painting, photography, motion picture, and video record properties of light reflected from the surfaces of three dimensional objects to render an image on a two dimensional plane. Convincing spatial illusions can be generated by stimulating visual perception variously, and there is a long legacy of such inventiveness, from prehistoric cave paintings under lamp light flickering to life from textured, curved, layered surfaces (Herzog 2010), painted ceiling vaults, "smoke and mirrors" fun house trickery, classical pictures refined by Renaissance pinhole projection and geometric perspective (the blueprint for cameras), anamorphosis, stereoscopy and entertainment spectacle.

The way that a three dimensional image is generated by a hologram is different from such modes of representation and difficult to define without explanation.

Instead of a picture on a plane, the hologram can be thought of as a graphic that behaves like a "magic mirror" that stimulates the eyes as if what appears is present.



Like convex and concave mirrors, such images can appear in front of the hologram, hovering in space, as well as behind, as if through a pictorial window frame. Photorealism that has been of interest since Ancient Greek and Roman culture depicts boxed space, Modern art anchors attention to the flat surface, and holography draws it to light in space – all three equally illusory.

In a hologram, wave properties of light are encoded in such a way that they are reconstructed when it is illuminated, enabling features unique to it.

The first special property is parallax, the ability to look around the image.

Second, holography can project a "pseudoscopic" image to appear in front of the film plane. We habitually focus on surfaces. With practice, it is possible to focus in space, after which it is hard to not

see effigies such as reflections hovering above coffee spoons and in the wake of a boat, myriad mini suns like coins flipping over the waves.

Third, a hologram's entire image can be reconstructed from any fragment. Unlike other modes of representation in which lenses and other techniques focus an image on a plane, in holography, each point of the recorded object reflects light to the entire recording medium; conversely, each point on the medium receives light from the entire object. Holograms are created when such light, modulated by an object to encode information about it, is recorded in a medium from which it can be reconstructed.

Fourth, the hologram's developed film appears chaotic, yet when illuminated generates a high definition three dimensional representation. This "holographic blurring" is another defining characteristic, as expressed by Karl Pribram, a thinker in the field, "A random distribution is based on holographic principles and is therefore determined. The uncertainty of occurrence of events is only superficial and is the result of holographic 'blurring' which reflects underlying symmetries and not just haphazard occurrences" (Shaw and Bransford, 1977).

In some contexts such as data storage and retrieval, this systemic structure of the hologram, "the holographic paradigm" and its encoding of information in such a way that the whole can be reconstructed from any fragment, is more significant than its power to generate three-dimensional images.

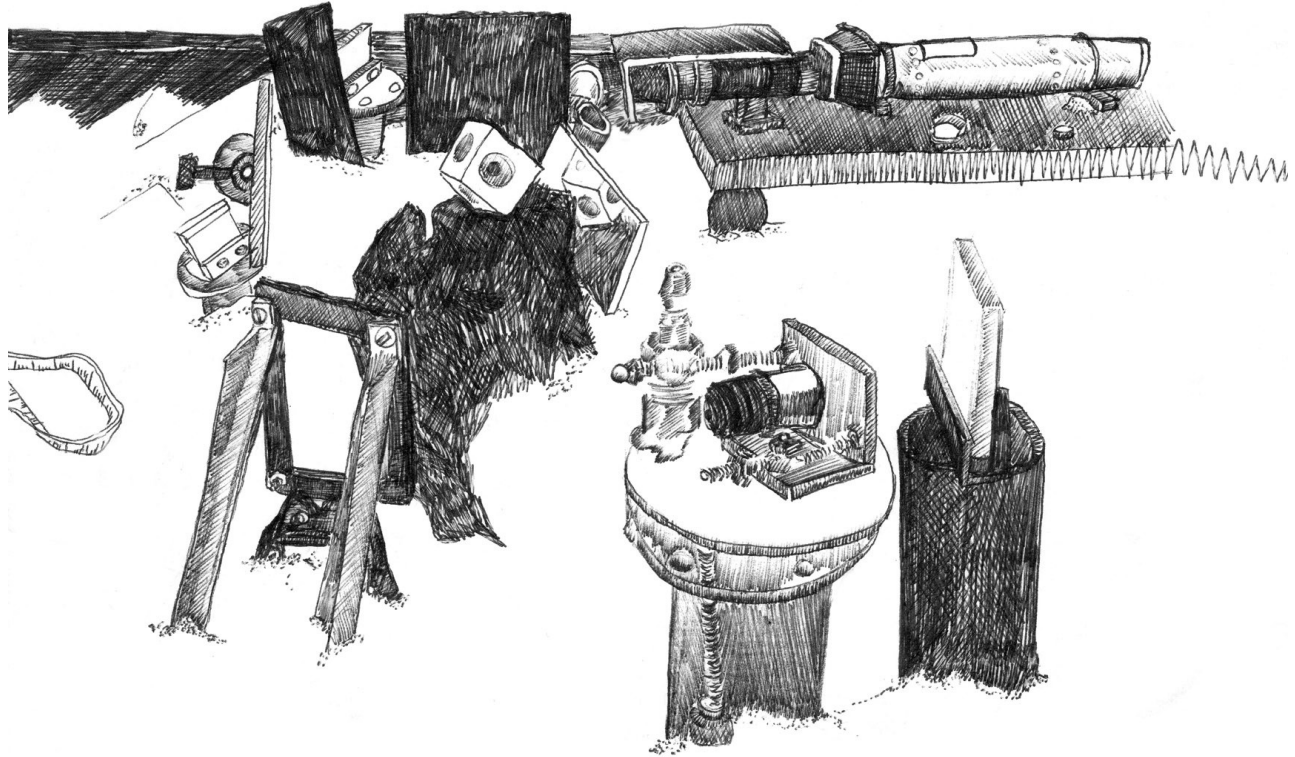
As a conceptual model, the holographic paradigm offers an alternative that is not antithetical to, contains and reconciles binary framing along an axis, such as oppositional contradiction and polarized tension. For example, the projected image in space seen from one side of a hologram, and the view of it as if through a window from the other side is a dichotomy reconciled in the hologram. Ditto for the entire image's encoding in every part.

In popular culture, there may be little awareness of the hologram's technology, and so conflation with stereoscopic imagery. Such a loose use of the term can be dismaying to those who value the hologram's special attributes.

As an art medium, the hologram's high resolution imagery, spatial optical illusion, and underpinning structure all figure, so need to be included in a working definition. I think of a hologram as a recording of data detected about light that encodes information so that the wavefront can be reconstructed from any fragment, generating imagery both behind the hologram surface and before it in space.

I also think of the hologram as a set of microscopic lenses and mirrors in a configuration that demonstrates a way that phenomena can appear as three dimensional to eyes and in mind. Organizing data holographically is different from and incorporates geometric perspective's film box and oppositional dualism. There are inseparable binaries in the hologram.

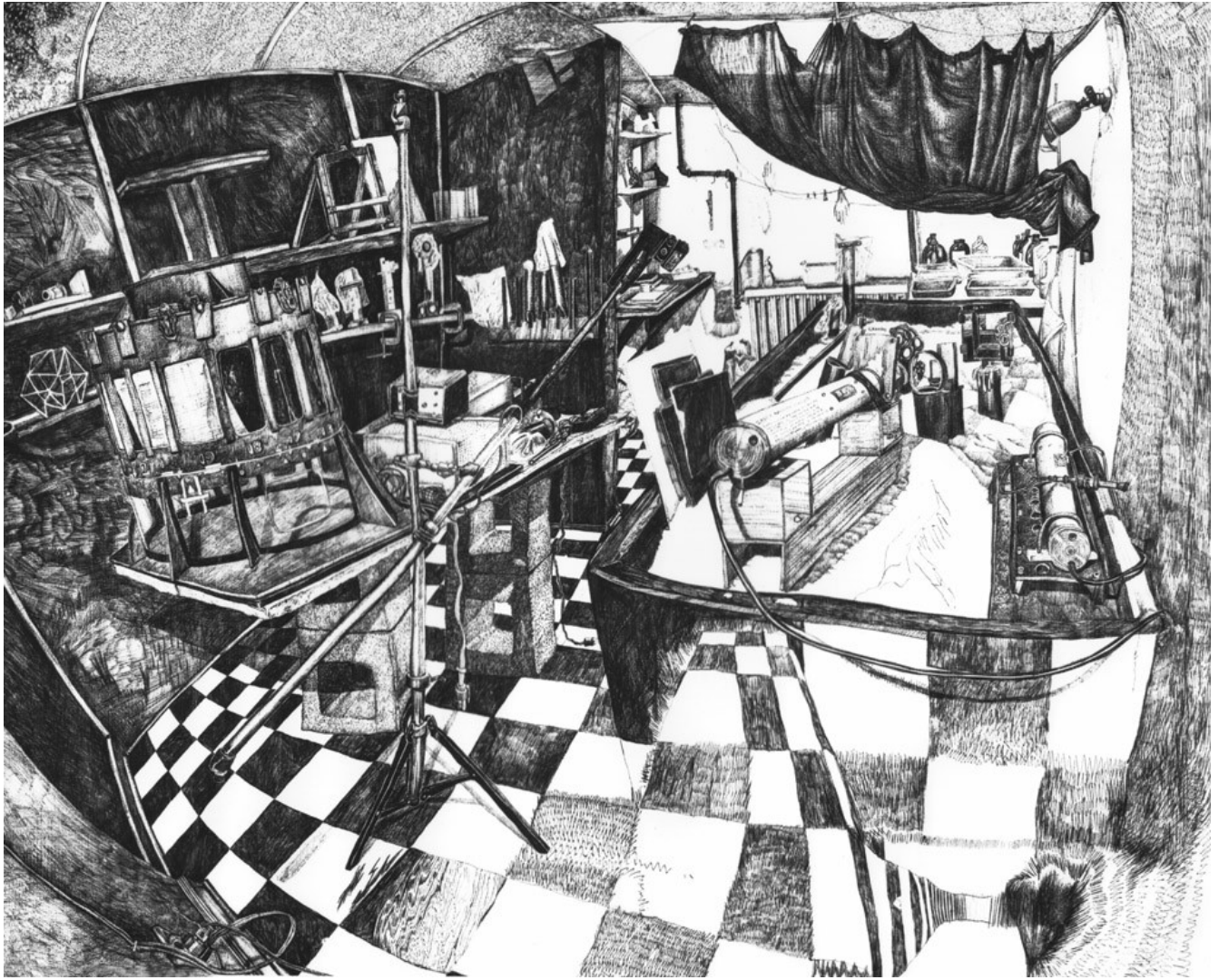
This kind of data, waveform phase information, requires a high resolution medium. Coherent laser light has been utilized in set ups that expose photographic film to standing wave interference patterns. I am not qualified to discuss digital and quantum holography.



2. WHAT A HOLOGRAM TURNED OUT NOT TO BE

When in the early 1970s holographic experimentation began outside the physics lab, there were spliff dreams of holograms becoming as ubiquitous as TV and visions of marketing jackpots (Rogers 1973). Holographic technology was developed at the same time as computer scientists and entrepreneurs were inventing the first user friendly operating systems and speculating on uses for personal computers. The Canadians engaging in this project for whom I worked envisioned “Community Memory” hubs offering computer usage freely as a public service like libraries, and they foresaw the labour saving potential of the technology enabling a four day work week, and more time for Lotus Land skiing and hiking.

In 1975 I was able to type research notes into a computer at Simon Fraser University and relay to a computer in the home of professor Doug Seeley on the other side of Burrard inlet, for his thesis, “The World is a Hologram in your Heart” – not as hare brained as judged by his university department. When the holographic paradigm is considered along with the Tantric subtle energy system, Buddhist codification of the nature and function of the mind, Karl Pribram’s holonomic brain, David Bohm’s implicate order and the etymology for “heart”, one might very well conclude that “the world is a hologram in your heart” without running off a tenure track.



+PLEASE ENTER THE KEYWORDS. KEYWORDS ARE THE WORDS YOU WISH TO USE TO
+ FILE OR INDEX YOUR MESSAGE INTO THE MEMORY.
+ PRESS THE 'RETURN' KEY TWICE WHEN YOU HAVE FINISHED.
+HOLOGRAPHICS HOLOGRAPHY ALCHEMY WORKSHOP

+PLEASE ENTER THE NUMBER OF DAYS YOU WISH YOUR MESSAGE TO
+ REMAIN IN THE MEMORY (MAXIMUM 90)

+90
+YOUR MESSAGE (#1302) HAS BEEN ENTERED INTO THE MEMORY.
+ IT WILL REMAIN UNTIL AFTER JULY 13, 1975.

*PLEASE ENTER A COMMAND OR TYPE 'HELP'.
*

*PRINT 1301

* 1301:

*THE LIGHTING EQUIPMENT NOW IN USE IN THEATRES IS NO LONGER ADEQUATE.
*THE PARTICULAR ACTION OF LIGHT UPON THE MIND; THE EFFECTS OF ALL
*KINDS OF LUMINOUS VIBRATION MUST BE INVESTIGATED, ALONG WITH NEW
*WAYS OF SPREADING THE LIGHT IN WAVES, IN SHEETS, IN FUSILLADES
*OF FIERY ARROWS. THE COLOR GAMUT OF THE EQUIPMENT NOW IN USE IS TO
*BE REVISED FROM BEGINNING TO END. IN ORDER TO PRODUCE THE QUALITIES
*OF PARTICULAR MUSICAL TONES, LIGHT MUST RECOVER AN ELEMENT OF
*THINNESS, DENSITY, AND OPAQUENESS, WITH A VIEW TO PRODUCING THE
*SENSATIONS OF HEAT, COLD, ANGER, FEAR, ETCETERA.

* ANTONIN AR

*HOLOGRAPHICS HOLOGRAPHY DRAMA THEATRE ALCHEMY

*PLEASE ENTER A COMMAND OR TYPE 'HELP'.
*

*ADD

*POETRY

*WRITTEN POETRY IS WORTH READING ONCE AND THEN SHOULD BE DESTROYED.
*LET THE DEAD POETS MAKE WAY FOR OTHERS.
*ENOUGH OF PERSONAL POEMS BENEFITTING THOSE WHO CREATE THEM.
*MUCH GREATER THAN THOSE WHO READ THEM. ONCE AND FOR ALL ENOUGH
*OF THIS CLOSED EGOISTIC AND PERSONAL ART.

* ANTONIN ARTRUD

+PLEASE ENTER THE KEYWORDS. KEYWORDS ARE THE WORDS YOU WISH TO USE TO
+ FILE OR INDEX YOUR MESSAGE INTO THE MEMORY.
+ PRESS THE 'RETURN' KEY TWICE WHEN YOU HAVE FINISHED.

+KEYWORDS?

+POETRY

+PLEASE ENTER THE NUMBER OF DAYS YOU WISH YOUR MESSAGE TO
+ REMAIN IN THE MEMORY (MAXIMUM 90)

+DAYS?

+90

+YOUR MESSAGE (#1303) HAS BEEN ENTERED INTO THE MEMORY.
+ IT WILL REMAIN UNTIL AFTER JULY 13, 1975.

STOP
* TEL# 738-4557
* INCLUDE PLUMBING TAP SINK TOILET CREAK REPAIRS
*
* PLEASE ENTER A COMMAND OR TYPE 'HELP'.
*
* UNDEBIND
*
* * * * *
* INTERESTED IN ANIMATION, COMPUTER-BASED OR IN HIGH TECHNOLOGICAL ART
* SUCH AS VIDEO SYNTHESIS, HOLOGRAPHICS ETC. CONTACT THE TUNDRA CO-OP
* OR COMMUNITY SYNAPSE AT 738-2300
*
* ANIMATION CARTOON FILM MEDIA COMPUTER VIDEO HOLOGRAM HOLOGRAPHICS
* TECHNOLOGY ART INTEREST KITSILANO TUNDRA COMMUNITY SYNAPSE
*
* PLEASE ENTER A COMMAND OR TYPE 'HELP'.
*
* ADD
* PLEASE ENTER THE TEXT OF YOUR MESSAGE. PRESS THE 'RETURN' KEY
* TWICE TO INDICATE WHEN YOU HAVE FINISHED. DON'T FORGET TO
* INCLUDE CONTACT INFORMATION (EG. NAME, PHONE) IF APPROPRIATE.
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* LUMINOUS VIBRATION MUST BE INVESTIGATED; ALONG WITH NEW WAYS OF SPREADING
* THE LIGHT IN WAVES; IN SHEETS; IN FUSILLADES OF FIERY ARROWS. THE COLOR
* GAMUT OF THE EQUIPMENT NOW IN USE IS TO BE REVISED FROM BEGINNING TO END.
* IN ORDER TO PRODUCE THE QUALITIES OF PARTICULAR MUSICAL TONES; LIGHT MUST
* RECOVER AN ELEMENT OF THINNESS; DENSITY; AND OPAQUENESS; WITH A VIEW TO PRODUCI
* NG THE SENSATIONS OF HEAT; COLD; ANGER; FEAR; ETCETERA."
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* PLEASE ENTER THE KEYWORDS. KEYWORDS ARE THE WORDS YOU WISH TO USE TO
* FILE OR INDEX YOUR MESSAGE INTO THE MEMORY.
* PRESS THE 'RETURN' KEY TWICE WHEN YOU HAVE FINISHED.
* HOLOGRAPHICS HOLOGRAPHY THEATRE ALCHEMY ARTAUD MAGIC LIGHT
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* PLEASE ENTER THE NUMBER OF DAYS YOU WISH YOUR MESSAGE TO
* REMAIN IN THE MEMORY (MAXIMUM 90)
* 90
* YOUR MESSAGE (#1300) HAS BEEN ENTERED INTO THE MEMORY.
* IT WILL REMAIN UNTIL AFTER JULY 13, 1975.
*
* PLEASE ENTER A COMMAND OR TYPE 'HELP'.
*
* FIND HOLOGRAPHY
*
* MESSAGE ITEMS WERE FOUND (1256 WERE SEARCHED).
*

At that time, Bill Gates, unconcerned with cosmology and public welfare, allegedly said that for sales success, the home computer doesn't have to be any good; it just needs to be necessary. He employed this strategy, pitching business machines to companies, institutions and service providers, making such devices a requirement for anyone other than off grid survivalists. Once there was a personal computer in every home, other needs were spawned by tempting the human herd mammal appetite for social connection until individuals now carry a computer/phone/snapshot hybrid that tweaks serotonin and dopamine biochemistry as devilishly as nicotine delivery mechanisms. The screen design and stimulation is such that with use it creeps up even a baby's hierarchy of needs. The only way parents can use their phones without a probing gooey finger intruding the way a cat plops down onto what we are reading for the warmth of our focus' chi, is to provide each child with their own flashy screens. Media condition human consciousness and behaviour, and spikes of desire and the fleeting satisfaction in novel stimulation are habit forming and potentially addictive. The current phone screen scaled to be worked by a toddler's pointer brings to mind an axiom of the Jesuit Aristotle, "Give me a child until he is 7 and I will show you the man."

That sci-fi fantasies of ubiquitous holograms in popular culture did not come to pass is a topic that can widen to bear upon digital virtual reality outside of specialist applications. Why do passports, drivers' licences, i.d. cards, portraits, memorabilia, home decor and popular imagery not feature forgery resistant holograms, while the personal computer and digital camera, developed at the same time are more prevalent than even the most extravagant capitalist wet dreams, with ungovernable potential for copyright and privacy violations, surveillance, deception and larceny?

Apart from occasional spectacles that draw new generations of audiences for whom 3-d illusion is novel, it turned out that the only characteristic of the hologram with mass production potential is its labour intensive and finicky technical production. That is, the most commonly seen 3-d image, anticipated "in-every-home", is fraud prevention security patches winking from credit cards and cash. These images do not display the full scope of holographic properties because their function is simply to be inimitable. It's comical to imagine forgers cooking up holograms:

"TURN DOWN THE SUBWOOFER! WE SHOOTIN'. AND HOW MANY TIMES MUST I TELL YOU NOT TO WASH DISHES IN THE SINK WHERE WE USE MERCURIC CHLORIDE!"

Why does three dimensional imagery not become ubiquitous? Is the craving for particular media innate, or is it manufactured by market agendas? A key principle in holography is that three dimensional reality can be described in terms of information located on a plane. Because appearances are the outcome of sensory detection and cognition, is that knowledge intuitive, 3-d data coming across as overkill and superfluous except as an occasional novelty?

What need is not met by the hologram, stirring a lacklustre "nothing-to-see-here" reaction evident in dogged hostility to holography expressed in disgruntled reviews and tight lipped stone walling by art critics?

Such resistance is intriguing in an art arena in which allegedly anything goes. Rigorous deconstruction in the 20th century concluded that particular means are not defining, legitimating characteristics of fine art, so artists are free to employ whatever they please as long as the conditions are assembled for art to appear (Wolheim 1984). People have cultural needs that are inconsistent with high minded theory; the austere Modernist theoretical justification to eschew decoration amounted to a trend with some masterpieces. The wariness of holography is perplexing in a field in which all other media after some resistance find acceptance and constitute schools – film, video, digital production, disembodied ideas,

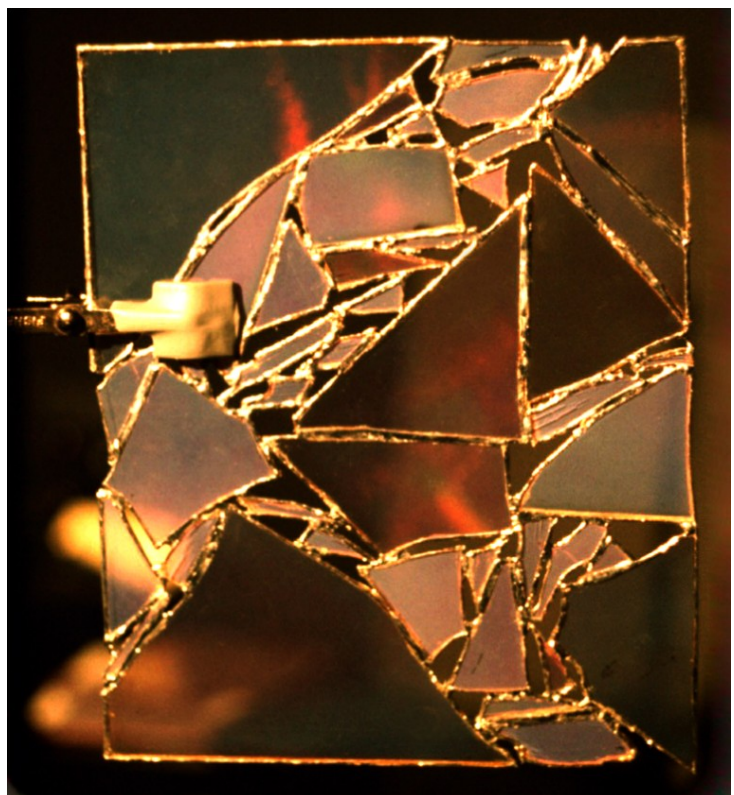
flotsam, jetsam, ephemera, and window dressing tableau rearrangements of the everyday. Even after heavy hitters such as Salvador Dali and Michael Snow commissioned holographic artwork, and brainiac Al Razutis took giant steps past rocket science technical experiment to integrate holograms he made into sculptures embodying big ideas, critics and curators remained peckish.

Curious about the lukewarm consideration and even shunning of holography as an art medium, I attended exhibitions, giving close attention and careful consideration to what factors thwart an art experience, even in the works of Titans. At the time I wrote for journals and my submissions about shows of holographic art were rejected. Other writers kept mum. Because of textual hegemony, authenticity bestowed when art is written about, the absence of reviews of holographic art was taste making.

I had my own small experiences of professional aversion to holography as an art medium. In 1973 David Hlynsky and Michael Sowden ribbed me about my interest in holography as “tricknology”, even though they both wielded gizmos as professional photographers and printers, and Sowden did stereoscopy, quipping, “Space is going to be a big thing.” I wondered what decreed their cameras bonafide art tools and disqualified holographic gear. Years later they teamed up to create the holography studio *Fringe Research* and the affiliated *Interference Gallery* in Toronto. Eventually the venture ran its course and amounted to entries slotted into resumes thickly stacked with photographic accomplishments.

In 1974, influenced by IMAGE BANK and General Idea’s spoof of the “art master” convention, the Art Gallery of Ontario curator Alvin Balkind extended an open call for submissions to a “CHAIRS” themed show. I responded in the spirit of Joseph Kosuth’s *One and Three Chairs* (1965) that had presented a chair, photograph of the chair and dictionary definition, posing the Buddhist challenge to nail down the location of a chair. I addressed scale, submitting an album that juxtaposed snapshots of toy chairs with regular furniture, a model throne, and a hologram I made using a miniature glass bead chair.

The snapshots and model were accepted into the exhibition, the hologram rejected. I shrugged off the curatorial decision as due to reluctance to drum up a laser for display. The glass plate came back in pieces. In the spirit of “when-you-have-lemons...”, the shards inspired “stained glass” collages with



fragments rotated willy nilly, a configuration that enables study of defining properties of the hologram, the entire view encoded in each fragment, and imagery both in front of and behind the plane.

The development of photography stimulated discourse establishing that representation, the rendering of a copy, even when exact, sensational, charming, mesmerizing, edifying and entertaining, is a technical

as distinct from artistic accomplishment. Photography unhitched art from the practical function of documentary replication, elevating the idea from a potential to legitimizing feature, thematized in conceptual art.

That art does not appear reliably when holograms are viewed is an opportunity to identify presumptions and needs brought to art. Any drawing is art, even if judged childish or crude; why not any hologram? No amount of rhetorical banging on, finger wagging scolding, pontification and castigation will sway what is looked for in art, even if human preferences differ from critical theory, and may even be manufactured by sales spin that benefits from clipping the wings of free spirited life. The current popular avalanche of Kodak picture perfect point-and-shoot snapshots along with entertaining and advertising imagery are a testament to the limited controlling power of papal decrees that pictures are acceptable only as scripture for the illiterate, and fantasia such as grotesques and imaginary beings must be relegated to decorative margins and ornamentation. The popular social media format of a captioned image likewise was not discouraged by parental and pedagogical disapproval of comic books.

When I considered this conundrum, it seemed that the amped up representational power of the hologram refers so strongly to things apart from the work of art, to elsewhere, another time, that it might undermine the cohesion of the piece, weakening aesthetic feelings for its presence, and conceptual attributes. If people presume ideas to be foremost in art, and current technology use has dialed up craving for missives, does looking for messages in a hologram frustrate expectations, making the work come across as deficient and dumb?

I observed that a hologram stubbornly refuses to mean anything much other than mere representation, no matter how uncanny the effigy. Tiny indications of the recording apparatus, such as minuscule scratches and specks on optical components, captured without the possibility of retouching, cue awareness of a setting that is spatially and temporally distant from that of the art, the reality of which in turn is other than the gallery setting. Such nested colliding realities has been a traditional theme explored in inventive variations of the frame, edge, pedestal, stage and screen's fourth wall.

In sum, is the hologram "TOO MUCH INFORMATION! I CAN'T SEE THE FOREST FOR THE TREES!" ? Without the forest outlined, mapped, a singular shape, do people feel unmoored, adrift? Is the holographic image too much there to be read as anything other than a replica, signifying nothing, insignificant? Does the viewer lack a compass?

I concluded that slow acceptance as an art medium needs to be addressed by nimble thinking straight talking semioticians.

I unearthed an unpublished essay from the eighties that I had written on an electronic typer using heat sensitive paper that faded into an archaeological puzzle. Without generous patronage for conservation, such deterioration could be the fate of holograms. The essay opens with a statement that in 1983 Toronto, "Interference Gallery for holographic art deserves more critical attention than it receives." Another fragment observes that "technical virtuosity does not satisfy artistic criteria, and in the absence of other features, the critic may be at a loss for words." It closes with the Zen jingle, "First there is a mountain, then there is no mountain, then there is."

Another article typed on the ephemeral paper is too faded to decipher, except for its closing salutation, "Holography offers evidence of courageous minds and presents a worthwhile challenge to anyone who dares to be enchanted by its spell."



PART 3. WHAT IS A HOLOGRAM TO ME

The following account unspools thinking and vision that might be seeded by holographic practice. I describe experiences that cultivated my interest in the hologram and hands-on experimentation, then how the practice spawned subsequent ventures.

It's hard for me to conceive of a hologram as an original thing by an individual creator. If not for the patient guidance and mentoring of a battalion of caring, generous family members, teachers, and peers, and if not for a fortunate birth where people are not completely absorbed in grubbing up subsistence and running for their lives, the hologram would have been obscure.

I regard the arts as a compost heap, from which arise the great works we love, for which some of us live. The genius pieces we seek for inspiration, motivation, insight and meaning depend upon a ferment of art lovers who share values and passion, while much of what is produced may not be stellar. Bit players churning out mudpies and pattacakes are essential in such an ecology. I have been happy to play my part as an extra in the shadowy, marginal lunatic fringe, marching to wild drumbeats, tripping along.



I was lead to holography by curiosity about how phenomena exist, appear and are known. As a child I was enamoured by meaning. How wired I was on a Sunday drive to the “highway”, bouncing on the backseat trampoline unfettered by seat belts, “When are we going to get there?!” only to deflate when, “We *are* on the highway,” that was not elevated at all. Ditto when a “thunderbird” turned out to be just

a lumbering car. I recall circumambulating the house on a weekend morning when my siblings were watching cartoons while our parents tried for extra sleep. I didn't watch much TV, only drawn by commercial jingles. The death of the mommy in Disney's *Bambi*, Sleeping Beauty's enraged mother's transformation into a flame throwing dragon, Peter Pan's abduction of the Darling children and their parent's heartbreak had given me nightmares, so I was wary of the mesmerizing box. With *Looney Tunes* boings and bonks in the background, I padded around pondering what adults meant by "reality", my dressing gown's Viyella floral print scratchy like an ascetic hair shirt.

Half a century later I used the memory of that family home as a memory palace mnemonic aid when learning Sanskrit, a language equipped with vocabulary, grammar and precision fit for philosophical thought. When to aid memorization I visualized depositing verb conjugations onto staircases, adverbs into drawers, adjectives into gender specific bedrooms, and noun declensions in the circuit of the ground floor paced by the ghost girl, I was responding to her fascination with meaning, loading her environment with language for her query. She is alive to me, not lost in time, wondering along still.

Other experiences along this personal trajectory intersected with the holography lab. The values in my family home were pragmatic. There was no social safety net, so an art vocation was too risky for serious consideration, like daydreams of growing up to be a princess ballerina. The only respectable and secure option for a female was marriage. "There's no point in getting an education. You're just going to get pregnant and married, Ha! in that order. Go to Queens because it's the best husband hunting campus and make it quick. Your brothers need the tuition more than you."

The quashing of career aspirations freed me to chose Mrs. Degree courses out of curiosity, thus inadvertently propelling me into art, embracing the domain of uncertainty, ambiguity, contradiction and complexity in what appeared to be the most, perhaps the only free field. In spite of its rancorous arena, art's low likelihood of causing harm added to its appeal. Already, after frolicking in DDT sprayed into ditches, modeling with asbestos play dough, crouching under my school desk rehearsing the event of a nuclear attack and studying LIFE magazine pictures of Thalidomide deformities, I was scrutinizing the ingredients on a Nestlé *Quik* label for clues to what triggered hysterics after holding my nose and chugging the compulsory, vile sweetened cow juice. I had read Rachel Carson's *Silent Spring*, heralding what was to be a lifetime of grim warnings that life on the planet is under threat, and it's *all our fault*. Might art be less likely to produce collateral damage that exacerbates ecological apocalypse?

As a child I assumed every suburban home vibrated in a way that would have pleased Pythagoras with the complex patterns within patterns of jazz resounding from three perfectly tuned speakers powerful enough for a Beatles show, in a room with a cathedral ceiling and Westminster abbey acoustics. My father Ian Edward MacTavish (1916-1971) was passionate about technology and an accomplished aviation engineer, test pilot, photographer, home auto mechanic, plumber, electrician, roofer, brick layer, fine woodworker, all purpose Mr. Fix-it and magic Santa. Apart from a correspondence course in radio engineering and his air force training, he was self taught, with insatiable curiosity about how things work. With a small team he designed and did the right stuff test flights of the CL-41 Tutor, the jet fighter and trainer aviation masterpiece still flown by the RCAF acrobatic Snowbirds. I suspect that his ear for jazz was honed when as an adolescent in rural Ontario, he listened deeply for signals from the wider world when dialing through the buzz, hiss and whistlings of his ham radio. His collection of postcards from fellow enthusiasts spanned the globe, worthy of a feature in the local newspaper. A patient teacher, as the space race intensified he sat his children at the kitchen table and drew diagrams of jet propelled rockets and satellites tethered in orbit by gravity. That the moon falls around the earth and the earth tumbles into and keeps missing the sun was spell binding to me.

My father's hi-fi and woodwork enthusiasms resulted in the three gargantuan speakers, fine wood cabinets fitted into corners, one in between, aimed at the stereo sweet spot on the couch. One day he used an oscilloscope to fine tune their alignment. I would have asked, and as with satellites, he would have explained the green squiggles in understandable terms – a foretaste of the interference patterns, phase information and standing waves in holography.

Another hi-fi episode was pertinent to the holography lab. In a home rattled by five children, the needle of my father's record player skipped, scratching his cherished vinyl. He jackhammered a cavity into a cement and brick mantle into which he installed tracks for a turntable mounted on a wheeled drawer with shock absorbers, and he ran wiring who knows how from the stereo cabinet. After his death, electricians just scratched their heads and rewired the house. After placing the diamond needle, the



drawer rolled in behind a hinged teak panel with brass lock and key. Speeding toddlers ricocheting off walls no longer gave Ella Fitzgerald hiccups. This inventive solution came to mind when to achieve isolation from ambient vibration necessary for the creation of holograms, we suspended a sandbox on ball bladders.

My father understood that shame and punishment were not effective discipline. Instead, he coached skills for the satisfaction of making and doing. In his basement workshop he built for the youngest feisty boy his very own workbench with small tools, and in a short time the little guy was wiring gizmos with switches, lights, and bells.

When I was rancorous with teen angst, my father gave me a no-frills 35 mm camera and a light metre, and taught me the optics necessary for its operation, film properties, aperture, focus, and how to develop and print in his basement dark room, that during the Cold War he assured us provided sufficient protection from fallout so we didn't need to dig a hidey-hole in the yard like the neighbours. Indeed the refuge from household din, eerie red light and dripping made the dark room grotto-like, and the incremental appearance of pictures on paper that miraculously didn't dissolve in pungent baths was magical.

These skills, along with a few years of undergrad science, enabled me to serve as studio assistant to experimental media artists. The experience made me appreciate that when we use black box instruments without awareness of the workings, such tools use us as much as we use them. An aspect of holography I appreciated was rebuilding the camera for every picture, able to see how light is modulated by optics. To me, a digital camera that eclipses the viewfinder with text option menus is a bot directing me to supply prescribed building blocks for a panopticon. Feeling thus ordered around triggers an impulse to mimic a John Porter film, and in defiance of prefabrication, whirl the camera on a tether to give surveillance bots dizzy spells. Even as a teenager, I was compelled to experiment in ways that made my family scratch heads and snigger. I made photographs of shadows, embraced dark room boo boos and printed murky shots, bad girl pictures. Perhaps because gender presumptions at the time evidently were not in my best interests I felt compelled to test standards of beauty.





My father didn't think of himself as artistic, because in his time a person who used a ruler and T-square was doing commercial work, a categorical boundary later collapsed by hard edge, minimalist and pop art. His photographs were technical exercises in which he strove to make images that conveyed the range of possibility in his instruments, that explored the limits of the medium – such as black and white prints demonstrating every possible shade of gray, and portraits shot in mottled shade, or sunlit through a mesh curtain. Test pilots aimed to stretch envelopes.





Unwittingly, my father modeled for me the fine art sensibility that conveys as much about a medium as about what is depicted – Marshall McLuhan’s “the medium is the message”, the system of construction in Pribram’s thinking, the property of painting that defined schools such as Cubism, nonverbal ideas that distinguish fine arts from message delivery advertising and propaganda. His example served me well when my selection of objects for holography was with the aim of demonstrating the powers and limits of the medium, avoiding a pitfall expressed by critics that trifles in life make trite holograms. This complaint merits comparison with the way that the significance of oil paintings and photoconceptualist prints is not diminished by depiction of doodads; instead the medium elevates the mundane. Why is the effect of holography the opposite, trivializing?



In spite of explicitly pragmatic values, I was being culturally incubated in my family home, the legacy of relatives who had been active in culture. My father’s uncle Newton MacTavish championed the arts, contributing to the development of the National Gallery, Art Gallery of Ontario, and Arts and Letters Club. He was editor and writer of the first art journalism, and he pushed for art made in Canada to be exhibited and collected on a par with European works.

In his *The Fine Arts in Canada* (MacTavish 1925), the first such survey, Newton MacTavish reflected that artists came to Canada and continued to work in the absence of public interest, market, galleries, colleges, critics and publications. He left hanging his rhetorical question as to why people would carry on making art even with paltry likelihood of fame and fortune. Aware that the conditions for art in Canada were optimal even without such rewards, Newton MacTavish dedicated his career to the development of galleries and publications, advocating for artists in Canada, including Indigenous culture, art by women and recognition of the log cabin as architecture.

I identified with this kind of artist, more mystic than professional, so I wasn’t overly swayed by male chauvinism in the 60s and 70s, and their fierce sparring over sparse resources, especially in film arts. Artists aiming for spotlights and jackpots went to New York, London and Berlin. Because as I describe below I lucked into a precocious introduction to deconstruction without Postmodern mumbo jumbo, to me the theoretical justifications for what amounted to pissing contests were humdrum. Not being ranked as a competitive threat in the boys’ club freed me to focus on the enterprise that, to me, was a game to play more than win. Others are more energized by contests.

When I was a 13 year old Beatlemaniaic who also played in a Baroque ensemble, my father took me to hear Thelonious Monk at the Montreal Jazz festival. “Listen to this.” I was not yet ready to fully appreciate the music. Because of the secure feeling seated beside my gentle giant dad, the respect conveyed by the glamorous Place des Arts concert hall, the reverence of international jazz lovers and Quebecois exuberance, my guard dropped. I opened and emptied to soak up the sound.

When I now listen to a bootleg recording of that performance, I am in a time loop like that with the little girl puzzling over “reality”, doing what I can to enable the teenager to hear. Even if baffled at the time, the head spinning patterns were internalized, to flower down the road. As Gary Lee-Nova explains, in the instance of Thelonious Monk, the mastery of skill is such that the artist is not playing the instrument, so much as playing with it – collapsing boundaries, the piano working the musician, the erosion of self versus otherness, the curator Glenn Allison’s definition of art as love.

In the company of reliable people with whom I felt safe, I was confounded and stretched by further such baffling experiences of art and music that set my bar high, oriented my compass and aimed a trajectory such that I could bear feeling out of my league and in way over my head in attempts to make holograms.

There is a presumption that imitation is characteristic of student art, outgrown with maturity; for me it is the other way around. It has taken a lifetime for me to grow into art that graced my way and reap its enrichment, a ripening of subtle seeds planted even on occasions when I was out of my depth. I ask – *Just what is internalized?* – something more fine grained than style and literal content. There were occasions like the Thelonious concert when the presence of admirable people enabled me to suspend reflexive judgment of the unfamiliar, and be receptive to initially baffling images, music, sculpture, performance, installations, films, videos, and literature. When with time I learned what was necessary to appreciate what had been intimidatingly alien³, each unveiling fostered an appetite for being in over my head, afloat in a cloud of unknowing.

At university in the late sixties, I had my first inkling of a version, a subset, of the holographic paradigm. I was not yet thinking in terms of holography, and only in hindsight discern its principles at play in my precocious introduction to deconstruction through study of the Buddhist Nāgārjuna (~ 150-250 CE). The course professor, John Cook, fresh baked from Cambridge, was essentialist, offering a survey of mystical practices effecting a coincidence of opposites that he noted at the core of major religions. Ascetic, ecstatic and meditation methods foster direct perception of reality, the divine, or sublime, depending on the aim (*nirvāṇa*, union with Brahma, oneness with divinity, realization of the way things are, etc.). We studied Nāgārjuna’s method to foster awakening through dogged running negation that kicks out the legs of premises, exhausts cognition and unveils the formative power of conception. Here was a taste of deconstruction, the method favoured by scholars over absolutist, reductionist, universalist, essentialist and contextualist frameworks.

At the end of that course, instead of writing the assigned term paper, I asked my father to show me how to build a wooden box in which I crafted a miniature room wherein things were made evidently from what they are-not – such as a coffee creamer serving as a scaled down waste paper basket, a jar lid for a table top, a bottle cap for a pot. This project was the blossoming of my childhood enthusiasm for the novel *The Borrowers*, about mini mouse people toggling together a residence inside the walls of a house, foraging for supplies at night. It was an extension of a miniaturist hobby that had been set in motion even before the dollhouse my father built in 1957 for delivery by Santa Clause. Near

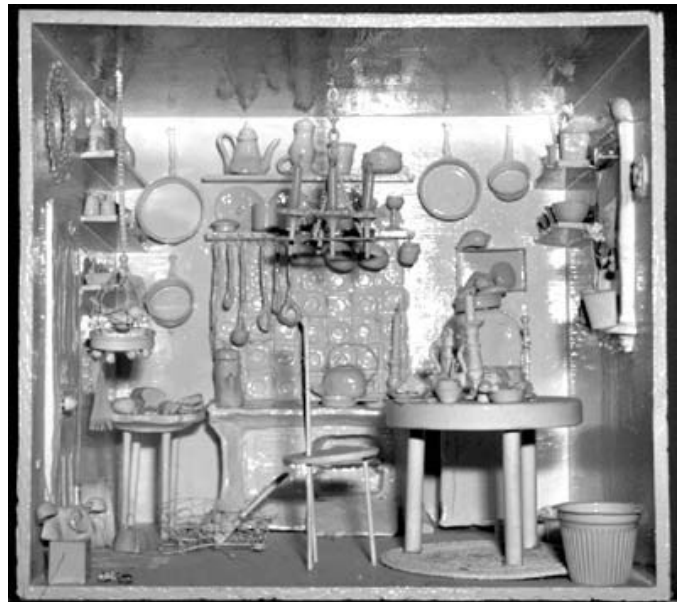
³ eg. Cezanne landscapes, a Duchamp prank, a Cubist still life, Cage silence, Tantric mandala, Marina Abramović, Dada, *Voice of Fire*, Sanskrit text-art, Antonioni, *Last Year at Marienbad* ...

sightedness made my left eye a magnifier, and was uncorrected until the age of ten. I was monocular, seeing things up close with one eye and distant with the other. This scanning and stitched patchwork mode was evident in my drawing, and exasperated teachers who wanted to see a boxed space camera cow eye view. Unable to relate to that scheme, I resorted to copying the pictures of the most praised artist in the class, and to this day I can draft his crayon crop of corn stalks standing at attention in a row under a yellow pinball sun trapped below a blue ceiling slab. The myopia also made catching a beach ball unlikely, so instead I settled under a shady shrub to craft miniature gardens from pebbles, twigs, flotsam and jetsam, playing with an architect uncle who performed sorcery, poking sticks into metrical lines and setting stones into zen alignment, the Modernist formal charm that characterized the house he designed for my father to build, then filled with prints and a Roman terra cotta sculpture, incubating me in art while people babbled about everything else. I didn't play with dolls so much as with scale that has been of interest to humans, a probe into just how identity survives magnification, shrinkage and the corrosive passage of time, a query that engendered math.

In my term paper dollhouse, every constituent was painted white, the title a mystical quote in which white stands for the unifying pure universal essence, the undifferentiated, absolute ground, or groundless, nature of everything. Because a prism unpacks the colour spectrum, white can stand for the ultimate source, latent potential, unmanifest wellspring of possibility from which phenomena appear to arise and dissolve, alchemical *prima materia*.

In the little assemblage, each part conveyed the overall systematic nature of the whole: what something *is* being inseparable from and dependent upon what it *is-not*, a seamless reality in which *is* and *is-not* are established from the same point of reference i.e. void, empty, selfless freefall, detection and measurement congealing and anchoring phenomena.

Although not exactly a holographic paradigm, it is an attempt (essay, from Old French *essai*) at a system in which the nature of the whole is encoded in and construable from any part. It is also consonant with the “theory of measurement”, uncertainty principle, and observer condition in pop physics (Ball 2018), and the Buddhist version of everything. Taking on board this model was a factor that semiconsciously contributed to my interest in holography.



At Queen's university I was too young to comprehend fully what I was being taught. To give us a taste of the practices under study, Professor John Cook took us on a day retreat with a colleague, Douglas Harding, a British mystic, who had coined a Zen-ish koan (Harding 1961, 2002). My adolescent self consciousness monkeyed with concentration. Even so I followed instructions and sat still with a squirming mind. Instead of the koan's recalcitrance being discouraging, I responded to bewilderment with a vow to dedicate my life to understanding what fired up the passion of these scholars, enthusiasm unmatched in other courses. It turned out that they were investigating the nature of reality, the term that had mystified me as a child. Unlike other professors whose lectures were overwrought diatribes about immanent nuclear holocaust, overpopulation and catastrophic pollution (Sinners! Repent!), to these gentlemen the apocalypse is an archetype and the whole world ends and manifests in each moment of

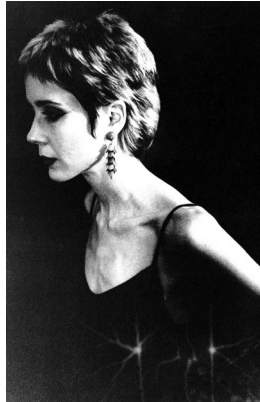
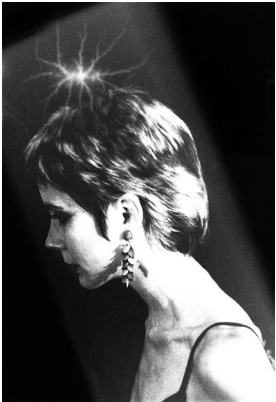
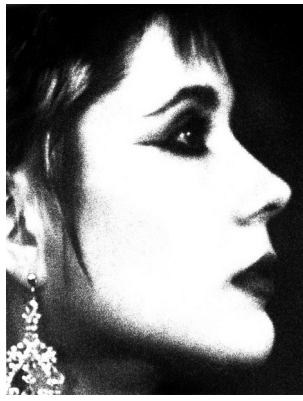
consciousness, blazes of glory at the same refresh rate according to yogis and neuroscientists (Hazra 1983, 48-49).

In the anti-establishment and anti-authoritarian sentiments of the sixties, it didn't occur to me to seek instruction in established religious institutions of any stripe. In New York city I saw dialectics and paradox in art, which therefore appeared to be the appropriate field for my pursuit.

Fine arts education in Canada in the early 1970s gave attention to media studies as pondered by cultural theorists. We came out of our training quoting John Berger's *Ways of Seeing* when gazing around galleries. Marshall McLuhan was a superstar in that discourse, that intersected with artful foreign cinema dissecting the film medium. The Canadian National Film Board's Norman McLaren was a leading edge experimental animator. I saw his work in passing, then the entire opus when I was just fifteen and our village movie house was put out of business by a mall Cineplex. Mysterious new management, rumoured to be gay, likely friends of McLaren, screened Hollywood fare on weekends and on week nights, series of N.F.B. and foreign films. My mother and I went as a kind of reconciliatory bonding exercise, because in the cinema we couldn't scream at each other. It was the sixties and she had been raised Catholic so I needed to be chained by the ankle, bla bla bla. I clipped off my hair like Jean Seburg in *À bout de souffle*. I let my mascara run like Edie Sedgwick and shared her appetite for speed and heights. Edie's heroin chic spread in LIFE magazine was a contagion to which I gravitated, more possessed by wastrel waif party artistry than by her impresario Andy Warhol.

photographs by Su Schnee





I was affected by international art masterpieces and film at the world's fair in Montreal, EXPO '67, especially the National Film Board's *Labyrinth*, which offered split screen wonders. I recall a three dimensional illusion of a pebble tossed from a screen into a rippling pond projected onto a floor screen, viewed from balconies. I stuck out the line up for repeat viewings, unable to unsee the phantom pebble arcing through space. With my parents' 8mm Bolex home movie camera I made jarring in-camera edited shorts thick with jump cuts. I rigged my own makeshift animation stand to toggle together a stop action Jackie Kennedy story from magazine clippings.

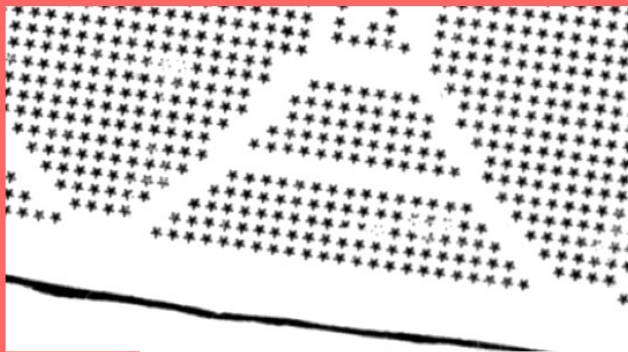
Marshall McLuhan, upon whom visual artists and cultural theorists of my generation teathed, encouraged reconsideration of what is meant by "content". I experimented with modes of representation to observe selective detection and rendering, with particular interest in degrees of "truthiness". I admired art works that stirred awareness of intrinsic properties of media, such as Michelangelo Antonioni's *Blowup* (1966) and Chris Marker's *L'Ambassade* (1973).

At York university, my professor Tim Whiten noticed this interest and with magisterial pedagogical skill, he guided me to pursue it as visual ideation. A tradition of such query by artists, particularly in European cinema, made experimental media a fertile arena for my investigation. Chewing over the nature of reality was in step with film makers, artists, philosophical and cultural theorists of "mediality", that in the current, digital hurly burly are a resource for calls for critical use of devices, especially with AI muscling in.

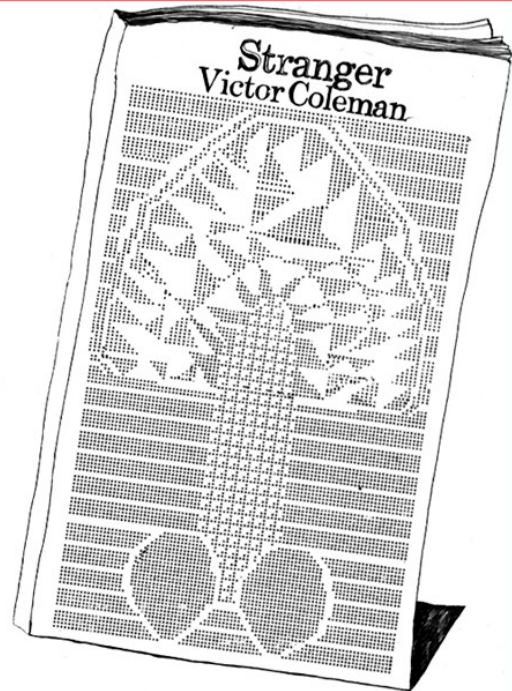
My education made me aware that art conditions how the world appears to individuals, awakening me to the way cultural artifacts and products serve social, power, political, and marketing agendas. I sought and exposed myself to as much art as possible, as antidote to the manipulative and subliminal coercion of advertising, propaganda and entertainment imagery and messaging.



That is how I came to serve at the age of twenty, as sorcerer's apprentice under Stan Bevington at Coach House Press where artists experimented with offset, letterpress, copy camera, book design, binding, and with photocopy machines and IBM Selectric typewriters, prototypes supplied by manufacturers for testing, still uncertain how they might be used by ordinary consumers.



ABOVE, detail of the illustration on a page of the Coach House Press Spring 1974 Catalogue



STRANGER
Victor Coleman
drawings by Michael Morris
144pp paper 4.00

New poems by the author of 'Light Verse' and 'America'.

Illustration of book cover typed to create "dot" screen, i.e. an offset print of a print (copy shot) of a typed reproduction of an offset print of a print (copy shot) of a Michael Morris graphic

WOMEN & FILM

WOMEN'S PHOTOGRAPHIC EXHIBITION



★ Women and Film ★



2 pages from a photocopy book for the exhibition component of the 1973 "WOMEN AND FILM INTERNATIONAL FILM FESTIVAL", the precursor of the "Festival of Festivals", that became the "Toronto International Film Festival" (TIFF)



NOTHING IS CHANGED BUT THE FLOOR



STARS OF THE FUTURE ★

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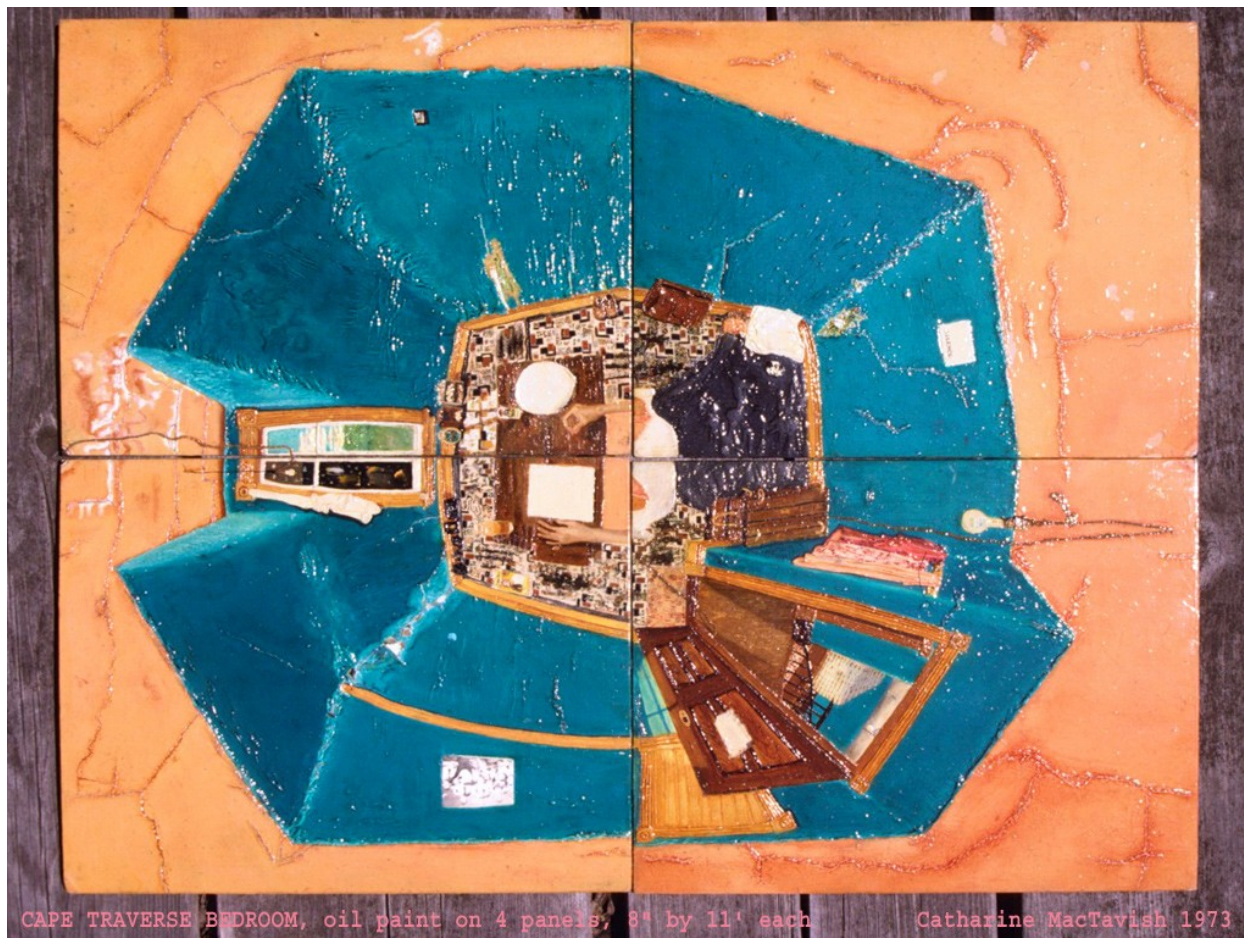
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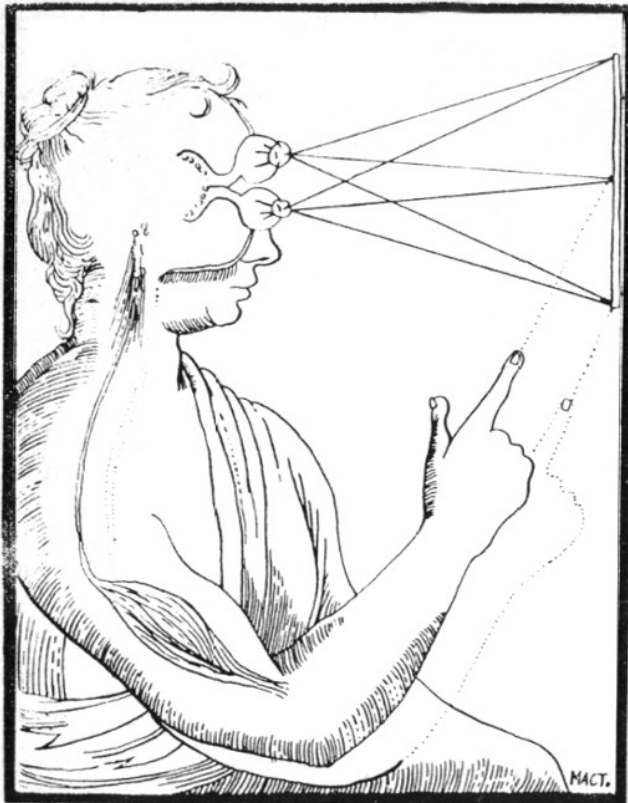
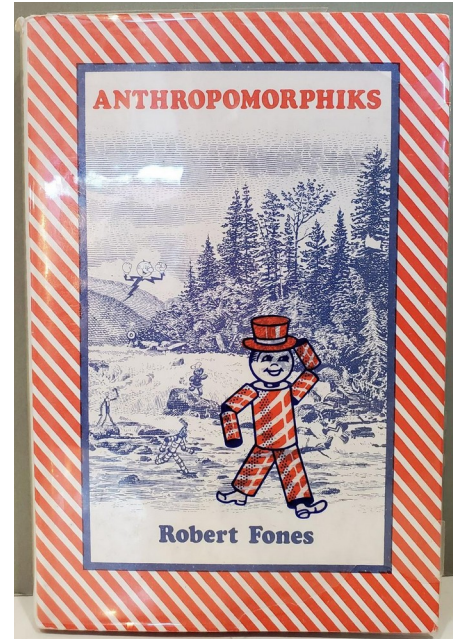
I resisted the habit and convention of life drawing and painting as if through the camera viewfinder.



While learning about various image making media, I came across an article about holography in a dusty *Scientific American* (Leith and Upatnicks 1965). I was intrigued by the unusual codification of data to engender a replica. To make a hologram, with the help of a student I met at a party I stealthed into a University of Toronto physics lab, in disguise as a preppy student sporting panty hose, penny loafers, demure skirt and cardigan.

I made an effigy of the poet artist Robert Fones' avatar "Candy Man", because of references to holograms in his poems, evidence that Canadian artists were thinking about the medium in 1970.

That glass plate transmission hologram was my ticket to be coached by Lon Moore at *Celestial Holograms* in California. Riding a wave of rock star notoriety kicked up by the 1973 *Rolling Stone* article about maverick holography, Lon Moore visited Toronto to demonstrate the medium at an artist run centre for creative technologies, *Memo from Turner*.



**Memo from Turner + Maitland
Memo presents HOLOGRAPHY**

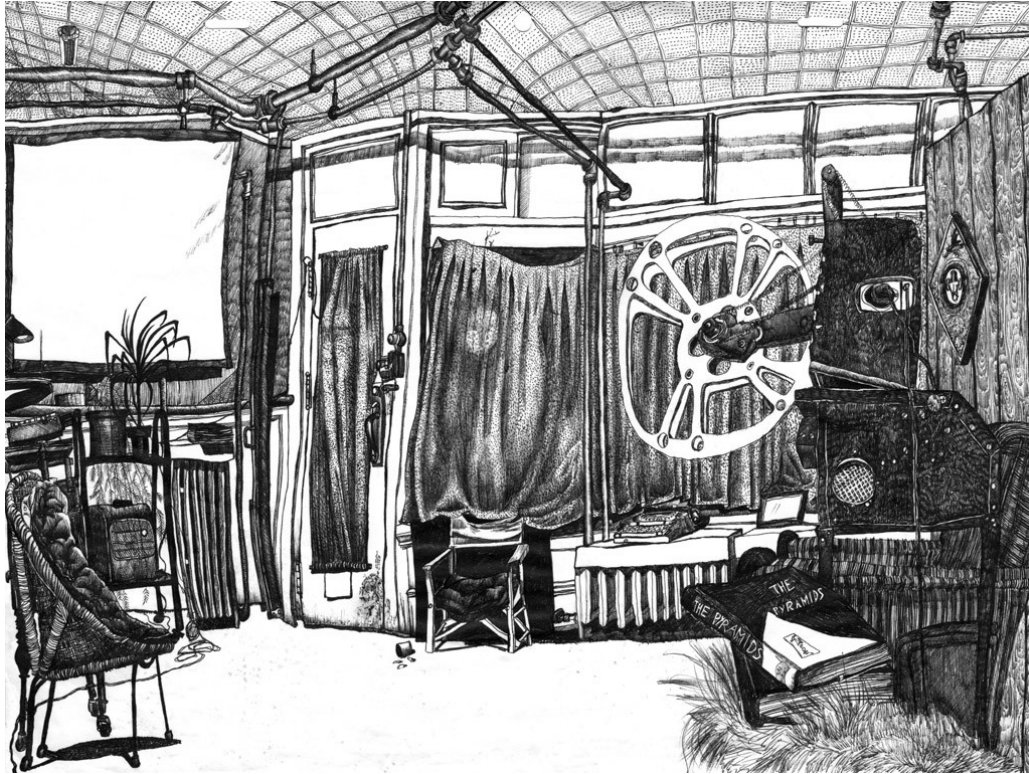
**Two slide lectures by Lon Moore from
The San Francisco School of Holography
3 & 4 March at 8pm for \$3.**

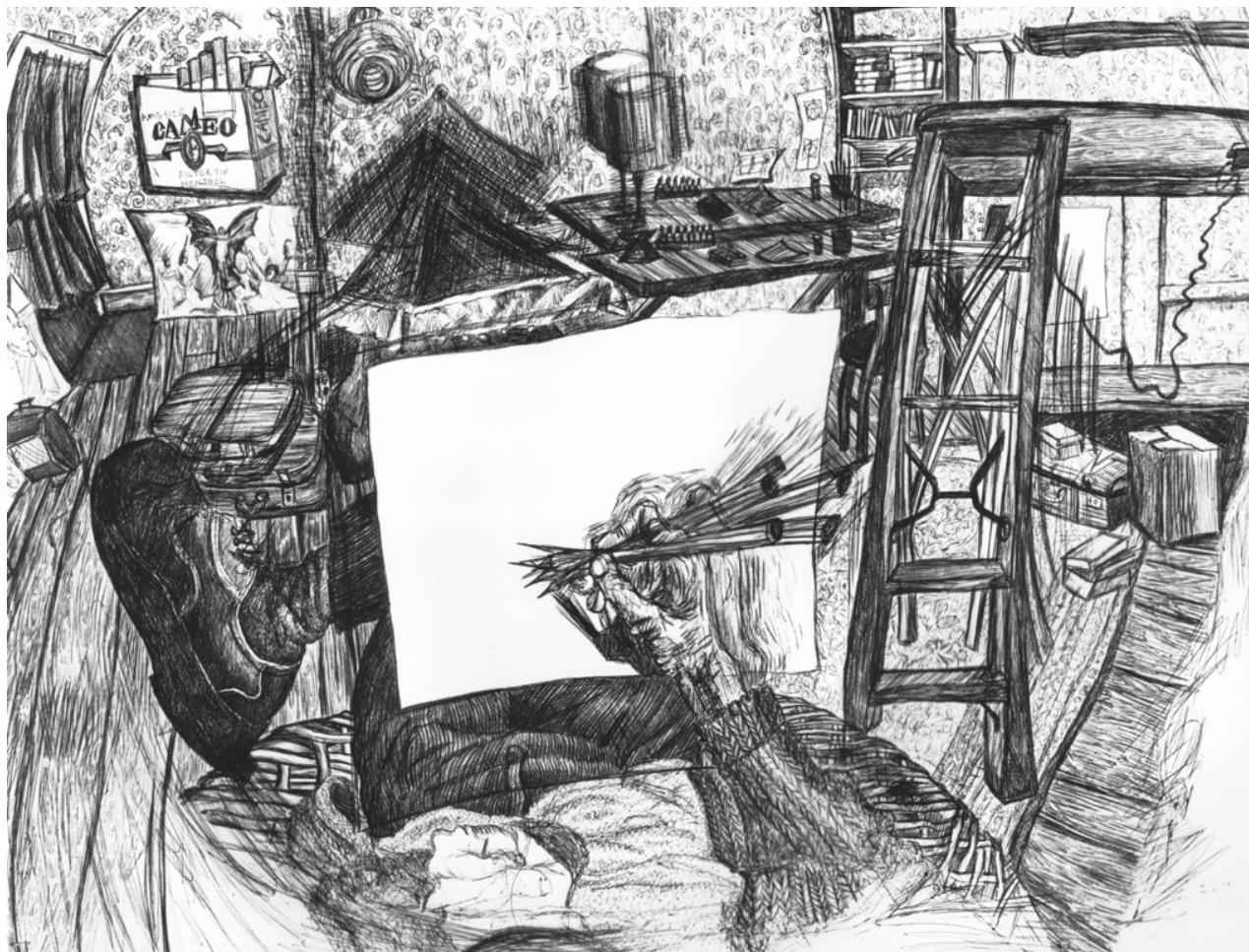
**Lecture on work in progress and
future applications of holography
by Dr. Damian Gouleff from
The Ontario Science Centre
5 March at 8pm**

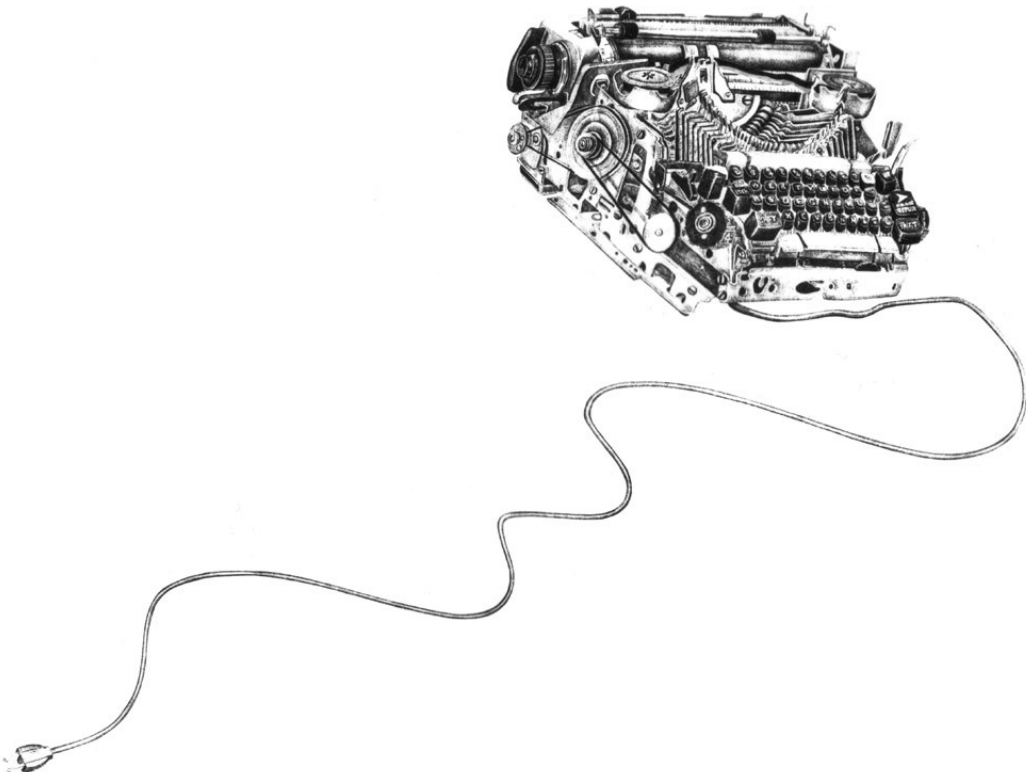
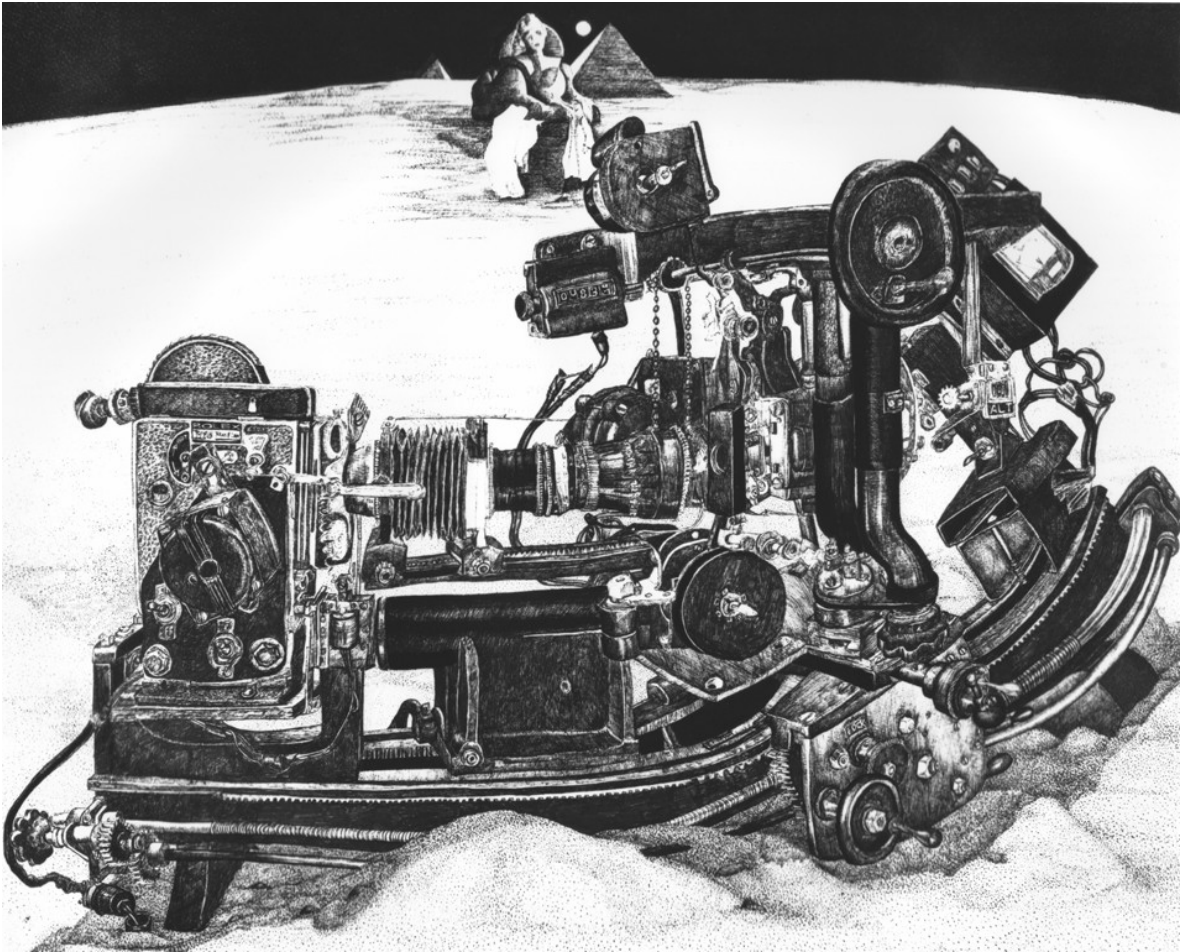
**Holograms on display
1 & 5 March 11 am-6 pm
961-3680**

When after the presentation, feeling like a bimbo groupie, I approached Mr. Moore, whipped out from my jean jacket pocket a glass plate and held it in his laser beam. "HOW DID YOU DO THAT?!" He said that if I could make my way to California, he'd teach me the sandbox method (of Jerry Pethick and Lloyd Cross) that was more affordable and less constraining than the magnet board with micrometer adjusted optics I had used. By working as an usherette at a Cineplex and like slot machine pulls,

racking up grant refusals until an application spit up an award for drawing, I grubbed up train fare and made the journey. After the training, my craving for bewilderment drew me on to assist Al Razutis in developing the sandbox method in his holography studio at *Visual Alchemy* in Vancouver, B.C.







My father, Michael Hayden, and Stan Bevington had mentored me in being self taught. In the holography lab I was indeed stretched. I sucked up the humiliation of blundering in order to access the bewitching beauty of coherent light. Through hands-on construction of the image making system for each shot, the holographic paradigm was internalized, and shaped vision and conception. Instead of seeing “blur” and “misty haloes”, I came to see diffraction patterns and spectra.



Thinking is conditioned by what is seen, and the finely chiseled optical configurations of coherent light organized awareness in a way that was a radical departure from the theatre stage and film boxed planes predictably and reasonably ordered in geometric perspective. I was losing interest in conventional camera lens and view finders that are unlike vision. “You can see a point from far away. What happens on the periphery, the snake that turns out to be a rope, the mugger who turns out to be a shrub, is more interesting.”

My lab notes read like a dream diary. Razutis scoffed that “playing with everything” was indulgence. My scribbles were judged “unreadable”, which to my ears began to sound like a compliment, as I was increasingly interested in illegible departures from convention. The holographic paradigm, in which blurring and haphazardness reflects underlying symmetries, was getting under my skin.

I stand by my experiments, which were attempts to identify and make images highlighting the properties of the hologram that set it apart from other media. Myriad techniques create three dimensional illusions seen through a window, such as angled glass used in an amusement park “haunted house”. Reflective concave shapes project images into space.

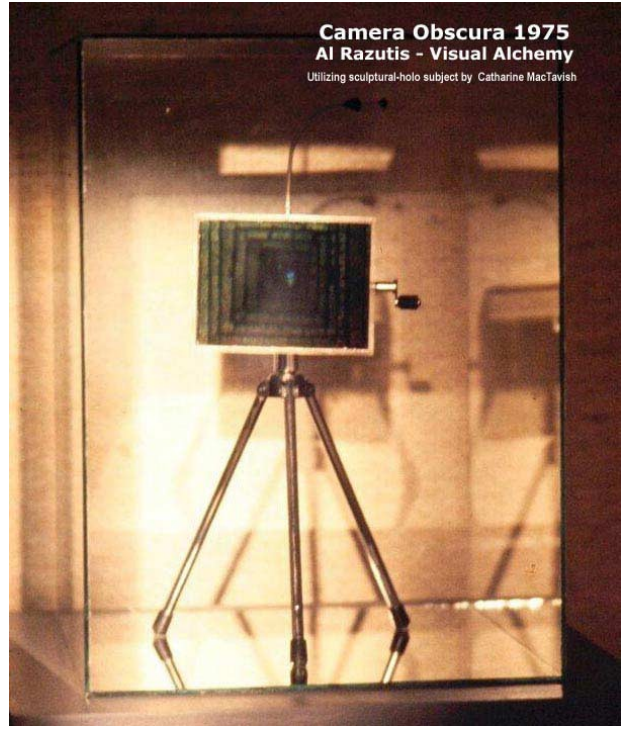
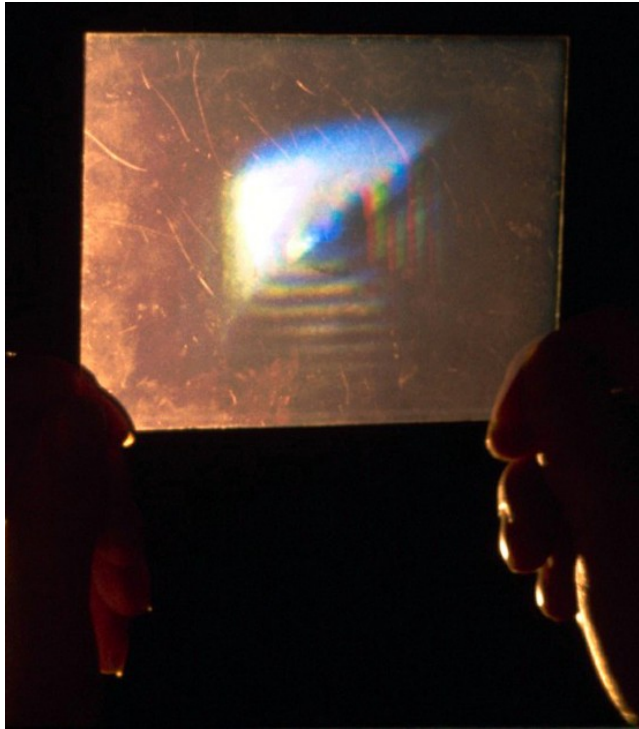
‘Pyramid’ and ‘Aether Vane’ by Catharine MacTavish and Al Razutis (respectively) at Visual Alchemy 1974 - 1974 - showing evolution and documentation



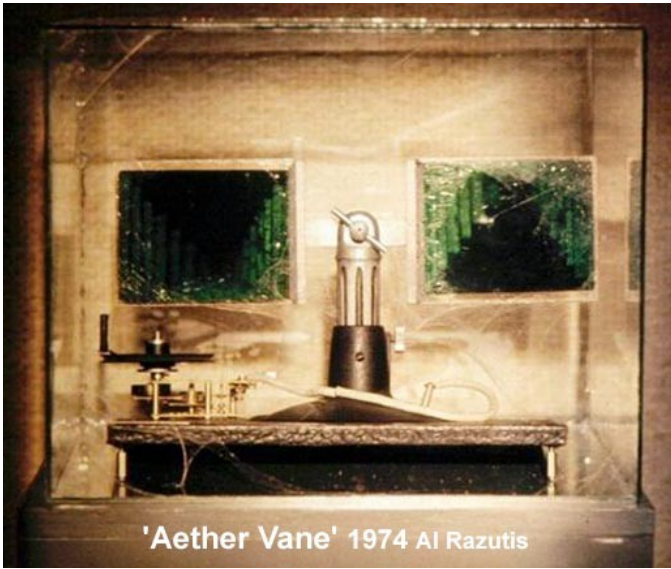
Imitations of ‘Pyramid’ holograms demonstrated and sold by Jason Sapan, Holographic Studios, NYC – purporting ownership



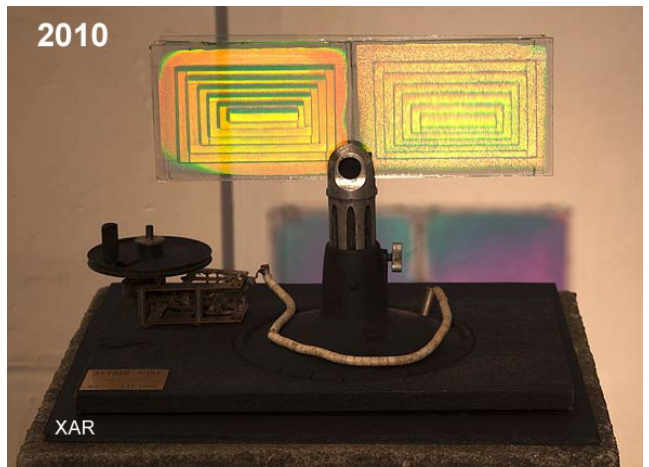
I worked to identify what forms create focussed and brilliant pseudoscopic images within the strictures of lasers and film at hand. The ziggurat shape made from reflective textured material (sugar cubes painted gold) is a geometry inherent to the system, generating optimal focus and brilliance. Anyone working seriously with holography will arrive at this form. As the physics educated systems analyst geek musician David Standish quipped, to say the ziggurat pseudoscopic hologram “is someone’s original is like claiming to have invented the octave.” Razutis incorporated the ziggurat into sculptural assemblages. I made a yardstick frame at the base of a pseudoscopic ziggurat because of conversations with Gary Lee Nova about systems of measurement conjoined with iconic forms in his art. (Below, Lee-Nova’s 1974 print *Indexical: Illusory Attending*, for which I lent a hand.)



Camera Obscura 1975
Al Razutis - Visual Alchemy
Utilizing sculptural-holo subject by Catharine MacTavish

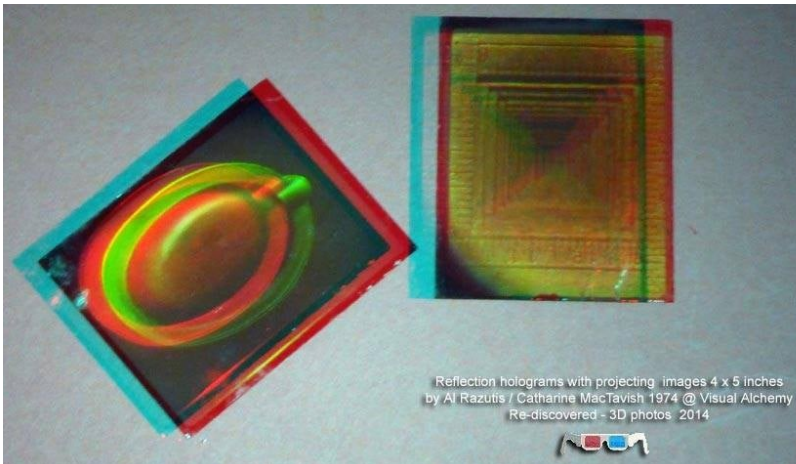


'Aether Vane' 1974 Al Razutis



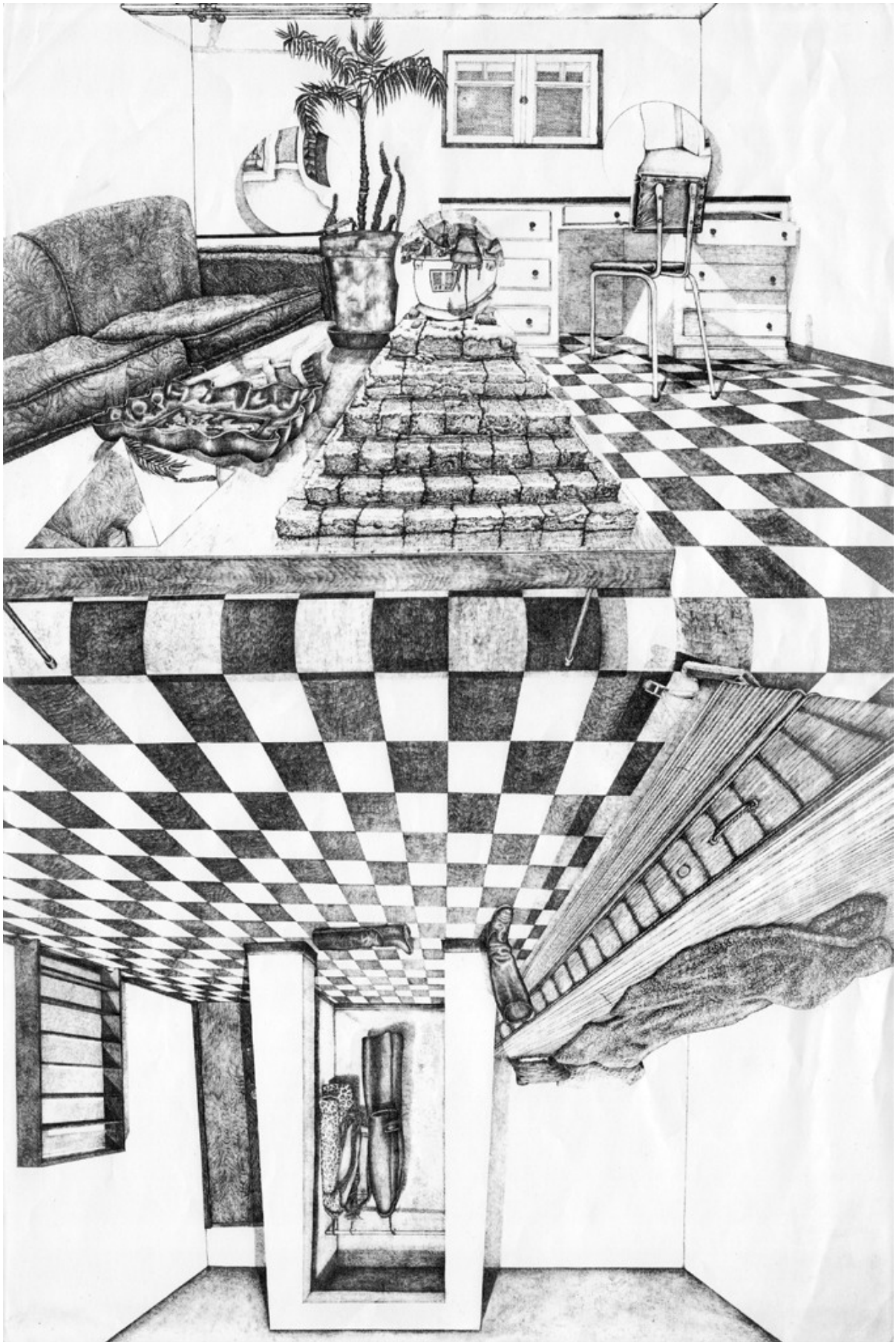
2010

XAR



Reflection holograms with projecting images 4 x 5 inches
by Al Razutis / Catharine MacTavish 1974 @ Visual Alchemy
Re-discovered - 3D photos 2014





To support Visual Alchemy, we offered workshops, which became salons for kindred spirits from diverse fields. We taught in the theatre design department at the Banff Centre for the arts where we brainstormed aesthetics, narrowing to Antonin Artaud's *The Theatre and its Double*. Razutis composed a manifesto *Treatise*, and I compiled an *Appendix to the Treatise* that surveys the ways that for forty thousand plus years artists have created three dimensional appearances. I offered a foundation in visual perception, the production of spatial illusion, optical systems, coherent light, diffraction, diffusion, Fresnel zone plates, wavefront reconstruction and techniques to create holograms. The bibliography included Collier's *Optical Holography*, Gombrich's *Art and Illusion*, Pirenne's *Optics, Painting and Photography*, Ronchi's *The Science of Vision*, Marcel's *The History of Surrealist Painting* and Lewis Carroll's *Through the Looking Glass*. The *Appendix* situates the hologram in the long legacy of photographic representation in art, and provides a practical introduction for those who wish a more comprehensive engagement than a "paint-by-number" recipe.

ADVANCED MEDIA STUDIES
 Visual Alchemy
 1923 Granville
 Vancouver, B.C.

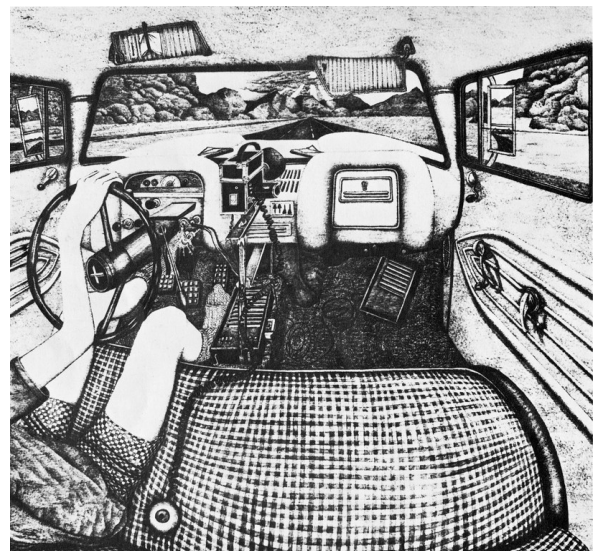
Applications are being taken for the first in a series of Advanced Media Courses offered in Visual Alchemy. Beginning November 12, 1974, a class in holography will meet at 8:00 p.m. on Tuesday, Thursday and Saturday evenings. The six week course will explore the technique, optical properties, perceptual character, basic physical theory, and the aesthetic of three dimensional imagery. Participants will make holograms in a laser equipped studio. Specific projects can be designed to accommodate individual interests and skills. The emphasis will be upon innovation and holographic experimentation as an emerging art form rather than a technical procedure. Experience with film and photography is not necessary.

The fee is \$250. Participants can expect an additional cost of \$100 for film, materials, and books. A limited number of applications can be accepted. Telephone 732-5126 for an interview.

David Rimmer made a hologram of a photograph. At the time, he was being flip, making a three dimensional representation of a two dimensional image, yuck yuck. Forty years later when Rimmer and I met again at the swanky TIFF screening of his reprinted films, I quipped, "Film emulsion is three dimensional. A reprint of a film properly needs to be a hologram of every frame." He remembered his hologram of a photograph, and we chuckled over the way his offhand gesture turned out to be prescient of challenges posed by the digitization of fading film.

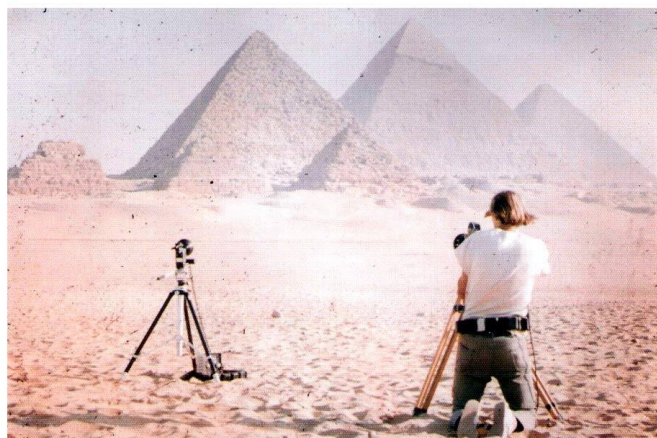
Another hologram workshop attendee, Don Worobey, was a National Film Board producer. I had played for Razutis a recording of Tibetan throat chants. The vocal overtones invoke the standing wave patterns and harmonics of holography and in a leap of artistic eureka Razutis declared, "I had a vision! We're making a film in Egypt." The orientation of monumental architecture to the sun is consonant with holographic configurations of reference beams and interference patterns. Indeed, the acoustic resonance of chambers in temples and pyramids turned out to be as harmonic as the visual structures. The sound was deeply moving and seemed as deliberately orchestrated as the stone architecture.

Even though the project pitch didn't meet the National Film Board mandate to make films by Canadians about Canadians, Don Worobey offered Razutis an experimental budget to test time lapse cameras in desert heat. We traveled through Utah, Arizona, Nevada, and California, shooting time lapse film in national parks, pink deserts, Big Rock Candy Mountain, the Grand CanYawn and Death Valley, gaining confidence that the gear would work even when broiled in the Sahara.



For me, the film shoot in Egypt was a grand adventure. After bumping up against restrictions on filming because of military installations in the desert, Cairo media centre producers unable to help us cut through red tape took us to meet a buddy. After a rowdy cab ride through Cairo that entailed a collision with a donkey, we rode up an elevator with glimpses of ever increasing English signage on each floor, that opened into an opulent setting where we shook hands with the Secretary of State. Then while sipping flower petal tea, the cabinet minister for Culture and Communication courteously heard out our need for permits to shoot film.

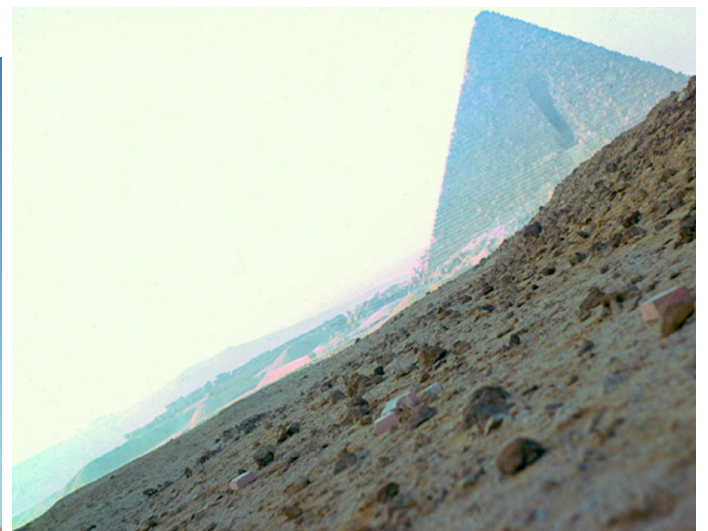
At the words, “National Film Board” he became animated, explaining that several decades previously he had met John Grierson, founder of the National Film Board and UNESCO director for Mass Communications and Public Information, among other such positions, which took him on a diplomatic mission to Egypt. The minister remembered Grierson as a gentleman, who as a gift offered a plan for a National Film Board of Egypt.



This fortunate encounter resulted in train and hotel reservations for us, and permission to shoot in temple sites that were closed to tourists, ending the maddening dilemma of how to keep them out of shots. Our government assigned censor turned out to be a jazz musician who “NO WAY!” would bake in the desert while we sat out time lapse. Instead we met him at the Hilton rooftop bar where he sealed and initialed film cans for safe passage out of the country, because it could not be processed in Cairo. If we indeed were spies, as so many people around us suspected, acting out James Bond movies, we outfoxed the security services. For all our censor knew we could have filmed anything. We were able to slip him reels shot before we had sorted out the censorship issues, understandable after one aimed a telephoto lens into the Sahara and saw poised missiles. I felt as much in a movie as making one.

I operated two time lapse cameras, one automatic, one manual, for the many hours it took for sun light to creep across carved relief surfaces, while Razutis did hand held traveling shots. The long spells tethered to one spot enabled immersion in the settings. In the enormous stone structures geared to the sun and stars, I was aware that I also was bathing in vibrational frequencies and acoustic standing wave overtones generated by harmonic proportions in the humming granite. Everything from towering obelisks, pillars and monumental sculptures, through relief murals, hieroglyphics, pots, carvings, statuettes and jewellery was composed with formal virtuosity and grace.

Gazing at a tomb ceiling, the sense of overall, even surface tension achieved with nothing more than hand brushed ochre paint stick figure stars, it dawned on me that the art I wished to contribute could be accomplished without complicating technology. The largesse of these artifacts created with simple means stirred a formal awakening that completed my basic art education and brought my apprenticeships to a close.

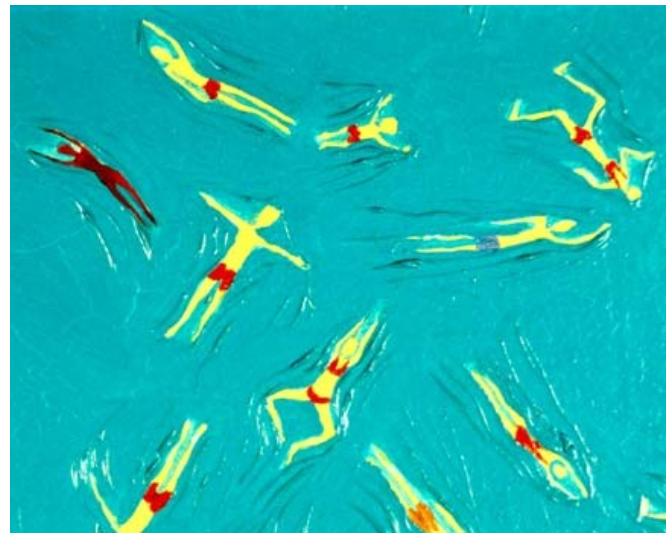
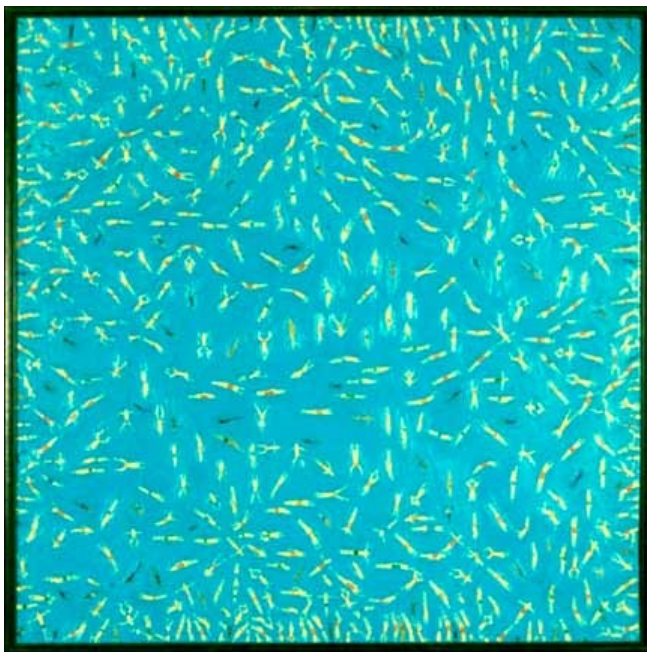


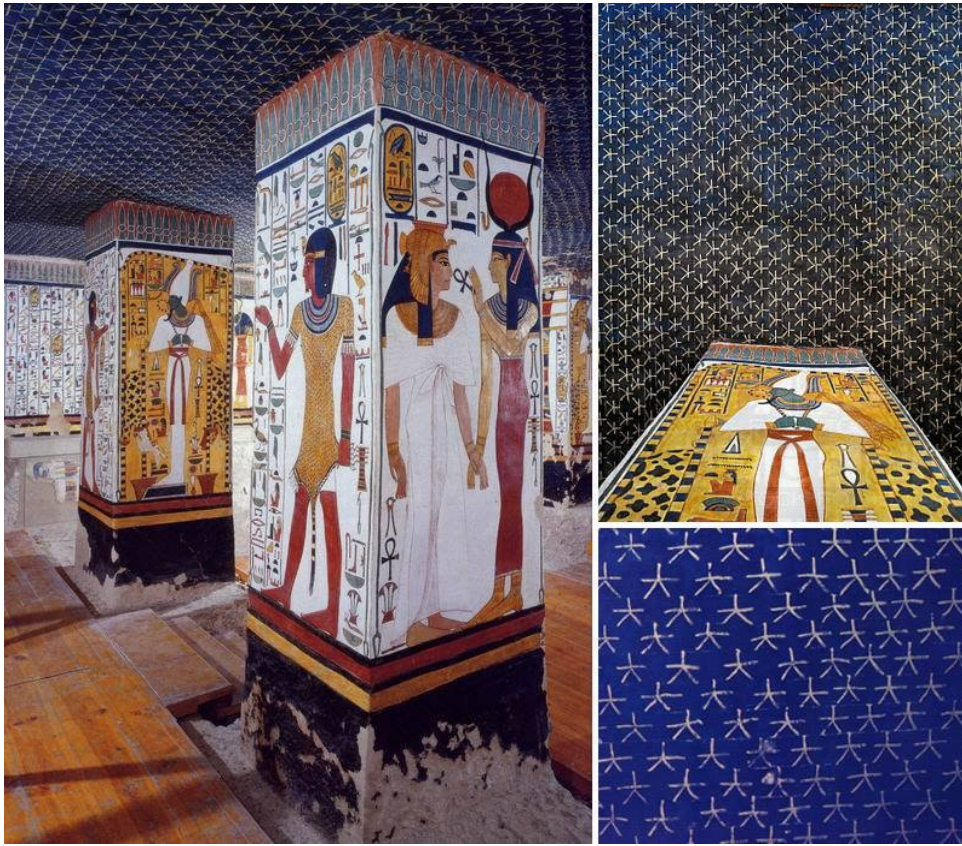
At a National Film Board nightshift animation stand I completed rotoscope special effects for the film, then moved on from *Visual Alchemy*.



With hindsight I appreciate the many ways that internalization of the holographic paradigm through hands-on practice empowered insight, delight and wonder in subsequent activities.

I made paintings on masonite, tentative afterimages of that tomb ceiling, and prelude assertions of painterly themes – illusory space and plane, surface tension and formal composition, and the clash of realities at the edge.





Many years later, the google high definition camera, prowling for art in which there is something to see up close, focussed upon one of this series.

<https://artsandculture.google.com/asset/cetacean-constellation-bathers-2-swimmers/YgH5XexLMaaHOA>

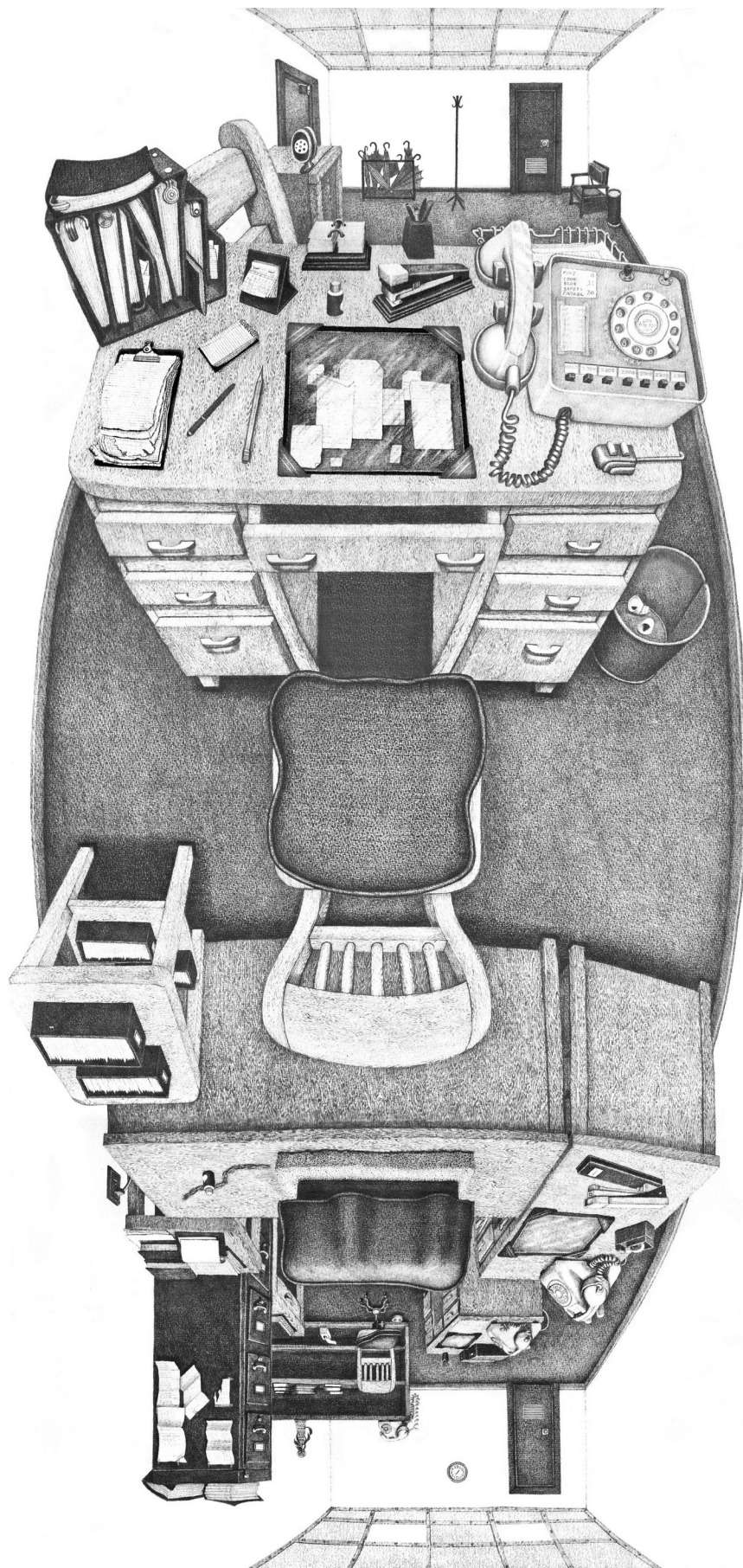


When I was ready to scale up, Gary Lee Nova kindly taught me how to stretch a canvas. In the *Wasp Vision* series of paintings I paid tribute to Jack Chambers' work by depicting a window as a boundary through which light is not diffuse, behaving impossibly like coherent laser light.

The window frame is not geometric perspective. When eyes focus behind the canvas surface, the two halves fuse for a stereoscopic illusion. A matrix of web like patterns in the inner dim, suggests interference patterns. In the pale blue outer "sky", tiny galaxies twirl – an incident of dream synesthesia when a wasp buzzed against the window at the foot of my bed. The influence of the holography lab is evident.

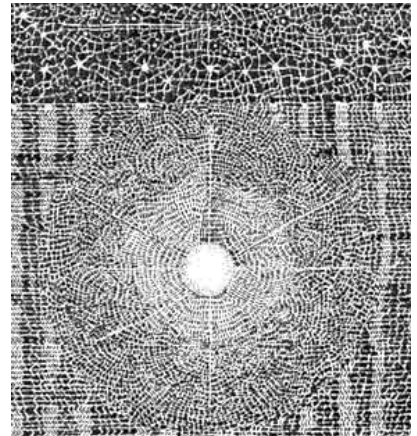
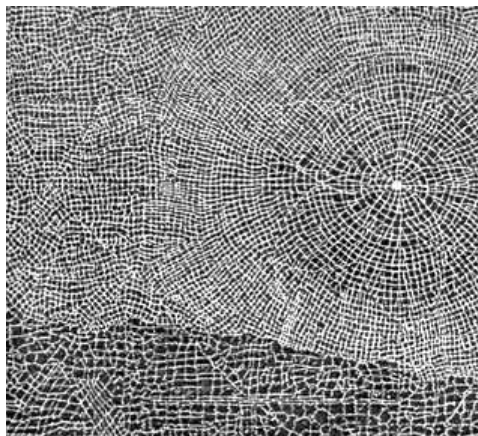
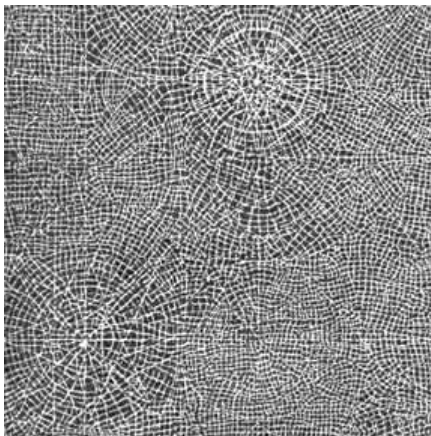
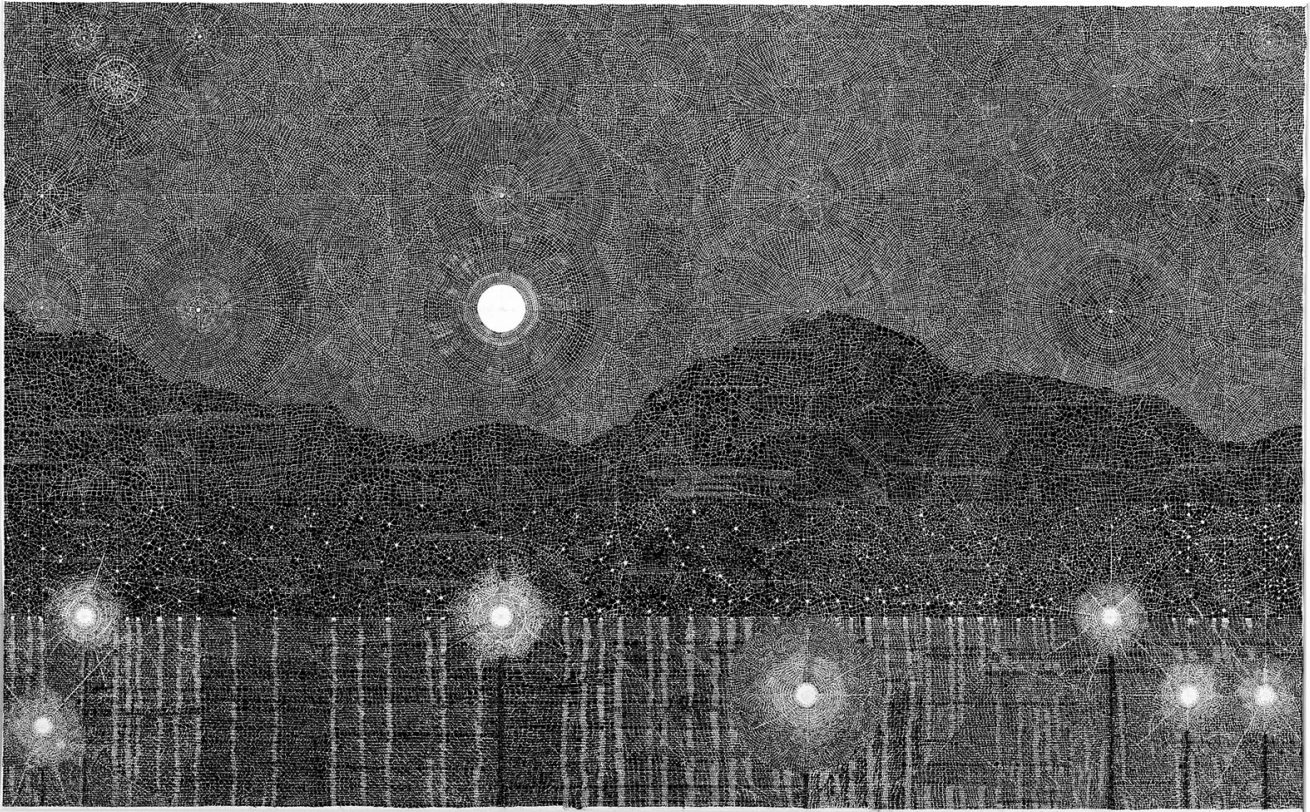


Sales of drawings along with income as a hospital night clerk funded another year of vagabondage. In Banff, away from urban light, life drawings of the field around the dimmest star in the night sky enabled study of "entoptic" features of our perception, that are ignored and dismissed as noise, such as the colourful evanescence that appears when illumination is below the threshold necessary to discern external objects. Physics experiments have demonstrated that the retina is sufficiently sensitive to detect photons in superposition (Tong 2019, 36, Ball 2018), and although not evident in our view, experiments support that this information impinges on consciousness. I regard the fine grained features of vision in terms of the holographic paradigm as unparsed underlying systemic order.

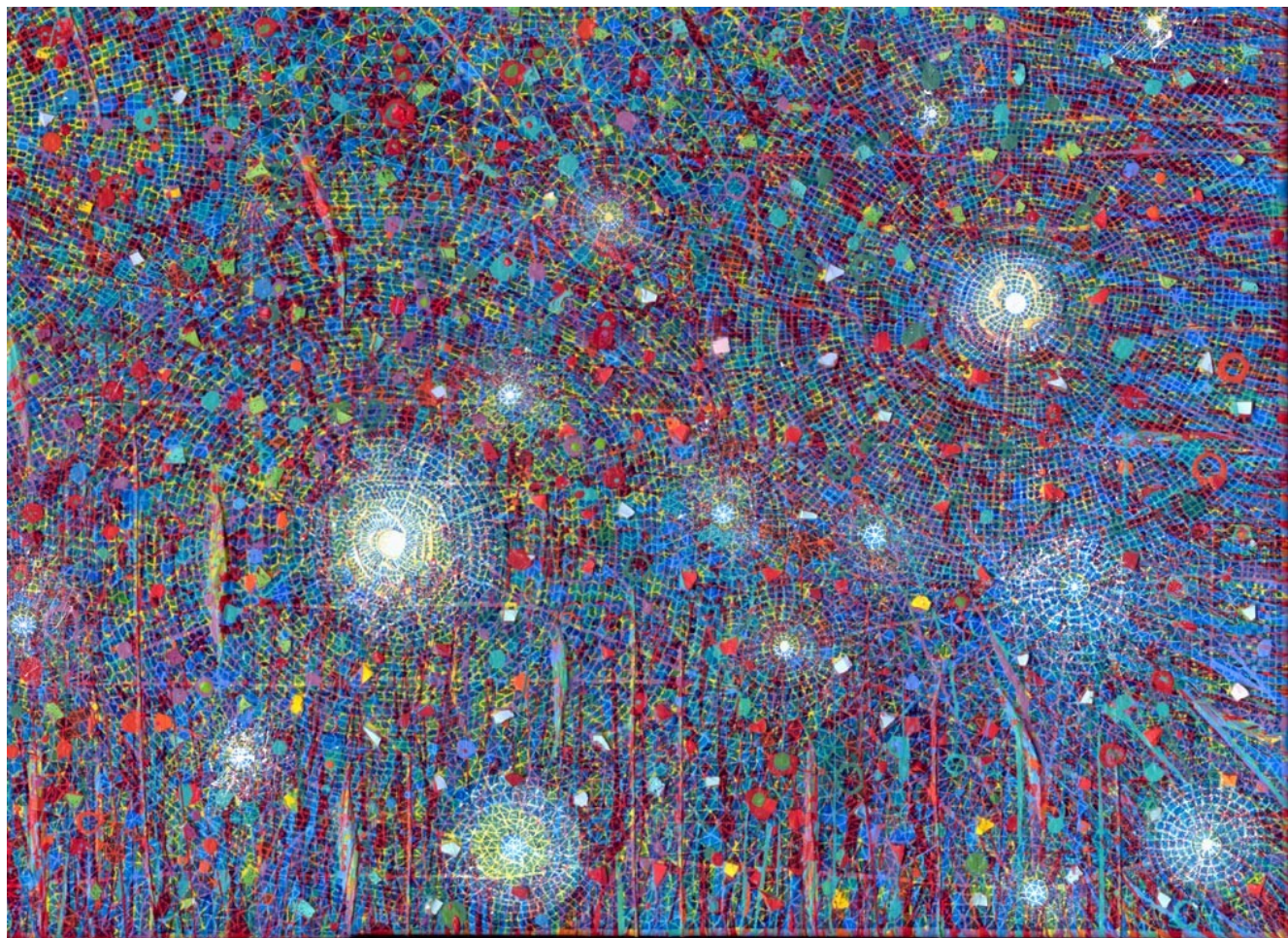


My brother Lachlan enabled me to do scuba diving on the Grand Cayman Great Wall continental shelf. Holography gave my vision acute sensitivity to the descent as a spectrum from turquoise into deep purple nitrogen narcosis. I made a second foray to Egypt, this time solo and for longer, to immerse again in formal harmonic fundamentals, then the Van Gogh museum in Amsterdam, and a trove of Egyptian artifacts in Leiden.

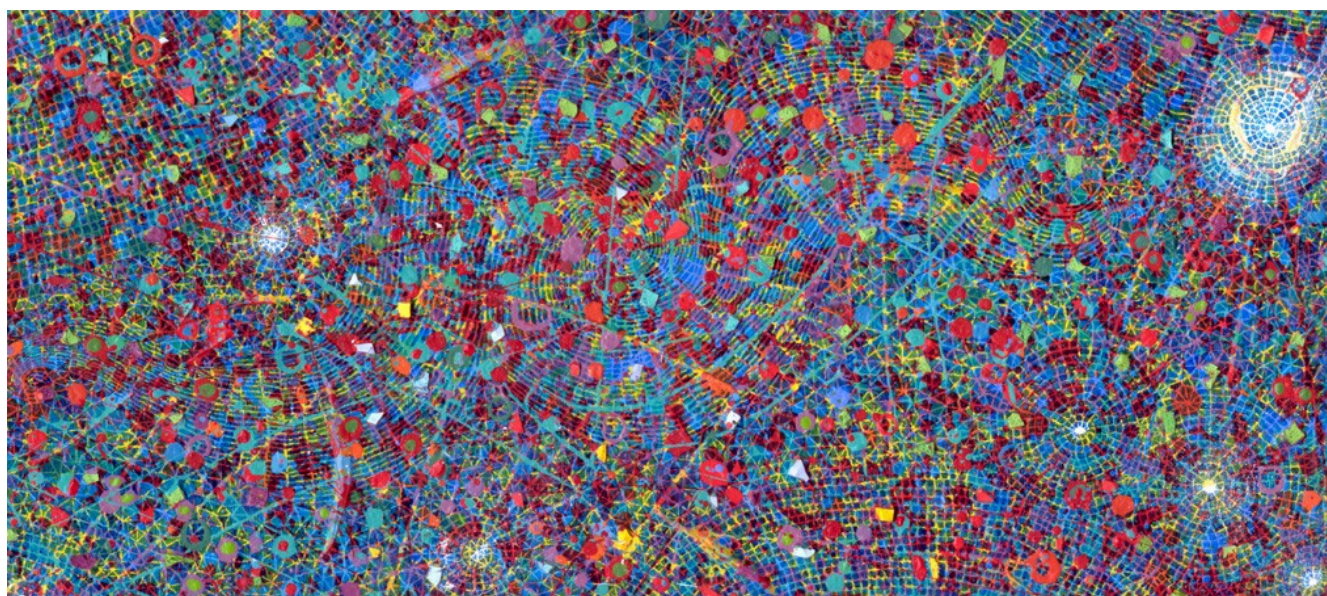
The *Night Vision* paintings of observations of the dimmest regions of the visual field articulated resolution made crisply evident when working with coherent light, what Stan Bevington described as “seeing seeing”. The plane of the painting is several inches behind the eyes, so the image integrates “external” light and “inner” fizz in patterns that suggest optical transforms. Over the years this aspect is slowly refining. It’s not easy to paint Newton’s rings. Even though people yelled at me that our vision must be stereoscopic, I still daydream about the two pupils as a double slit set up.

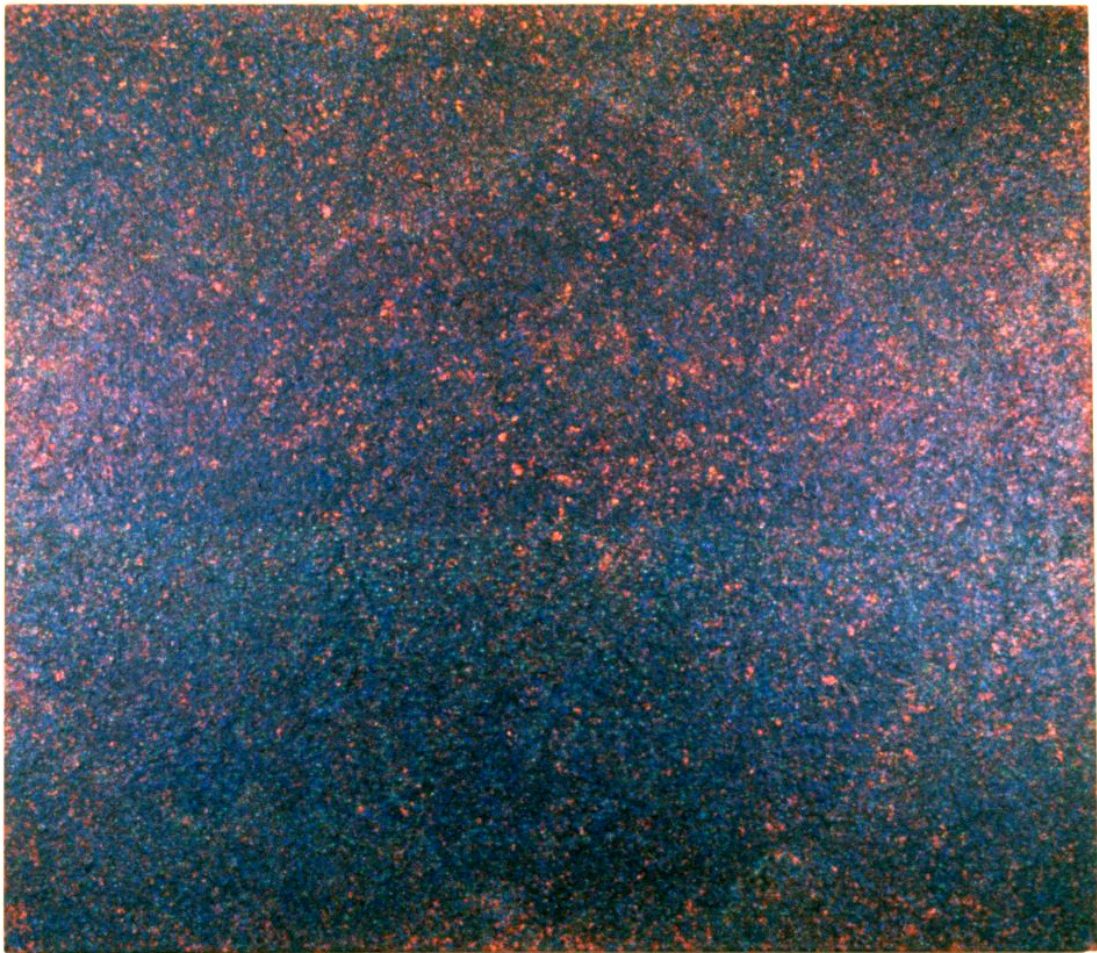
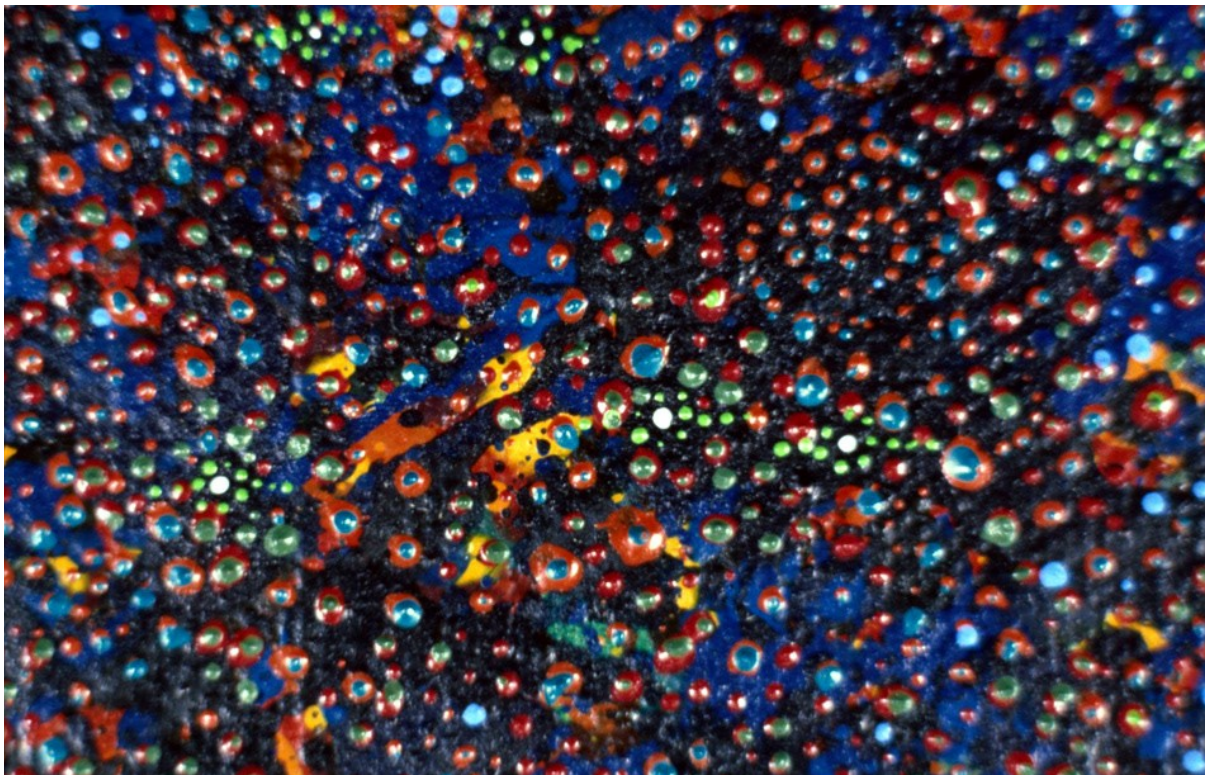


In the *Night Vision* paintings, the ground is built up by layers of paint in the order of the spectrum. Thus, in even a small fragment there is evidence of mind, and the colour signature of the entire painting – a tribute to Gary Lee-Nova’s colour bar and the holographic encoding of the whole in each bit.



Night Vision #19, Time Lapse, detail





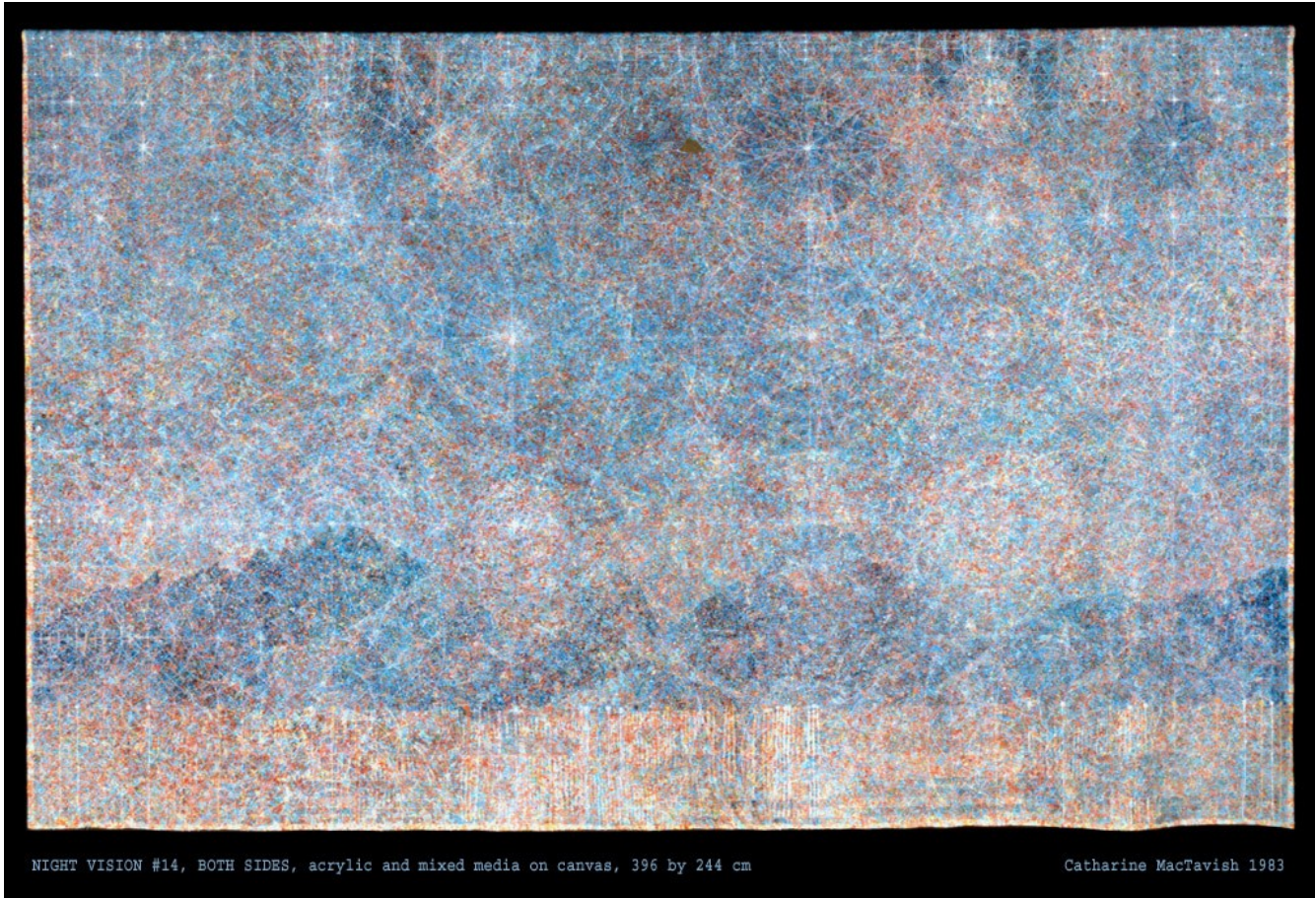
Sometimes I painted on both sides of a canvas, staging dialectical dichotomies, the way the hologram is structured with “real” and “virtual” dimensions on either side of a plane. I soaked canvas in acrylic medium and built texture using dried acrylic paint, so that the pieces are not heavy, and hang curtain like from a rod off the wall without sagging. Acrylic paint does not require the rigid ground necessary to prevent oil paint cracking, so freeing the fabric from stretchers integrated form and function into a flexible boundary.

The structure demonstrates the way binary opposites are a subset of the holographic paradigm. What most intrigued me is that contradiction collapses and turns out to be poles of a gradient, a yin yang in which opposites seed each other, inseparable, entangled. For example, attempts to paint one side with exact control fell short, and haphazard application on the other side generated unplanned patterns. On the messy side of one of these paintings, some acrylic dribbles dried into discs resembling psilocybin, so I affixed two actual shrooms as well. The organic matter absorbed resin, swelled and pushed out dents evident on the other side of the canvas, so a viewer can figure out which are “real”. I sloshed on two gigantic cartoon mushroom cartoons that were interpreted as atomic bombs given the heated arms race at the time. The painting is in the collection of the Art Gallery Ontario, and no matter how much I gossiped that I had sold an illegal substance to the institution, there has been no acknowledgment.



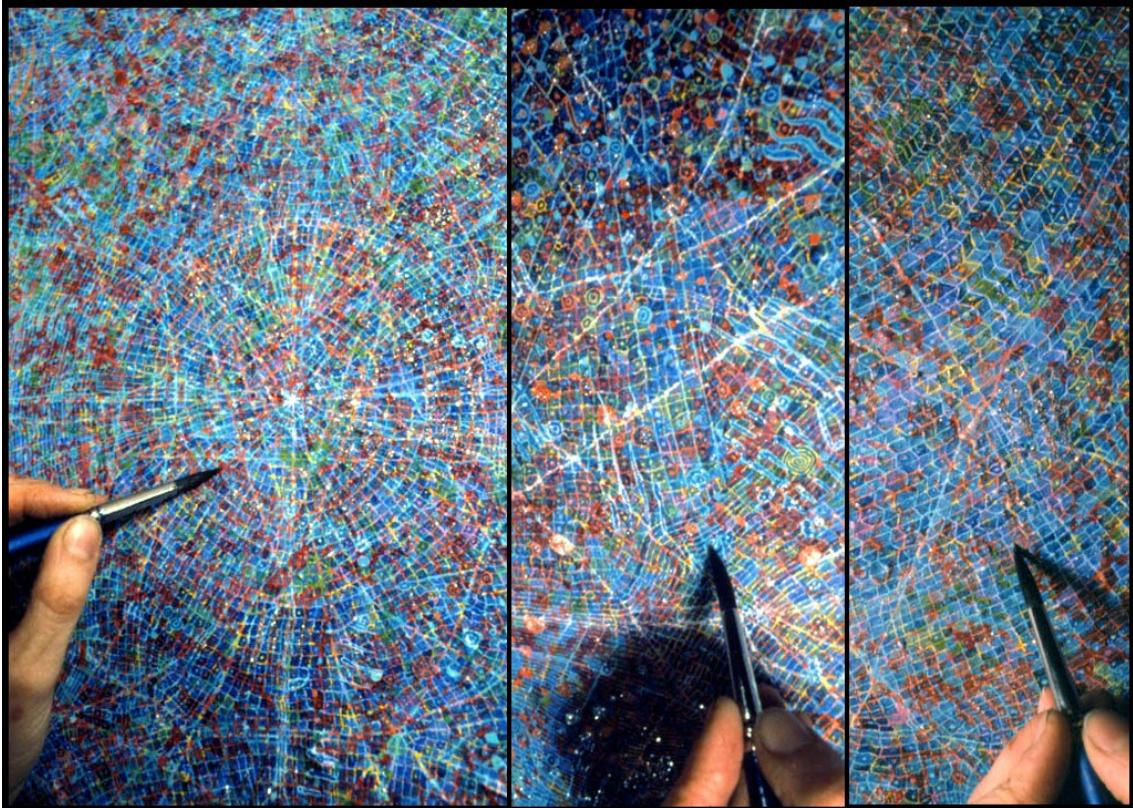
NIGHT VISION #14, verso, The Pure Gold Baby that Melts to a Shriek, acrylic and mixed media on canvas

Catharine MacTavish 1983



NIGHT VISION #14, BOTH SIDES, acrylic and mixed media on canvas, 396 by 244 cm

Catharine MacTavish 1983



NIGHT VISION #14, BOTH SIDES, details

Catharine MacTavish 1983

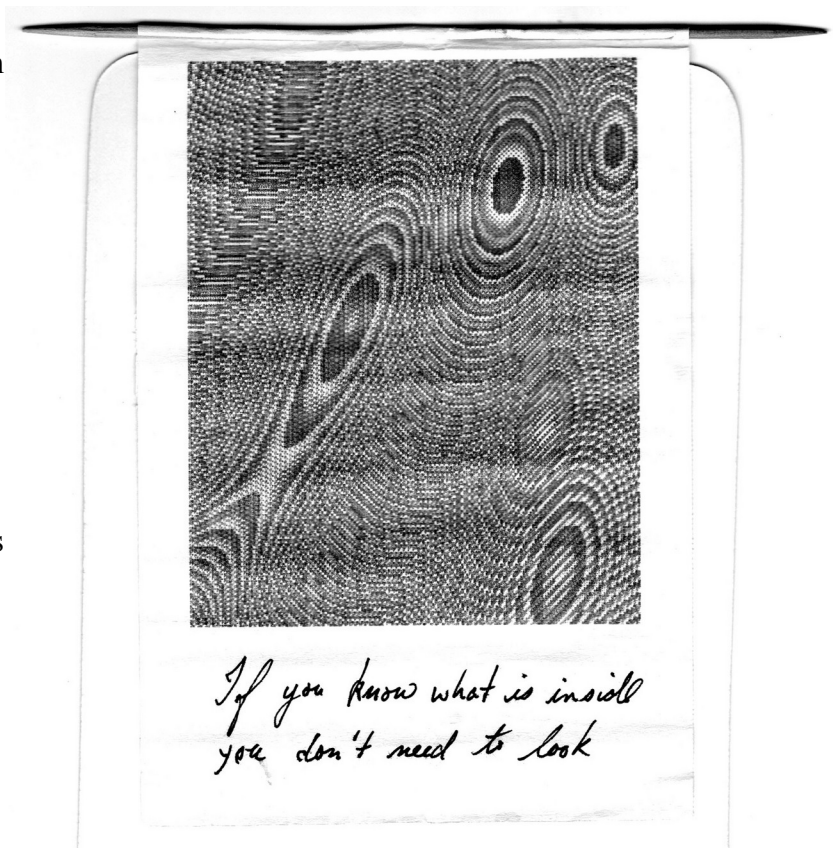
As a teenager, psychedelic art seemed a lazy, approximate rendering of what appears in such states. After an, er, interesting, er, night, while gazing at the dawn's scintillating evanescence undetectable to a camera, I dismissed the notion of rendering the vision in paint as "too much work". I forgot about that musing until a decade later the memory was cued by dabbing the very last dot onto an arduously high resolution canvas depicting a patch of such a sky. Watch out for ideas that percolate below chatterbox surfaces.



The painting *Arms Race* is a free hanging painted canvas that on one side conveys detente through compositional formal surface tension. It is perforated, so if hung away from a wall and lit with spotlights, bulls eye target interference patterns might appear on the wall behind. In the half dozen times the painting has been freed from its vault coffin, installers refused to generate this effect, and instead hung it up against the wall.



Before there were many computer graphics outside labs, David Standish made imagery he programmed using the dimensions of the monitor and pixel. His formulation was akin to my organization of the painting surface in dependence upon the measurements of its edge, sometimes golden ratio, because in the holographic paradigm, what can be known about a space is inscribed on its boundaries. Some of David's graphics bore startling resemblance to the *Night Vision* series. I asked him for images I could include in this account. He said that he can find code in backups, Pascal and Assembly; however he no longer can run it. The only artifacts are tiny dot matrix printouts with which he gift wrapped a miniature Buddha with a scroll upon which he inscribed "If you know what's inside, you don't need to look." It's an example of deft, brilliant 1980s experimental digital art that now is pixel dust.



Gary Lee Nova's enthusiasm for William Burroughs encouraged experiments with text cut-ups, which make sense when considered holographically. When we read, an entire world is imagined. A cut-up demonstrates that this whole view is not a linear arithmetical sum of the words. From a fragment of a cut-up text still a whole view appears to a reader. Such disruption discloses registers other than the thread of literal meaning – subtext. The reconstruction occurs in the reader's mind. The holographic paradigm integrates subjectivity and objectivity in reading, real and virtual dimensions, instead of just allegedly objective content.

The Sanskrit language did not develop through usage. It is a fixed artifact the design of which was an application of theories of language, semiotics, sound, ontology, phenomenology, and epistemology to the phonetic root building blocks of the ancient Indo-European language. Sanskrit's extensive and finely tuned grammar enables precision, powers and properties not possible in vernaculars that develop through usage. Sanskrit can encode multiple registers of meaning, dizzyingly complex definitions and even paradox (Pollock 2006). In this language culture, the pun is not frivolous. Ambiguity is not dismissed as murky, and is valued as offering a range of possibilities. The meaning of a text is understood to arise in the subjective dimension of the reader's mind. The "whole view" is constructed by the hearer/reader from any increment. Extensive commentaries telescope into condensed abstracts, "spells", mantras, and even right down to a single seed syllable, because such bits serve as mnemonic aids, accessing recall. Consideration of this language in terms of the holographic paradigm deepens appreciation of its special features.

KraftdragKaraokeKirtan - https://www.youtube.com/watch?v=3KRanxKB9qA&list=PLaDJmj4dAhNfCocyWdlpr5CB_p-F7OOho

The above are examples of the way that for me the hologram has been interesting and of value as an alchemical practice that effects inner transformation and psychic refinement through experimentation and manipulation of materials. Through hands-on practice constructing the system, the holographic paradigm is internalized, and serves as conceptual lensing for understanding and insight. This paragraph would make no sense to people gung ho about the hologram's potential for profitable commodification and spectacle, and I do not regard my orientation as superior to scientific, business, commercial, marketing and profiteering objectives.

In conclusion, a hologram serves various applications in engineering, physics, data archiving, security, entertainment, popular culture and fine art. People with no awareness of holographic technology sometimes think of it only as a three dimensional illusion, conflating it with stereoscopy and other spectacles.

A definition needs to include the properties that distinguish the hologram from other modes of representation. The pseudoscopic image is such a feature, projected in space, in front of the hologram surface. The hologram's three dimensions are generated by wavefront reconstruction, which is different from stereoscopic fusion. The superficially chaotic blur of the recording is the outcome of underlying order. The wave properties of light, phase information, are encoded in such a way that the whole image can be reconstructed from any part.

The hologram is a set of microscopic lenses and mirrors in a configuration that demonstrates a way that phenomena appear in three dimensions visually and mentally. Organizing data holographically enables technical and conceptual accomplishments.

The holographic paradigm asks what about everything is in every bit, inseparable from what it is-not, without independent self sufficient existence, interdependent, ultimately empty, space like.

This text is a holographic experiment; pose a pointed question and the response can unspool endlessly, the whole story accessed though a small window, Leonard Cohen's "crack in everything, that's how the light gets in" (*Anthem*, 1992).

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