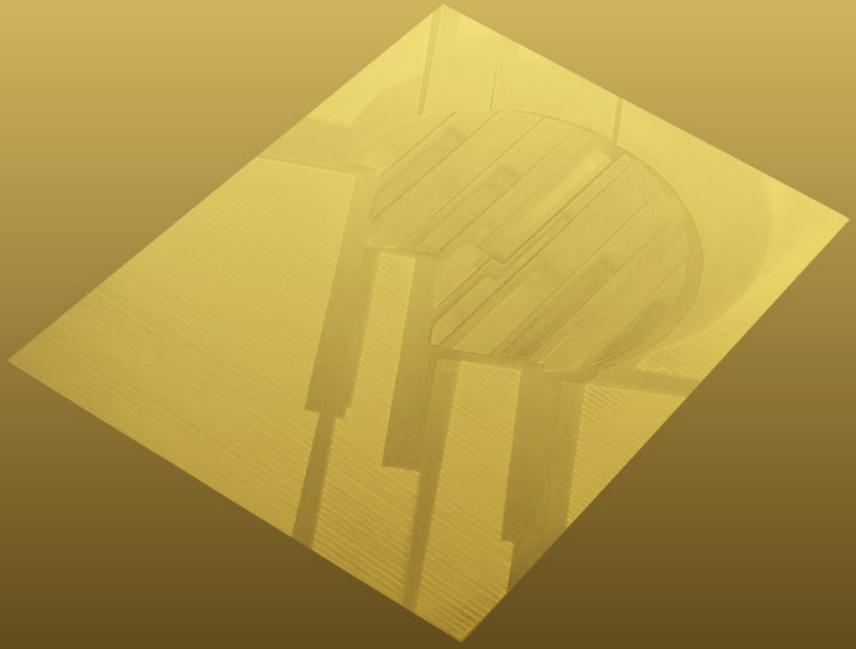




arts



Holography

A Critical Debate within Contemporary Visual Culture

Edited by

Andrew Pepper

Printed Edition of the Special Issue Published in *Arts*

Holography—A Critical Debate within Contemporary Visual Culture

Holography—A Critical Debate within Contemporary Visual Culture

Special Issue Editor

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Cover image courtesy of Melissa Crenshaw. *Healing for Broken Hearts*, 1986, Pseudo-color Reflection hologram, 12' × 16' × 8' from the Z-Axis series. Produced at the Global Images Holographic Studio, Vancouver BC, Canada.

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About the Special Issue Editor

Andrew Pepper is an artist and senior lecturer in fine art at Nottingham Trent University, UK. He has exhibited his work with projected light, installation, drawing and holography, in group and solo exhibitions internationally. As a Fulbright Scholar, he was resident at the Museum of Holography, New York, during its significant and influential period as a world-centre in the field of creative, technical and educational holography. He received a Lionel Robbins memorial scholarship to support his Ph.D. in creative holography, which is considered to be one of the early examples of doctoral practice-based research and the first of its kind awarded by the University of Reading fine art department.

Preface to "Holography—A Critical Debate within Contemporary Visual Culture"

This Special Issue attempts to provide a platform for the critical discussion, reflection and analysis of holography, as a process and methodology within the work of creative practitioners. The Issue examines, through the values and vocabulary of artists and curators, how this medium has developed as a considered practice and where pressure can be placed upon the critical principles of this relatively young medium. The participants published here have taken a risk, not only through the public examination of their development, but also by attempting to contextualise the use and display of holography within a contemporary, cultural framework. I want to thank the contributors of this Special Issue, who share my curiosity towards the critical investigation and contextualisation of our work and ideas in the sphere of creative holography.

Andrew Pepper
Special Issue Editor

Editorial

Fence-Sitting and an Opportunity to Unsettle the Settled: Placing Critical Pressure on Creative Holography

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1. Introduction

The field of creative holography is not known for its critical introspection. There is limited analysis of its development as a practice, process or methodology employed by artists. Artists struggle to place pressure on their own work in the medium. Their comments often slip into a diarised or practical declaration of the “how” rather than the “why”.

A great deal of generalised reportage in popular media frames attempts to engage with clear commentary, critical observation and primary research. Critical analysis does exist but, as with many fringe or pioneering media, you really have to hunt for it. Critical pressure is not something a reader might casually come across in a contemporary art journal. Tenacity is required.

Frank Popper, in his review of art in the electronic age, commented that “[i]n order to build an historically legitimate aesthetic of holography one has to detach oneself from the dependence upon the photographic paradigm so important in understanding computer art. The persistence of this paradigm reveals itself especially in the overemphasised ‘third’ dimension of holography” (Popper 1993, p. 37). It is this “third” dimension on a flat surface, the illusion of “reality”, which both attracts and distorts critical interrogation.

There appears to be a great deal of “fence-sitting” by artists, critics, curators, publishers and cultural observers. Commentators, including artists who work in the field, are unsure where creative holography “fits”. It could be a remarkable and genuinely significant medium. However, it may not be, polluted as it is by the tacky commercialism of spectacular visual flotsam. A similar issue exists in other media. There is a world of terrible painting, sculpture, performance, installation, graphics, moving image and conceptual making. Why then is it so difficult to view a critical framework for holography? The worst of the worst in holography cannot be any less awful than the worst examples in other media.

2. Tipping Point

There appears to be a tipping point, which has not yet been reached, in the critical discussions around holography. The technical process is a little over 70 years old (Gabor 1948), and artists began to work with it as soon as it became viable as a display technique in the mid-1960s (Leith and Upatnieks 1965). Within three years, the first acknowledgement that this new technique might be relevant to artists appeared in the, then recently established, *Leonardo* journal (Wilhelmsson 1968). So, at most, it has been viable for artists for 55 years.

The use of video by artists is of a similar vintage. A recent survey and retrospective exhibition of work by Nam June Paik at Tate Modern in London attempted to chart the significant development of his practice in particular and video art in general—interwoven against a background of the Fluxus movement and enthusiasm for “new” technology. The exhibition drew on 50 years of cultural analysis, which has now generated further (current) critical observation around the impact the “father of video

art” made on a changing media landscape (McMullan 2019). That type of “rolling” analysis has not happened, on a similar scale, with holography. This is not “sour grapes” on the part of myself and others working with holography (although it is easy and convenient to characterise it as such). It is fact.

The comparison between holography and video as media is clearly a blunt one. “Holes” can indeed be “picked” in it, but this type of basic overview can sometimes be helpfully provocative.

3. Attempting to be Critical

As we change decades, and 55 years on from a declared starting point, this Special Issue aims to offer a platform for critical discussion and a location for artists, curators, writers and cultural observers to place pressure on their practice or that of others invested in the field. The invitation to contribute cited the work of artist Margaret Benyon (1940–2016), her considerable and considered practice and the doctoral dissertation “How is Holography Art?”, which she submitted to the Royal College of Art, London (Benyon 1994).

It is a fascinating read, all 226 pages of it, and it charts her attempt, through practice and precise critical analysis of the work she produced, to answer the question. It appears to be the most extensive catalogue and interrogation of a single artist’s work by an artist who had developed a clear practice using holography. It has not been published, although attempts were made by Benyon to do so (Pepper 1995). Apparently, it was not thought to “have an audience”, and that analysis is a persistent one. A literature review clearly indicates that the books that are published deal with the technical aspects of an optical process; generalised, procedural development; self-help or broad cultural observations framed from a scientific or engineering point of view. Within these publications, there are moments of critical commentary, but they lack depth, context or authority.

Through this Special Issue, there might be a more contemporary analysis 25 years after Benyon’s attempt to untangle the question she posed.

This is a compact, nine-paper Special Issue. Makers and observers are still sitting uncomfortably on the fence. Authors who did submit their observations and opinions have contributed to what is, I hope, a significant “moment” in the reflective and critical analysis of the medium. It includes the following:

- Reflection by a range of artists on their extended and developing practice.
- The investigation of critical issues surrounding where holography “sits” in relation to other more traditional media.
- Analysis of the unique spatial qualities that holography offers and how aspects of the narrative are explored within a continuing practice.
- The impact of institutional collections within the broader “framing” of creative holography.
- The opportunity for holography to act as a progressive practice and research methodology within the traditional gallery.
- The curator’s view, which examines the ephemeral document, a core point of reference within visual holography.

Not everyone felt able, or willing, to place pressure on their practice or dogmas, so I would like to thank those who are published here for their bravery and tenacity. I have witnessed the editorial process as these papers have developed during the past months and seen how robust editorial questioning has focused attention, exposed conflict and adjusted “voices”. The cumulative result is a timely “litmus test”, manifested through the observations of creative practitioners willing to investigate their practice (and possible insecurities) while attempting to place their activities in a more comprehensive, cultural and critical context. Perhaps, this Special Issue will become a moment of slight disruption. An opportunity to develop further questions that will place pressure on the critical values and aspirations of those who are developing holography as a medium, methodology and critical framework.

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Article

When the Image Takes over the Real: Holography and Its Potential within Acts of Visual Documentation

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Abstract: In *Camera Lucida*, Roland Barthes discusses the capacity of the photographic image to represent “flat death”. Documentation of an event, happening, or time is traditionally reliant on the photographic to determine its ephemeral existence and to secure its legacy within history. However, the traditional photographic document is often unsuitable to capture the real essence and experience of the artwork in situ. The hologram, with its potential to offer a three-dimensional viewpoint, suggests a desirable solution. However, there are issues concerning how this type of photographic document successfully functions within an art context. Attitudes to methods necessary for artistic production, and holography’s place within the process, are responsible for this problem. The seductive qualities of holography may be attributable to any failure that ensues, but, if used precisely, the process can be effective to create a document for ephemeral art. The failures and successes of the hologram to be reliable as a document of experience are discussed in this article, together with a suggestion of how it might undergo a transformation and reactivation to become an artwork itself.

Keywords: ephemeral; document; documentation; Bartram; hologram; holography; artwork

1. Documenting Ephemeral Art: Flat Death and Being There

Ephemeral art, such as performance or live art, requires documentation to prove its existence beyond the moment of its happening. The answer is often photographic, yet there are issues for the legacy of the work with this type of response. The event is date and time stamped by the photographic document, which stands as proof of it taking place, which locates it to a specific time and to a certain place. A two-dimensional photographic document of the ephemeral event or happening resigns the embodied experience to a “flat death” in this way. The document proves its existence yet denies the opportunity of its experience. The actual experience of the ephemeral artwork is, therefore, lost to the viewer of its document. They see only its record of happening created through a particular view and vantage point. Roland Barthes, in *Camera Lucida*, suggests that “flat death” is the fate of the three-dimensional experience represented photographically, so from this perspective, this result is not unexpected. The depth and varied nuances of the event go largely unrepresented in the photograph, and, in Barthes’ terms, a flat and dead image is the result.

The hologram, however, with its spatial and three-dimensional realisation of an image, offers a potential solution to this problem. In providing a view of the dexterity and depth of an inert object or human body, it creates a more comprehensive photographic document that exists as a potential act of legacy. Although this cannot fully account or attest to the experience (as that can only occur through active and present observation), the three-dimensional representation within the hologram allows for greater understanding of “being there” at the time of its happening. The hologram, therefore, is potentially more suitable to document the active and first-hand art experience. Yet, appropriateness and suitability are as open for debate with the hologram as with its two-dimensional counterpart, concerning how it successfully operates in this context.

2. The Wonder of Things

The hologram is a thing of wonder. It offers an apparent view of an object that appears three-dimensional on a flat surface. The image glistens when enlivened by light. As light touches the surface of the hologram, it exposes the object, held as if in suspension, at its centre. Moving one's position around the surface of the image, whether by turning the hologram between the fingers if small enough or by shifting the eye from one side to the other, the object is momentarily revealed. Then, it disappears, leaving the surface appearing dull and lacklustre. The image is visible and "exposed" only in certain viewing positions. Seeing these light-enhanced objects within the hologram brings a type of observational delight. This animated snapshot accounts for some of its wonder, because it appears to emerge out of the depths of the holographic surface, somewhat like an apparition. Moving from the dull and undescriptive surface to one that is light-saturated and suffused with depth, it opens up a challenging and questioning regard for its very existence. How can this be, and what made it? Produced by lasers and reliant on technology, it is beyond most of our frames of reference, comprehension, and experience. This, together with its light-possessing and -yielding properties, informs the onlooker about how it is perceived, triggering a sense of preciousness and magic. The holographic process is a systematic re-articulation of the relationship between the object and its fixity through photographic means. Holding the moment of capture of the object in stasis, its three-dimensionality allows the historic and contemporary to exist simultaneously. They are present concurrently. This is beyond photography, a two-dimensional means by which to hold captive a moment that cannot be revisited. Time stops when the shutter closes with photography. Holography, through its ability to capture convincing three-dimensionality, imbues a sense of the image being "active". One sees different angles and perspectives of the object in the hologram, which creates a sense of being present and "there". This "sense" is born of being able to move around the image within the hologram spatially, to take advantage of different observational potentials. The object within the hologram appears to extend beyond the boundaries of the film plane, negotiating and offering a different way of being seen. The perspective of the image changes in relation to the viewer's position to the hologram, and this creates a feeling of movement around the object. Turning the three-dimensional subject into a two-dimensional photographic image, the hologram presents an alternative to standard lens documentation. In this way, the record of a historic time and place becomes an active proposition in the here and now—a document that is not just a document; the past and the present in seeming simultaneity; a representation of life that is in fact dead. Ephemeral, spooky, unreal, un "there".

If we are to regard the eerie in image making, Roland Barthes and his critical consideration of the resonance of the photograph seem relevant. Although Barthes' discussion in *Camera Lucida* mainly concerns his specific reflections on photography, such as the history and constructed essence of the image, it also highlights deliberations of resonance, melancholy, and death. The photographic image represents a death of a specific time and reflects posthumously on a particular moment. Barthes observed that with "...the photograph we enter into flat death" (Barthes 2014, p. 92); yet, with the hologram, there is a representation of death (in terms of documenting a time past for Barthes), renewed by situating the subject spatially. However, this mutability does not allow for physical and conceptual stabilization in the sense of Barthes' observations or for a precise response to its current state. In a hologram, the three-dimensionality of the image, which is different from the two-dimensional photograph, does not fully represent Barthes' flat death. Instead, it represents a more dynamic, but spatial, death. This adds critical complexity to the process of holography and the hologram (which increases its sense of wonder), forging a relational adventure between the perceived and actual understanding of the image and its subject. Establishing a constructed criticality from "perceived" to "actual" knowledge of the artwork in this way removes it from the conventions that determine the three-dimensional, the site-specific and the embodied. It is not static as an object might be perceived and perhaps not a document that appears fixed and finished. This defiance ensures that the aspects of criticality are both engaged and of enduring interest. An enhancement of its intended analytical and perceptible framework occurs as a consequence. The observational distance that the

“flat” document permits is denied, and tension is engaged. It does not stop still to allow meaning to settle and for distance to be born of acquired knowledge. Instead, it asks that an individual and independent experience determine how the image/object appears at a particular time. This requires a confrontation and immediacy with the hologram, which is dependent on the conditions in which it is sited or installed.

Defying spatiality in its two-dimensional flatness and three-dimensional portrayal of an image, the hologram is both a reflective, factual document of the past and an active representation in the now. Documentation of an event, happening, or time is traditionally reliant on the photographic to determine its ephemeral existence and to secure its legacy within history. Essentially, the photographic document proves it occurred. However, if we are to follow Barthes’ idea that the photograph is a potent and responsive emblem of death, then its appropriateness for referring to the ephemeral is questionable. The event is represented, but the experience is lost and cannot be revisited. Here, the photograph acts as a memorial to, and of, the event. Its flatness does not allow for an evocation of embodiment in depth, as the actual experience is unrepresented. The hologram, with its three-dimensional references, is actually a memorial with depth. This spatial depth and attention to three-dimensionality makes the experience appear a little more present. Holograms bring the event closer to the now, and this is of value for documentary representation of the active or temporal.

Holography proposes and demonstrates tensions between time past and the present, within a document that both evidences and uses itself historically and contemporarily. Through the spatial and temporal relationship between the photographic image and its transformation to hologram, the document and its three-dimensional reanimation coexist. This not only sets the agenda for past and present, but also for the flat and the spatial. Holography, therefore, is a unique demonstration of how the critical tensions engaged in two- and three-dimensional image making can exist in synchrony, as each occupies the same representational territory for the image. This unyielding tension sees possibilities for photographically capturing the ephemeral object beyond the purely archival.

3. Preservation of the Ephemeral–Performative and Live Art

Ephemeral artworks uncomfortably transform into an archival document through still or video photography. Whilst this evidences their existence, it also denies the transient intentions of the artwork. Ephemeral artworks seek an active and present audience, witnesses connected by both event and experience—but they do need to be preserved in some way. A paradoxical situation: how can ephemerality and transience be preserved for artworks that rely on this concept, when photographic documentation is the antithesis of such an activity? A solution may lie in responses to the active and present tense of the artwork itself and how this can accommodate fluidity. The fields of performance and live art have long tussled with the question of correct and appropriate methods to document their experience. A hologram’s light-infused three-dimensional portrayal of perspectives allows a viewer to “see” the “body” or corpus of the image through access to multiple viewpoints and angles—these possibilities are available through the spectral, conceptual, and visual spectrum of multiplex holography specifically. This method captures images from moving film, and as the process begins from movement, it is, perhaps, suitable to refer to the acts of embodiment. Such a process is not unlike being present in the space of a performance. The movement necessary for access to the depth and nuances of the spatial within the holographic image is responsible for the enlivenment of the object held within it, and the shifts in the viewer’s position affect how they gain access. In effect, their relationship and bodily alignment to the hologram is responsible for how they “see”. As a simultaneous document (as an image captured of a time and place) and *non*-document (as a re-represented three-dimensional version of that time and place that is seen only by movement of the observer’s eyes and body, the hologram accepts and refutes the conventional, which can be valuable for the documentation of ephemeral art.

4. Holography as a Possible Creative Process

Holography and holograms appear to be an impressive addition to the potential of a document to be enlivened and reactive to the present. This quality, coupled with the delight of witnessing the image exposed by light within the surface, sees the hologram become of interest to artists and those working beyond the field of holography. However, is it the “ooh” and “ah” responses to witnessing a hologram’s qualities that really make it attractive to artists, so is it really viable as an alternative document? Beyond the technologically productive capabilities of holography, artists acknowledge its capacity to produce an artefact in its own right (such as sculpting or drawing with light). How successful this is in creating a coherent and succinct visual narrative, however, is debatable. Bruce Nauman, an artist making holograms in the late 1960s, explored the medium for its capacity to articulate and document the moving body. This activity is also present within the practice of performance artists such as Carolee Schneemann, to which the theorist Amelia Jones refers when discussing her artwork in *‘Presence’ in Absentia: Experiencing Performance as Documentation*. Ephemeral art and the photographic document and documentation for Jones are mutually useful as the “event needs the photograph to confirm its having happened; the photograph needs the [body] art event as an ontological anchor of its indexicality” (Jones 1997). The remains or evidences of Schneemann’s live performances in the 1970s specifically, as discussed with Jones in *Perform, Repeat, Record: Live Art in History*, are available as still images, and these, as the artist states, “become the work and a substantiation of it” (Jones and Heathfield 2012, p. 445). For Schneemann, the document is akin to being an “archaeological discovery” of the once live and alive, whilst also performing at a distance from its original criticality (Jones and Heathfield 2012, p. 445).

Extending this view on photography, holography, then, seems a more viable and useful means by which to attest to an event, particularly as it adds greater three-dimensional depth to better reflect its spatial experience. Contorting his body and face to make two series of holograms, *Making Faces*, 1968 and *Hologram H*, 1969, Nauman tested the medium’s critical malleability in response to documentary conventions. In these series, Nauman performed directly to the camera, setting the experience of the live within a relational discourse of body to lens. So, his performance within the holographic studio, which used a pulsed laser and complex optics to freeze a nanosecond of time and space, offered Nauman the opportunity to make a portrayal of (his) body as active and performing. These are successful to a certain degree and develop an intriguing response, particularly as they were made at the end of the 1960s when holography was not widely accessible beyond the science and engineering laboratories in which it was being developed. Certainly, it was not used by many artists at that time, who, perhaps, could not afford such experiments (maybe this is the preserve of the wealthy and successful, but that is for another essay). Yet, Nauman used the holograms in *Making Faces* as the source for silkscreen prints in 1970, hereby making a translation of the three-dimensional image to a static representation of a different type. Did Nauman believe that the hologram was not enough or was he seeking to extend the process into a multi-relational, -faceted, and -composed documentary only to be disappointed? Perhaps the more traditional means of making artwork seemed more suitable, more viable to the artist and the artwork, in a time when wonder should perhaps be limited to small and discreet outings and experiential opportunities. Or, perhaps, the hands-on process of “making” was necessary to fulfil the visual existence of the idea for the artwork for Nauman, to ground it *as* artwork.

5. Containing the Space—Aspects of Loss

Bruce Nauman was concerned with the body, the moving, the dexterous, the animate, which brings an engaging critical consideration for the hologram in this context. Whatever the failings or unfulfilled effects of the process for the idea to satisfy the demands of the artwork visually (if any exist), there is an engaging and exploratory process brought into the critical framework of making by using holography to capture the moving body. Its suspension within the two-dimensional pictorial plane seals the image of the body almost as if in a box. The situation of the body in this context is given greater emphasis through the three-dimensional perspective of the hologram. Essentially, the

hologram represents the image of the body as more fully and spatially formed, whereas the photograph offers one that is flat. In some ways, the spatial properties of the hologram hold the body as if in a cage or cell—a captive body held in stasis and suspended animation by the frame and depth of the hologram. Cells and spaces of containment are intriguing in regard to issues of isolation and confinement, and perhaps, this is where the hologram is of use. This act of physical and illusionary containment suggests that the represented object is of interest and value. In some ways, what it offers best is the spectacle, or spectacularisation, of the object. It makes it important to see by giving the object priority within the image plane.

There are nuances and subtleties created by the surrender of the performing body to the stasis of the hologram. Here, an inertia is created that goes beyond the standard form of documentation. It “sort of” works in a way that a conventional, still, two-dimensional photograph of an event cannot, which is further enhanced by its observational need for activation by light and movement. A doubly embodied gesture activated by viewing. A reasonable vehicle for documenting the live body in the right conditions. However, what of those who engage with holography to capture the presence of a sculpture? Louise Bourgeois makes sculptural “cells”, spaces of occupation and containment that suggest a holding and presence of the body, even if that is not in situ. In their physicality and materiality, her sculptures are referential of the body absent and (suggestive of post-) mortal. In certain circumstances and artworks, it appears as if a previously occupying body or bodies have recently left. Indeed, when details resembling the physicality of a human are included in her sculptures, they are dismembered and isolated, heralding images of torture and death and the body past. Somewhat reminiscent (for me certainly) of the sexually explicit, multi-body psychoanalytically informed narratives by Georges Bataille in his novel of 1928, *Story of the Eye* (Bataille 2001), illustrated by the artist Hans Bellmer, they speak of narrations of past acts of disembodiment and violence. Sculptural materials stand in for corporeal matter. Limbs are plaster (for example) rather than flesh, made rather than once a living body part. When constructed to include these details, such as in the artwork *Leg* (Bourgeois 2002) of 2002, the sculptures embody the essence of the living and corporeal represented as dead and immaterial. This effect is demonstrated in the holograms made by Bourgeois exhibited in *New Order: Art and Technology in the Twenty-First Century* at MoMA, New York, in 2019. (MoMA 2019). The sculptures of Bourgeois evoke the eerie and macabre through their use of cast and fabricated objects. The holograms at MoMA are in keeping with this intent but with the addition of the sense of observational movement that a hologram imbues. Through the observer’s interaction and exhibition site, her holograms offer a different, documentary, point of access to the complexities within her sculptures. In her Guardian newspaper review of the MoMA exhibition, Frani O’Toole suggests that the holograms create “their own medical moving images” (O’Toole 2019). The holograms contain images of the objects common to the sculptures of Bourgeois: cells, iron beds, cages, and dismembered human limbs made in plaster. They appear as if snapshots of a particular viewpoint of a sculpture’s exhibition installation, bathed in light. In some ways the holograms create a deeper connection of intimacy with the observer than the sculptures seen in situ, as they are drawn into observation at close range. Scanning the hologram to reveal the image rather than stepping back in order to “see” the full detail of an exhibited sculpture, the observer is drawn intimately into an engagement with the macabre worlds represented. They present an intimate “seeing” of Bourgeois’ representation of torture and dismemberment at close and affecting range.

Barthes stated in response to Sartre that there is a “poverty of the image” that comes to fruition when denied a full narrative, as one would find in an illustrated novel or text (Barthes 2014, p. 89). There is certainly a poverty created by the history that is held within a photograph, one that can incite mourning for the lost experience of that time. A yearning is created for time experienced but gone or simply not encountered. Peggy Phelan states that the “centrality of the single perception (the “perfect” viewpoint) is fortified through the experience of its loss, just as the endless process of establishing psychic identity is punctuated by its loss”, and any eventual mourning is part of the process (Jones and Heathfield 2012, p. 25). I propose that mourning is inevitable for visible and

experiential loss (whether by having seen and not being able to revisit as with conventional gallery works, accessing the document and documentation after missing the event, or seeing nothing and hearing second hand) and part of its necessary posthumous and affective aftermath. At the very least, there is a disaffection and sense of experiential *lack*, which initiates a process of dispossessed and distanced critical mourning. This distancing and separation from the density in criticality of the original encounter dilutes affective potency for the artwork, leaving its observer deflated and experientially short-changed. Although Phelan's notion of invisibility giving legacy maintains a truth to the original (and it is an approach that I attest to, as imagination, as embodied response, pertains more to the experiential), it still carries the weight of loss. One suffers the effects of not witnessing first-hand the breadth of the artistic act in the time and space of its happening, and the document is a monument to grieving in this respect. By not being able to experience and embody that experience in its intended ephemerality, the document becomes an object of loss for the observer.

6. Not Witnessing

The lack of full reference and testimony to an enhanced experience is where any failings of holography reside. This is due to a "not witnessing". The loss of the actual and "within the present time" experience is felt when viewing the hologram. Although it may represent the embodied and three-dimensional reality of an event more than the two-dimensional photograph, it cannot replace "being there". Instead, it acts as a substitute or replacement for the actual experience. For although a more active document than the traditional, it still does not satisfy the necessary testimony of the performing body for Nauman, who sought to make screen prints to satisfy his claims for the legacy of the artwork. The representation by Bourgeois of her sculptures in holograms could in no way account for being there and seeing their form in situ as the artist originally intended. So, the act represents loss and creates observational mourning of, and for, the experience. A loss to criticality is the consequence of a lack of first-hand experience of specific details, colours, and vibrancies. The ephemeral artwork sets its own agenda in acknowledgement of loss and grief, to combust when conditions dictate, which the artist predetermines. The artist may feel the loss himself or herself, but they know it will expire, as that is the ephemeral artwork's intention. The viewer, however, has no way of managing his or her grief and is unlikely to even acknowledge this state, as he or she has no say in its life, either in the moment or thereafter. This inherently makes the document and documentation of ephemeral artwork troublesome. It highlights affective mourning of the neglect of experience when perceived second hand.

An answer may lie with precision and construction. The hologram requires the same level of criticality to be an artwork as a performance or sculpture and to be treated as a medium of making as any other. A requirement for this may be (but is not absolute, as with the right agenda, the hologram could flourish as an artwork in its own right) for it to become a component part within an artwork. Strategically, with certain conditions in place to position it integrally, the hologram can fulfil the critical demands of an artwork to see it transcend the legacy of the document. When integrally positioned with other components that create a relational dialogue, the hologram enters a taut limbo between life and death, of living and loss. In this situation, it is in tension between document and documentary through a systematic re-articulation of the situated art experience and its photographically fixed representation. Here, the historic (representation within the hologram) and the contemporary (its place within a new situation) are simultaneously represented within a constructed assemblage. Invariably, this may include a confrontation of low- and high-fidelity values, as the objects to which it relates draw the hologram into a critical discussion of complexity within spatial making. The hologram relies on high fidelity to exist, and those lasers and skills do not come cheap. The more conventional art object or installation might take skill and training to make, but the artist's hand alone set to work in their studio is often the low-tech agency responsible for their critical manufacture. Combining high and low elements is, perhaps, where it gets interesting for the hologram within the context of the artwork.

7. Conclusions

How might an artist negate the effect of loss when making artwork as a hologram if this creates a void in representation of intent? Indeed, can the sense of mourning for the experience of the art object represented within the hologram ever be surpassed if its reality can never be revisited? The wonder of the hologram itself can take over, seducing the artist to use it experimentally without possibly realising that its capabilities do not fulfil the remit and intent of the artwork. This is perhaps what led Nauman to make screen prints of the original holograms in *Making Faces*, to continue the trajectory and story of the artwork as if to engage it in a two-step process of evolution. Bourgeois' acts somewhat defeat the objective of the original sculptures. On exhibition, the sculptures are already immobile and secure in their situated physicality, and in compounding this inertia, the hologram deals them a further deathly blow. With the right conditions and circumstances, however, the hologram can exist as a vitally engaging contemporary artwork, but there is a need to consider how it performs in its contemporary existence. In contrast to the work of Bourgeois and Nauman, the difference lies within its being drawn into the here and now by a re-configuration of its value beyond the magic of its making. The "oohs" and "ahs" need to be ignored to get to the core of the hologram's possibilities and potential. It can be a part of contemporary practice, but it needs to be treated as a process such as any other and one that is only included in the making of an artwork from the beginning. As a component within an artwork, it can add value: it can aid how the artwork creates and identifies knowledge and the observer's understanding of its intent. Perhaps, science needs to embrace the art, and not vice versa. Then, we might get somewhere in its progression within the language of art.

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Article

Reviewing the Inclusion of Artists' Holograms in the Permanent Collections of Fine Art Museums

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Abstract: Opening in 1976 with the exhibition, “Through the Looking Glass”, the Museum of Holography (MOH) emphasized from the beginning the importance of artistic holography with the inclusion of several holograms by artists whose primary practice was holography, articulating for the first time a distinction between artists, scientists and technicians. While the scientific and engineering principles underlying the technology could educate a public, holograms made by artists provided the visual syntax for the creative possibilities holography could offer. The MOH continued to encourage and support artists’ work throughout its history, amassing a large collection of holograms representative of the most prolific period of artistic activity from the mid 1970s to the mid 1980s. The Massachusetts Institute of Technology Museum (MIT Museum) in Boston acquired the entire archive including artistic and technical holograms as well as all related materials when the MOH closed in 1992. This paper will seek to explore whether the medium of holography within the visual arts has led to fine art museum acquisitions in the intervening decades.

Keywords: holography; hologram; laser transmission hologram; white light reflection hologram; Multiplex hologram; installation

1. Introduction

From the 1960s, gallery exhibitions of holography featured both artists who were dominant forces in the world of artistic holography and established artists whose occasional holographic work for site-specific installations or projects was outsourced to studio production facilities. Concurrently, there were recognized distinctions between galleries and museums that were dedicated to exhibitions of holography such as the MOH and galleries whose artists included holograms in their exhibitions. By the 1980s, a few artists whose primary medium was holography had made the transition into the wider art world and were exhibited in art museums. Recently, there have been donations to fine art museums of holograms by internationally acclaimed artists who experimented with holography as a tool for dimensional image making but whose formal disciplines were in other forms of expression.

In a 2012 Canadian newspaper review in the *Globe and Mail*, culture journalist, Sarah Nicole Prickett, wrote, “[a]nd so do holograms, which already give the appearance of having time-travelled from the past’s idea of today, have less than a century to go? Or will they flicker in and out, trendily, never surpassing kitsch?” (Prickett 2012).

Fifty-five years ago, artists glimpsed the first hologram titled, “Train and Bird,” by American scientist Emmett Leith. Ever since, the imaging possibilities of holography have intrigued artists from various disciplines and practices. The MoH was opened in 1976 to provide a focus to both the science and emerging art of what was then a new visual technology. While holograms were collected by museums outside the dedicated centers for holographic art, holography has not received widespread recognition as an art form. Reading several articles by writer Sean F. Johnston, Professor of Science, Technology and Society, at the University of Glasgow, it appears that a confluence of factors, including the perception that art holography had come late to the “art and technology movement in the 1960s”

formed the accepted rationale about the lack of a formal collections policy for Holographic Art in most museums (Johnston 2009).

The Metropolitan Museum of Art in New York sets out its acquisition policy, in part, in these terms, “[c]urators should propose exceptional works of art for acquisition to the collection that significantly further the Museum’s stated mission. All works should be in, or capable of being returned to, an acceptable state of preservation, unless the deteriorated physical condition is integral to the meaning of the work. The Museum must be able to display, store, and care for the proposed acquisition according to generally accepted museum practices.” From this mission statement, it is possible to conclude that the collection by museums of holographic art mirrors the collection policy criteria for any other artwork.

The Getty Research Institute, as part of the Photography collection of the J. Paul Getty Museum in Los Angeles, announced in March 2019 the acquisition of 105 glass plate holograms by 20 artists produced in the 1990s. The donation of 89 laser viewable masters and 16 white light reflection holograms was conceived in collaboration with C-project, a holography studio then operating in New York. In describing the acquisition, Senior Curator of Photography at the J. Paul Getty Museum, Jim Ganz said, “[w]e are pleased to add these visually compelling and artistically significant holograms of the late 20th century to our photograph collection, which has such great depth in 19th-century stereography, including examples by Carleton Watkins, Eadweard Muybridge, Mathew Brady, Roger Fenton, Francis Frith, and Adolphe Braun . . . ” (Ganz 2019). thereby viewing holograms as an extension of 19th century stereograms within the larger domain of photography.

While the properties of holograms are radically different from photographic stereograms, these hologram acquisitions must fit within the context of a museum’s existing collection and provide meaning to the donated artworks within a medium that often slips through the cracks of art and science. Donations and bequests often provide a crucial boost to a collection. Most fine art museums are non-profit organisations with tight operating budgets that depend on government grants, admissions revenue, investment and donations. Few museums have budgets that would allow for the outright purchase of art. Reviewing the Getty donation, all of the artists’ works included fit the demanding criteria of a museum donation; importantly it’s provenance including the artwork or artist’s exhibition history, any critical writing and previous ownership.

2. Background

From the 1960s, holography attracted practitioners from all areas of art and science. The galleries and museums that opened in the 1970s specializing in holography were very popular. To explain the emerging art form, technical explanations were offered addressing the illusion of dimensionality and corresponding parallax, that wide horizontal angle of view that set it apart from two-dimensional imagery. Holography was often compared to other media. The pioneering holography artist, Margaret Benyon, quoted Ian Lancaster in her 1994 PhD thesis, *How Is Holography Art?* “There is still considerable ignorance in the art area about holography, and about what it can and can not do. Judgments and expectations learned from more familiar media are often applied to holography, with damaging results. Many people are not receptive perceptually, emotionally or intellectually to the achievements of holographic artists, because they fail to understand that holography is a medium in its own right, with its own unique characteristics” (Benyon 1994).

The tantalizing promise of being able to create unique dimensional works where the figure or object could be seen in its original physical manifestation was key to the engagement of many artists experimenting with the potential of holography. From the beginning there were established distinctions between artists whose primary medium was holography and had transitioned into the wider art world and recognized artists who chose to experiment with holography but whose formal disciplines and studio practice were in other forms of expression. These artists came to holography to render their existing ideas dimensionally as other media, key to their developing practice, could not provide this opportunity. These distinctions were further refined to encompass the question of whether artists

making holographic art and light related installations were creating works in their own studios or out sourcing production. Ironically, the artists whose works have recently been acquired by fine art museums have for the most part not been artists whose discipline is primarily holography. Despite its promise and with few exceptions, the mainstream galleries were not exhibiting holograms unless those artists were already in their stable and that trend continues today.

3. The Importance of the Non-Holographer

Salvador Dali collaborated with Selwyn Lissack whose company, International Holographic Corp., created several holograms for the artist between 1971–75. Dali said, “[a]ll artists, . . . have been concerned with three dimensional reality since the time of Velasquez, and in modern times, the analytic cubism of Picasso tried again to capture the three dimensions of Velasquez. . . . with the genius of (Dr. Dennis) Gabor, the possibility of a new Renaissance in art has been realized with the use of holography” (Chimera n.d.). These holograms are still in the collection of the Dali Museum in Pubol, Spain.

Lissack understood that to introduce holography to the art world required a name artist. His perception rings true today. The holograms selected for museum exhibitions and entering major collections are 20–40 years old, created by internationally established artists and typically acquired to fill out 20th century collections of photography. With the Getty Museum acquisition, it is a progressive step forward that curators are proposing and fine art museum boards are approving the purchase of artists’ holograms to add to their contemporary holdings. While museums such as the Victoria and Albert Museum in London, England, had been at the forefront of acquiring examples of art holography, most recently with the donation in 2015 of Dr. Paula Dawson’s 2006, hybrid hologram of Dr. John Gage, few international museums have been ready to add holograms to their collections. Putting aside the important questions of archival storage, display and promotion, this lack of inclusion into institutional collections neglects a formative element in the developing history of technological art. There are many artists working in holography today whose practices transcend the obvious tropes of light, colour, and dimensionality.

In the 1990s, American collectors of contemporary art, Guy and Nora Barron, were investors in C-Project, a unique collaboration between the New York holography studio of Matthew Schreiber and twenty noted artists from various creative disciplines including sculptor Louise Bourgeois, painters Chuck Close and Ed Ruscha, and light artist James Turrell. These holograms were originally recorded as laser viewable images. In 2017, several were later transferred to white light viewable reflection holograms, a type of hologram that allows it to be mounted on a wall and lighted from above.

While the Turrell holograms of light recordings have been widely exhibited in galleries and museums, the holograms from C-Project that have generated particular interest are a series of eight images, called “Untitled,” by Louise Bourgeois. Her work is renowned for its personal content involving the unconscious, sexual desire, and the body, often drawing on events from her childhood. Bourgeois transformed these experiences into a visual language using objects such as spirals, spiders, cages, medical tools, and sewn appendages to symbolize the feminine psyche, beauty, and psychological pain (The Art Story Contributors n.d.). This extended to her holograms, which became an extrapolation of her approach to art and philosophical preoccupations rather than intended as original concepts specific to the strengths of the technology. In these holograms, Bourgeois had been working with small dioramas that translated well to the technical demands of holography production.

In 2017 these holograms were shown at the Cheim Read Gallery in New York. Reinforcing negative perceptions, the gallery described the works as a spectacle rather than integral to the artist’s ongoing oeuvre, “Bourgeois’s compositions takes on the cold, sentient glow of an untrustworthy computer in a vintage Sci-fi film.” Gifted from the Easton Foundation to the Museum of Modern Art (MOMA) in New York, holograms from the same series were exhibited in 2019 as part of the exhibition, “New Order: Art and Technology in the 21st Century.” The curators’ intention was to explore the nexus of where art meets technology in the 21st century. “Today, when technology seems utterly smooth and weightless—composed of invisible waves, wireless signals, abstract codes—*New Order* explores the

ways in which these systems are still stubbornly tied to the physical world. Technology, they suggest, is always mired in matter” ([Museum of Modern Art 2019](#)). The marketing of these exhibitions to the public was profoundly different. If holography as an art form is to mature, its artistic integrity has to be paramount and supersede questions about the technology that creates it.

The Barron’s gift of several Louise Bourgeois holograms from C-Project to The Detroit Institute of Art in 2018 and 105 holograms from the same project to the Getty Research Institute in Los Angeles introduce a seminal point of departure for the acquisition of holographic art and installation by other museums. These important donations to American museums are the most significant to date and acknowledge art holography as a legitimate medium of expression while providing fine art museums with name artists that strengthen their contemporary collections.

Other recent donations and acquisitions to art museums include Multiplex holograms by the Italian American choreographer and dancer, Simone Forti, who recognized the potential of this type of hologram where viewers could experience her dance in the round and began to collaborate with Lloyd Cross in the 1970s. Her focus was improvisational dance and her association with the Judson Dance Theater Group revolutionized dance in New York in the 1960s ([Movement Research n.d.](#)). Her “Striding Crawl,” 1977, was acquired by the Whitney Museum of American Art in New York in 2003 while “Harmonics (3),” 1973-78, was collected by the Albright-Knox Art Gallery in Buffalo, New York this past year. This type of hologram, invented in 1973, is called an Integral Stereogram or multiplex hologram. It was an accessible technique where the subject was photographed on a turntable performing a motion. The frames of film were processed as vertical strips of information side by side on a large sheet of film. To reconstruct the dimensional image, the film would be mounted on a transparent cylinder and lit with a light bulb from underneath.

For many years one of the only fine art museums with a commitment to exhibiting and collecting artist’s holograms and installations has been the Butler Institute for American Art in Youngstown, Ohio, and has exhibited and collected holograms by artists whose primary medium is holography. Separately, though not a museum, the Holocenter in New York has for over twenty years provided education, artist-in-residence programs and exhibitions highlighting fine art holography and installation works. The Museum of Modern Art in New York, Victoria and Albert Museum in London, England, the Australia National Gallery in Canberra, Australia, the Montreal Museum of Fine Art in Montreal, Canada are some of the international fine art museums that have collected holography by contemporary artists. In addition, the Hologram Foundation in Paris, France, provides financial assistance to artists and programs for the production of holograms. It is one of the only foundations that continue to underwrite art holography. For artists, conferences and published papers remain the primary platform for the critical examination of Art Holography.

4. Conclusions

The purpose of this paper was to discover whether holography as a medium for artistic expression had in the last few decades found its way into mainstream galleries and fine art museums. Initially, celebrated artists from various media including Salvador Dali, Bruce Nauman, James Turrell, Louise Bourgeois and Michael Snow amongst others were commissioned to collaborate on holographic works in an effort to bring artistic credibility and validation to the emerging technology. Artists who began their practice in collaboration with scientists often went on to create “labs” of their own and developed and extended the visual and physical language of art holography. Today a handful of fine art museum collections are accepting donations of these seminal artworks. Current representations by artists working in holography include gallery installations encompassing the broader parameters of the technology including holographic interferometry, light, video and laser projections. Taken together, while several private collections and museums have acquired holograms by artists in the decades since the MOH closed, the medium has not gained the foothold that would be expected of a visual art that has been in existence for over fifty years.

Physically, the properties of holograms are not especially different from other sensitive material factors found in contemporary media art. The aforementioned considerations of caring for unstable gelatins, aging lasers, the unique requirements of archival storage, specific exhibition and lighting concerns are important contributing factors to a museum's acceptance of a donation but perhaps the greater paradox for museum curators continues to be the line between technological gimmickry and aesthetic value, hence the preference to collect established artists in other media who have made holograms as an extension of their oeuvre.

In time, art world curators will catch up with the existing wealth of holographic art as a specific genre and more than a means of augmenting existing photography collections. In time, the success of an artist's holographic work will not be whether it projects into deep space or shows unusually bright color or animation. The best fine art holograms will transcend their technology and imbue the viewer with a desire to look further in the same way that a sculpture seductively invites the viewer to move around the object to see all sides and experience the volume of the work as a whole. Artists say that creating images that lack material textures but are visible dimensionally as light cannot be compared to other media but that is exactly what is required—holograms and installations that take the medium for granted and stand up to all and any comparison.

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Article

The Dynamic Display of Art Holography

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Abstract: Holograms have been displayed in single-artist and group exhibitions, since the late 1960's. The content within a holographic image can be greatly compromised if the hologram is not displayed correctly. Holography exhibitions can either enhance or diminish the impact of the images depending on how the exhibit layout and lighting are designed. This paper looks at art holography from the exhibition installation perspective and offers methods for assuring dynamic displays.

Keywords: holograms; art holograms; hologram exhibitions; reconstructed holograms

1. Introduction

The history of holography, methods of hologram construction, and the trends in how the field has evolved is beyond the scope of this paper. This information is readily available. In Appendix A, I have listed some good resources for anyone wanting to better understand the medium.

During the time period from the late 1960s through the mid-1980s, there were technical and material challenges to producing holograms that were bright enough for the types of lamps that were available for illumination. Holograms required a white point source of light and at that time, there were few options. As a result, exhibition rooms were generally kept dark for the holograms to appear bright and clear. Over the years, the recording materials improved, formats enlarged, chemical processing improved and MR-16 halogen lights became available. These advances made it possible to move holography out of dark display spaces and into exhibition spaces with ambient light. The visual possibilities and myriad of special effects available to the art holographer that have resulted are also beyond the scope of this paper but are readily available in the literature (Crenshaw 2009).

The focus of the earliest exhibitions and into the 21st century has been to install holograms so that they appear bright, so that there is enough space in front of the holograms for viewing and that the predominately glass artworks are safe. Traditionally, installations were arranged based on the size of the hologram and which of the two main varieties they were, white light viewable Reflection or white light viewable, Transmission holograms.

It is the opinion of this author, as both an artist and curator, that after all these decades, we have not taken a critical look at how we design holography exhibitions. There are few guidelines, no standards, and minimal installation instructions requested for participation in a holography exhibit. This is in part due to a lack of understanding of the full dynamic range of holograms. In this paper, I address some of these fundamentals in this paper and offer suggestions for hopefully mitigating some of these issues.

2. Brief Biography

As critical and practical comments in this paper are based on my experience as a holographic artist and curator, this brief biography is provided to help contextualize those comments. My exploration of the medium began in 1979 when I attended the Fine Art Research & Holographic Center in Chicago, Illinois. This excellent school provided both theory and hands-on experience for people who wanted to understand holography and create their own holographic images.

During the 1980s and into the early 1990s, as Director of The Holographic Studio in Vancouver, BC Canada, I was fortunate to work in this art holography optics studio and I was able to produce a

large body of abstract pseudo-colour holograms. During this time, I also worked in collaboration with Sydney Dinsmore and we produced a series of figurative holograms. I have always created my own art holograms, rather than commissioning them to be produced for me. My artworks are still included in international holography exhibitions. In addition to creating holograms, I have curated, designed and installed holography solo and group exhibitions internationally.

3. Why Is Installation Criteria So Important?

Holograms are virtual sculptures made from light; they are not stereo or 3D photographs illuminated by a lamp. Holograms are rarely installed or understood in the same way traditional sculptures are.

It has been my experience that installations, in general, do not require detailed information from the artists about how to best exhibit a work. This may diminish the impact of the images, by not considering some important fundamental aspects of holograms. This lack of understanding holograms in this way means that people do not fully understand how to engage with the image in the viewers space, and this can compromise the intent and impact of the image.

4. The Illumination of the Hologram

Reconstructing the holographic image as it was intended is dependent, in part, on the characteristics of the illumination lamp, and the angle of incidence of the lamp to the surface of the hologram. The lamp does not merely illuminate the hologram, the light from the lamp transforms to become the image. This aspect of holography is a tool in the kit that artists that can take advantage of if they are aware of their options. Changing the characteristics of the reconstruction light will change the characteristics of the hologram.

4.1. Colour Temperature and the Point-Source, Reconstruction White Light

If colour is important in an image, then the colour temperature of the illumination source is of great importance. Colour temperature is indicated in the lighting industry as a value of Kelvin (K). Colour temperature will, of course, alter the colour of anything that is illuminated, but the hologram is unique because the reconstructed image is actually made from the light from the source, as indicated above.

In general, artists working in holography are still limited to using white, point-source light for holograms, although this is changing due to the availability of LEDs ([Sarakinos and Lembessis 2018](#)). The colour temperature K value and spectral output of white LEDs and incandescent halogen MR-16 white lights can be quite different, and this difference will show up when a hologram is reconstructed. MR-16 lamps, used almost exclusively in the field for decades, have a warm tone and a lower K value of around 2900 K. Some white LEDs can have a K value above 5000 which produces a very cool almost blue white light. Artists and Curators need to be aware of this when they are installing images in various venues. The Kelvin temperature value is available on lamp packages or in the lamps technical data sheet.

Holograms that I created based on the colour playback finalized, under MR-16 lamps were exhibited with LEDs of different colour temperatures and the warm tones in the images were compromised. [Figure 1](#) shows one of my very early abstract holograms as it appears, illuminated with the MR-16 warm tone lamp it was tested and finalized with. [Figure 2](#) is a simulation of how it would look if illuminated with the incorrect cool temperature white LED.



Figure 1. A 9" × 7" pseudo-colour hologram titled *Color Study with Light Blocks* created by the author in 1985. It shows the reconstruction with an MR-16 warm temperature (~2900 K) lamp.



Figure 2. A simulation of how a different lamp can drastically alter the playback colours.

There is so much left up to chance these days, as there are many new lamp configurations with different spectral output curves and K colour temperatures and other properties that are not well understood. The LED offerings in the marketplace continue to expand. It will be important to understand how these changes in the reconstruction lighting can possibly enhance or compromise the intent of the image. Supplying the required colour temperature and lamp properties to best optimize holograms should be included with other installation instructions. It is my experience that this is not the case currently.

4.2. Monochromatic Illumination

Holograms recorded using a specific wavelength colour of laser light, like red¹, for instance, will reconstruct in that same colour, unless some colour control techniques are utilized during the recording process (Saxby and Zacharovas 2004). If the artist desires the hologram image to be monochrome, then the clearest and brightest images are reconstructed using the same laser wavelength

¹ Red laser light is light in the wavelength range of ~600–700 nm.

light as used in the recording. Lasers are not installation-friendly, but colour lamps are, and LEDs can mimic the properties of laser light if they produce a narrow bandwidth of light.

An example of monochromatic lighting being used to enhance holograms, or that appear to have been utilized for this purpose, is in the installation of the Louise Bourgeois holograms in the *New Order* exhibition at the Museum of Modern Art (MOMA) in New York, which I had a chance to see in the spring of 2019. The Bourgeois holograms (Figure 3) were exceptionally clear, bright and with good depth resolution and they were illuminated with a red light which was further controlled by using a focusing projector system.



Figure 3. Louise Bourgeois, one of *Series of Eight Holograms*, 1998–2015 (photo taken by the author).

The Bourgeois holograms technically could have been illuminated with a white point source of light but an informed decision was made to use a monochrome source for depth and clarity necessary to reconstruct the many visual elements in the images and to suggest a reference² back to the red laser used to create the holograms. If these holograms are displayed in other venues without the same monochrome lamps, the quality and content of the images will be compromised.

5. The Angle of View

Holograms have a predetermined horizontal parallax which is the angle of view (AOV) of the image. Not all holograms have a vertical parallax, but most do have a horizontal parallax. The AOV will depend on how the hologram was made. Some variables that support the criteria are

- the ratio of the size of the master hologram to the copy hologram
- the number of masters and their placement in relationship to the copy hologram
- the properties of the recorded object if it is a direct recording and so on.

The AOV is a technical limitation that an artist can use effectively if aware of how to control it to best reveal the content of an image. Unfortunately, the angle of view (AOV) is not well understood and is generally not requested as an installation specification when holograms are exhibited. To date, I have never been asked to supply the AOV.

² <https://www.heimread.com/videos/louise-bourgeois-holograms>.

5.1. Determining the AOV

The AOV can be defined in a general way by placing a protractor at the face of the illuminated image and then moving through the reconstructed images viewing (playback) area, as shown in Figure 4. This simple technique can be done for any hologram and the AOV is indicated in degrees and can then be included in display instructions. The hologram shown below has a wide $\sim 120^\circ$ AOV, which is, in part, a result of the type of hologram it is, a direct recorded single beam hologram and how the content of the image was designed.

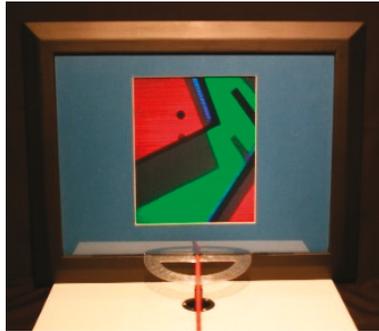


Figure 4. *Colour Study with Light Blocks* hologram and protractor with string.

A series of figurative holograms was created in collaboration with artist Sydney Dinsmore³ in the 1980s. The limited AOV is obvious in the following hologram from the series *Is This What You Want?*⁴, as shown below in Figure 5. This hologram was photographed at an equidistance from the center of the image out to each side. This hologram has an AOV of $\sim 40^\circ$ AOV. The narrow AOV was based on the technical limitation of the master and the copy or transfer hologram being the same size.

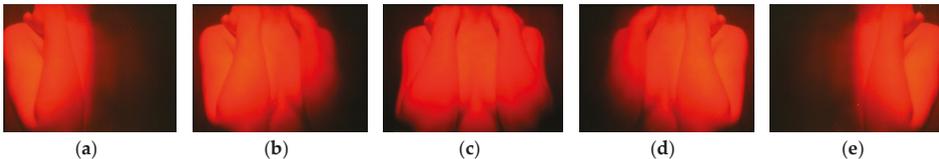


Figure 5. (a) 20° to left of center, (b) 10° to left of center, (c) center, (d) 10° to right of center, (e) 20° to right of center.

5.2. The AOV of “Levels with Light Blocks” and its Importance in the Exhibition Space

The hologram produced by the author is shown below. *Levels with Light Blocks* (1985) in Figure 6 shows how the AOV impacts and reveals image details when the viewer moves through the AOV. In this reflection hologram, the viewer’s movement through the several deep levels of light opening and closing in the image throughout the AOV is critical to the image created. The display environment should not diminish this changing imagery by cutting off the AOV due to the limitations of or incorrect placement in the display space.

³ <https://www.sydneydinsmore.com/>.

⁴ This 30 cm \times 40 cm pseudo-color reflection hologram as created in collaboration with Sydney Dinsmore. From the series *Is this what you want?*, 1988, 12” \times 16”.

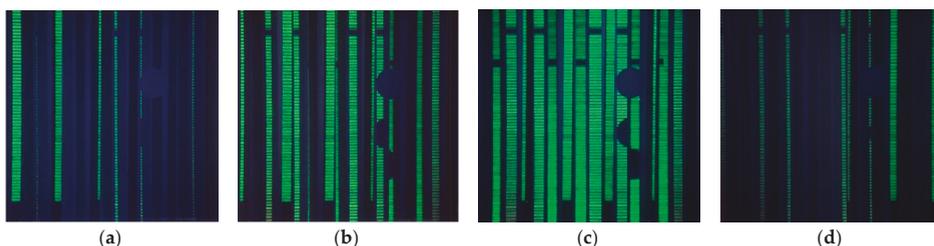


Figure 6. (a) Far left view of hologram, (b) left of center view of hologram (c) center view of hologram (d) far right view of hologram.

5.3. The AOV of “Is This What You Want?” and Its Importance in the Exhibition Space

The collaborative project with Sydney Dinsmore titled *Is This What You Want?* is shown in Figure 7. The figures with their protective gestures are designed to be viewed as a set, not as individual holograms in isolation from the larger group of art works. Sydney and I both have backgrounds in curating and designing exhibitions. Building on this experience, we designed an installation that enhanced the content of the series. This approach assisted the viewers to clearly see the images, achieved through experiencing the collective angle of view and provided subtle clues as to how to move within the entire series. Hanging the images separately on the wall without taking this into consideration would have diminished the essence of the series and what the work was about.



Figure 7. Pseudo colour reflection holograms, 30 cm × 40 cm, from the series *Is This What You Want?*

Figure 8 is an image of a suspended hologram in front of a 5' × 3' photographic banner. We photographed the laser images in the master holograms and had them printed on banners. Figure 9 indicates how we defined the viewer space using the photographic banners. The banners identified the contained space and the holograms were placed in such a way that the angle of view of each hologram overlapped with the angle of view of each adjacent hologram. This placement of opening and closing of the image view assists the viewers to move through the series as the content unfolds and then diminishes, unfolds and so on. Figure 10 shows one of the banners suspended at the entrance to one of our exhibitions.



Figure 8. Suspended hologram in front of a banner created by Crenshaw & Dinsmore.



Figure 9. The defined space.



Figure 10. Photographic banner by Crenshaw & Dinsmore at the entrance to one of our exhibitions.

5.4. A Note on Vertical Parallax

Certain types of holograms do not have vertical parallax. This is a technical constraint that is inherent in the creation of white light transmission, so-called Rainbow holograms. Most holograms do have vertical parallax which can be considered the upper and lower AOV of the image. There is little flexibility in exhibits with regards to the vertical AOV as images are set at standard viewing heights based on the type of venue they are displayed in. Most venues set the center of art holograms at 60" (152 cm). For this reason, this aspect is not given the same consideration as the horizontal parallax AOV, which gives the depth clues required for true 3D imagery.

6. The Exhibition Layout

Some art works are designed to stand alone and are not part of a series that requires reference to other images in an exhibit. Even so, it would be beneficial to request information on an image AOV so that holograms can be placed in a sequence that enhances rather than confuses or distracts. Understanding such properties and mapping this out as an installation instruction would assure a more dynamic display in general, no dead zones where images are not visible, and would subtly guide the viewers throughout the entire image field of the exhibited artworks.

An example is shown in Figure 11 of the partial installation placement of holograms in the *Déjà vu* group exhibit in Vancouver BC, 2010. This exhibition space was adequate but limited and had to be shared with another artist and two other displays. Designing the layout based on the AOV of the images created a dynamic display with limited visual dead zones.



Figure 11. These pseudo-color reflection holograms were created in collaboration with Sydney Dinsmore. *Rumours* 1992 multi-channel panel (14" × 48") is on the left and the figure from the series *Is This What You Want*, 1988, 12" × 16" is on the right.

The *Rumours* panel is made up of five multiple exposure (aka multi-channel) holograms. The panel reveals many images as the viewer moves back and forth throughout the AOV. This hologram requires enough space to allow viewers to move around in order to view the full impact of the imagery. In order to playback the image on the right, which had to be placed in a corner, the hologram was tilted out from the wall on one side which swung the AOV back into the viewer space by slightly changing the angle of the hologram to the illumination lamp. The shadows under the holograms reveal how the lighting is manipulated.

7. Proposed Installation Specifications for Holograms for Any Display Space

In review of the information presented and, on the criteria, affecting the hologram display, Table 1 shows a proposed installation guide that could accompany any art holograms. The first four items are currently requested, the next three are recommended. As an example, the sections were filled in as it

would be for the vintage image shown in Figure 1. Figure 12 is a suggested installation diagram of the AOV that should be included as well.

Table 1. Hologram Installation Guidelines.

Title, Artist, Date of Artwork	Technical Classification	Format and Dimensions	Lamp Playback Incident Angle	Lamp Colour Temperature	Preferred Centre Viewing Height	Horizontal Angle of View (AOV)	Other Information
<i>Colour Study with Light Blocks</i> M. M. Crenshaw 1985	Pseudo-colour reflection hologram	Glass, framed, 9" × 7"	45°	2500–3000 K MR-16 type incandescent halogen, or similar LED	60"	120°	Wall mounted

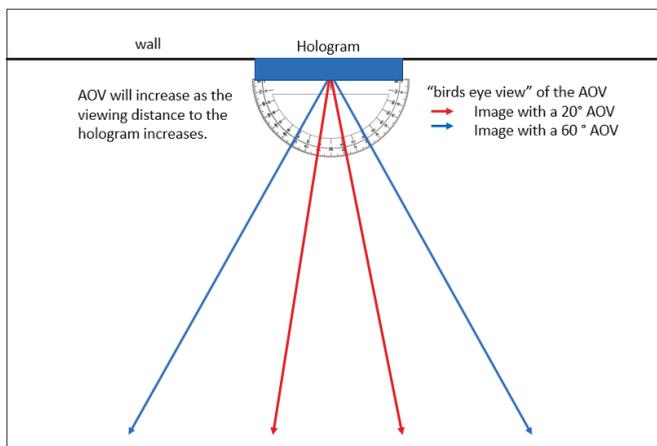


Figure 12. Birds eye view diagram of the angle of view of a hologram with a 20° AOV, and one with a 60° AOV.

8. Conclusions

The quality of Art holography installations has been limited, in part, by a lack of knowledge of the technical criteria to support effective viewing. We have at least moved on from dark rooms and poor reconstruction lighting to more favorable environments, but the full dynamic range of images is still not fully understood and/or acknowledged. There are some large collections out in the world such as the *Global Images*⁵ collection, which, sadly, is in storage and the *C-Project*⁶ collection, which is in the safe hands of the Getty Museum in the USA. These hologram collections are being saved, but unless specific information on playback illumination and the viewing requirements for the many images is available and understood, it is possible when these are displayed in the future their impact will be diminished and the experience of viewing these art works will be undervalued. Hopefully, the discussion I have presented in this paper will assist artists in creating holograms and designing exhibitions and will advance a dialog to remedy this by establishing more precise exhibition and display guidelines. In the meantime, we may only be seeing part of what is really there.

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⁵ <https://www.globalimages-hologramartcollection.com/melissa-crenshaw>.

⁶ <http://news.getty.edu/getty-museum-announces-donation-105-holograms-created-by-20-noted-artists.htm>.

Conflicts of Interest: The author declares no conflict of interest.

Appendix A

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Article

The Gallery as a Location for Research-Informed Practice and Critical Reflection

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Abstract: Creative holography could still be considered a fringe medium or methodology, compared to mainstream art activities. Unsurprisingly, work using this technology continues to be shown together with other holographic works. This paper examines the merits of exhibiting such works alongside other media. It also explores how this can contribute to the development of a personal critical framework and a broader analytical discourse about creative holography. The perceived limitations of showing holograms in a “gallery ghetto” are explored using early critical art reviews about these group exhibitions. An international exhibition, which toured the United Kingdom (UK) and Australia, is used as a framework to expand the discussion. These exhibitions include examples of the author’s holographic work and those of artists working with other (non-holographic) media and approaches. The touring exhibition as a transient, research-informed process is investigated, as is its impact on the critical development of work using holography as a valid medium, approach, and methodology in the creative arts.

Keywords: holography; hologram; drawing in space; cross-media; criticality; critical frameworks; projection; installation; sculpture; ephemeral

1. Introduction

It is not unusual for works produced in similar media, or those which investigate similar processes, to be visually and critically grouped. It was, for decades, an essential curatorial backbone for exhibitions. This can encompass broad areas of investigation, such as painting, sculpture, video, print, or performance, and provides a loose, comparative grouping for audience consideration.

Within those primary media areas, there are extensive practical, theoretical, critical, and cultural subsections, which then become more engaging as they start to highlight, or juxtapose, works which activate discussion or respond to a curatorial “thesis”. From this develops the construct of the gallery as a “laboratory” or research “workshop” (Hou et al. 2013), which can be most recently seen in the range of activities at the Research Pavilion organized by UniArts (University of Helsinki) alongside the Venice Biennale in 2019 (Research Pavilion 2019).

2. Safety in Numbers

Unsurprisingly, works with holography were grouped since the mid-1960s (Leith and Upatnieks 1965), when this technology developed sufficiently to allow public displays. The “blockbuster” exhibitions of the 1970s and 1980s testified to the enthusiasm of the public for these wondrous, and often “magical”, gatherings (Johnston 2016). They also attracted ridicule, and sometimes venomous comments, from art critics who, quite rightly, questioned where the critical or creative content was. They were concerned about the lack of any aesthetics beyond the spectacular, high-fidelity, display of seemingly three-dimensional objects. When the group exhibition “Holography ’75: The First Decade” was held at the relatively new International Center of Photography (ICP), New York, it was met with harsh criticism

from art critic Hilton Kramer in a review for the New York Times. His review became significant for artists working with holography, as well as for critical observers (Kramer 1975).

For the group of artists taking part in the exhibition and the curators who organized it, it was a significant attack, particularly as this was an early occasion when a curated group exhibition took place in a legitimate cultural venue. Other exhibitions of holography, showing work by individual artists, took place previously, in notable art venues, but this was an early attempt at surveying the field by gathering together a wide range of work and makers. The technical, commercial, and scientific examples included in the exhibition were compared to early pieces made by artists and triggered some of the criticism from Kramer.

Kramer commented that the exhibition “... dramatically underscores the center’s refusal to confront the difficult aesthetic problems that a museum specializing in photography is now obliged to deal with. An aesthetic void is always vulnerable to the romance of technology, and this is all that the present exhibition offers” (Kramer 1975).

While these comments ostensibly expressed Kramer’s concern for the stance of the venue and its approach to separating photography from other cultural genres, they also allowed him to refer to a colleague’s previous scathing review as a way of confirming his opinion that little changed. “... ‘Holography ‘75’ is being offered to us as nothing less than ‘an event of historic importance’. It even claims to be the ‘first’ show of its kind—which is unkind to the ‘N Dimensional Show’ of holography that the Finch College Museum of Art mounted several years ago. Reviewing that exhibition, my colleague Grace Glueck wrote that it had ‘all the aesthetic kick of a postcard from Montauk’, and ‘Holography ‘75’ certainly marks no discernible esthetic advance.” Kramer carefully selected one of the negative statements from Glueck’s review; however, she did attempt to offer an insight into the approach taken by the artists included in the exhibition—it was not all acerbic rhetoric (Glueck 1970).

3. Curator’s Response

Rosemary (Posy) Jackson, who curated the ICP exhibition with Jody Burns, commented that “Hilton Kramer was simply doing what was expected of him as the establishment figure in art criticism and that, by damning holography, as he did, he was utterly in line, historically, with what the critics in Paris were saying about the first photography exhibition” (Jackson 2019).

As Jackson points out, however, Kramer’s criticisms were based on misguided expectations. “... The unfortunate issue was that neither Jody, nor I, nor Cornell (Cornell Capa, Director of the ICP) ever said Holography ‘75 was an art exhibition. It was simply referred to as ‘a new medium’. But Hilton Kramer took it upon himself to critique the works on display as if we felt they were all fine art. That was his mistake, not ours. But his disparaging comments hung around what was soon to be some really good art holography for far too long” (Jackson 2019).

Jackson concludes by saying, “Those who needed someone else to tell them what they were seeing have always been too insecure to make their own minds up. So, a lot of really good work gets passed by and that is a grievous shame. [...] A lot of what Mr. Kramer said was dead on right. Fortunately for holography, and for the brave artists who took it on, his opinion did not make much difference (to them). Unfortunately, it did mark holography for way too long as a wannabe, pariah, kitschy tool. But, in reality, that is more the fault of how the art buyers kowtow to the critics than whether Mr. Kramer’s comments were valid or true or important. The real situation is that holography as an art medium was then, and maybe still is, light years ahead of everybody in the visual arts” (Jackson 2019).

4. The “Aesthetic Naiveté”

So how could the curators and organizers have got it so wrong for Kramer? These large group shows were surveys of the “state” of the process, technology, and medium and, as such, may not, at the time, have captured an identifiable creative development which went beyond the technological progress. Either that or the emerging engagement and investigation by artists was diluted due to the bombastic demonstrations of advanced technology by the scientific, technical, and commercial

examples. For the public, the story was very different. In a definite age of technological advance and associated hope for a better future, they were willing to wait in line to see the spectacle—one which was not presented with such mystery, probably since Brunelleschi demonstrated perspective or Giotto unveiled his work in the Arena (Scrovegni) Chapel.

Kramer twisted the knife further: “The aesthetic naiveté of this show must really be seen to be believed. No mere description could begin to do it justice. Images of a stupefying innocuousness, ranging from peep-show porn and low-grade beer commercials to the even more ludicrous parodies of so-called ‘serious’ art, are unrelieved by the slightest trace of aesthetic intelligence” (Kramer 1975). Perhaps the show made itself vulnerable to such an attack due to the wide range of examples, which included commercial work and pieces by artists beginning to adopt the process, as it became problematic to differentiate between them. “It is difficult to know which is the more repugnant: the abysmal level of taste or the awful air of solemnity that supports it” (Kramer 1975). What works in commerce is not always a critical accelerant for explorations by artists. Kramer continues, “There are, to be sure, a few ‘artistic’ attempts here at abstraction and pop art and the familiar neo-dada repertory, but these are even more laughable than the outright examples of kitsch. Much of the work in this show has, I gather, been produced not by ‘artists’ but by physicists professionally involved in holographic technology. The physicists appear to favor objects out of the local gift shop, whereas the ‘artists’ do their shopping in provincial art galleries . . . ” (Kramer 1975).

When this exhibition took place, a curated painting exhibition, for example, would have been unlikely to include works by artists shown alongside industrial and chemical examples of what the pigment could achieve. Paint as a creative medium has an established pedigree, an accessible critical history. Holography was (and continues to be) such an unusual visual process that it seemed justifiable, in a survey show, to include examples of that uncommon view, manifest through research, commerce, and art. Currently, as the gallery spaces become a manifestation of the research studio and comfortably act as a reactive and generative venue, such a curatorial stance would be accepted and, in many cases, applauded. Too much, too early, perhaps?

5. Out of the Gallery Ghetto

As part of the critical investigation and development of my practice as an artist, I participated in institutional research critiques where my work with holography and the work of my colleagues (in a variety of media) were placed under critical pressure and analysis. These activities take place as part of the fine art course on which I teach. We move out of the institution, physically away from the demands of the courses we teach, to mirror the activities of our students and place our work under open, collegial pressure. In one of these sessions, I presented details of my work, which was on show in Korea, as part of a group exhibition curated by Professor Juyong Lee, which included selected holograms by 13 international artists. I was advised not to show work in holography exhibitions, but to investigate opportunities to exhibit alongside artists working in other media, so that my activities could be evaluated beyond the narrow focus of holography. That advice and its critical context were valid. Works in a specific medium should not support themselves (or dodge critical examination) by subtle isolation or through a process of “safety in numbers”. This aspect of the gallery ghetto (Pepper 1994) is an issue I am curious about, almost since my first engagement with the holographic process.

Early works by artists using new processes, methodologies, or technologies can be critically reviewed and assessed by bringing together examples using the same medium. A survey exhibition of the use of digital imaging, or early analog video, for example, is quite acceptable. The difference here is that a historical and critical framework exists, which can be used for evaluation. Currently, holography appears to lack that framework. There were comparatively few attempts to provide considered critical observations.

Aside from the blockbuster survey holography shows, holographic works are included alongside other media, away from the gallery ghetto, and framed within the critical sensitivities of municipal, state, and commercial galleries. The exhibiting artists can be divided into two distinct groups:

1. Artists engaging primarily with holography, who developed a visual, critical, and practical vocabulary over several years. In this case, holography would be considered their practice.
2. Artists significantly established in other media, who experimented with the holographic process, often supported by technicians, manufacturers, or scientific labs.

The former are more likely to exhibit alongside other artists using holography, which can be seen as a positive process of peer analysis or comparative critical scrutiny. Occasionally, examples of their work are shown in exhibitions with a curatorial stance, alongside similar ideas or approaches which use a variety of non-holographic media or techniques.

The latter present their holographic works as a part of group or solo exhibitions. These are generally selected because of a specific investigation or approach, which connects with other works on display. Examples include Bruce Nauman, who experimented with holography alongside print, neon, paint, video, and audio; Chuck Close, best known for his large-scale painted portraits, who experimented with holography to produce five holographic portraits; and James Turrell, whose work with light led to the use of holography as a way of testing his visual vocabulary. Each of these established artists connects to an extensive critical framework about their work, which can be referenced. It is, therefore, possible to examine why they experimented with holography and how this contributed to their practice. Their works are investigations, made prominent by holography, not, as in the most negative connotations, holograms which mainly demonstrate the visual impact of the medium. It is these "holograms for hologram's sake" which attracted the irritation of Kramer and Glueck.

6. The Exhibition as a Space for Critical Reflection

I, like many of my colleagues working mostly with holography, exhibited in gallery ghettos and un-curated exhibitions which included only holograms. They offer a location for peer comparison and a space to contextualize our activities within a professional field. In this instance, they are useful as a learning opportunity and platform for self-reflection. Work I admire from engaged artists, who use holography as an integral element in their practice, provides an opportunity for discussions around approaches, intention, and staging. They are invariably not a location for critical discussion, being mainly self-referential and self-congratulatory. It is for this reason that I completely understand the advice from my fine art teaching colleagues referred to in Section 5.

A group exhibition, *Art in Holography: Light, Space, and Time* (Bjelkhagen and Pombo 2018) at the Aveiro City Museum, Portugal, as part of the 11th International Symposium on Display Holography, separated itself from previous exhibitions by establishing a clear demarcation between scientific examples and works by artists. Previously, as is the case in many international, subject-specific conferences in general and holography in particular, work from delegates would be exhibited together in a "bring and show" format with little consideration for staging, grouping, curatorial stance, or contextualization. Whatever arrived with the delegates was put on show. This type of exhibition has its place in a meeting of experts, by offering an opportunity to contrast, compare, and swap technical or procedural information. However, such a model would be difficult to justify in an international art conference. There would inevitably be a curated exhibition or pre-announced platform for research and exchange.

The significant difference of the Aveiro exhibition was that it took place in a respected cultural museum which implied a credibility not typically associated with a conference "trade show". It is implied, rather than real, because the work appears in a venue with a cultural and curatorial pedigree and has a subtle influence on a viewer's perception of what is shown there. This does not undermine the value of alternative or fringe exhibition spaces, or the questions surrounding institutional perceptions of art and culture.

The Aveiro exhibition also followed a familiar exhibition framework, with a printed catalog, contextualizing the work on show through the activities and achievements of the 25 artists included. It had an extended viewing period (unlike trade shows which tend to finish when their conferences

finish), and it was open, free of charge, to the public. One aspect of specialized conferences and subject-specific exhibitions connected to them is that they are only accessible to the expert audience attending the conference. Experts are talking to experts—a closed-loop lacking in external provocation.

7. Silence Is Golden

One positive aspect of the Aveiro museum exhibition was that active critical discussion did take place. This is not unusual in institutional exhibitions, where public discussions are actively organized and promoted. However, it is unusual in exhibitions containing mainly holograms. During a research activity organized by artist Pearl John (one of the Aveiro exhibition organizers), she invited other exhibiting artists to critically interrogate her work in *Holography: Light, Space, and Time*. Organized as part of her doctoral research, it used a robust pedagogic approach tested in contemporary fine art degree teaching—the “show and listen” seminar (or silent student critique) (Elkin 2012), in which the presenting artist (student) is not allowed to explain or discuss their work, but is asked to remain silent and listen to the discussions of a critical audience. This was the first time I encountered the use of this critical feedback assessment technique applied to holography in a public exhibition. John obtained a significant amount of relevant and critical feedback, which contributed to her PhD thesis (John 2018).

As part of an undergraduate and postgraduate fine art teaching team, I used this technique for several years to enhance the teaching and development of critical engagement within contemporary art. It facilitates the early development of a critical voice.

If work on show needs to be explained, then it is probably not functioning in the manner the artist hoped. The separation between “intention” and “interpretation” is too wide. If the meaning, context, or background of a work is introduced before a discussion, it limits the interpretation, as viewers will be unable to provide subjective analysis or feedback about the difference between what they see and what they are “told” to see.

An additional technique, often used in our fine art group seminars, is to restrict the discussion from the viewing audience to a series of observational questions. This is particularly valuable in early-stage critical discussion, where a student may be uncomfortable about using a critical voice, or unfamiliar with critical vocabulary.

Questions might include the following, among others:

“I am confused because the image I am looking at is not visible when I move over here. Is this intentional?”

“Was that the intention of the artist or a limit of the medium being used?”

“Am I expected to understand the relationship between the part of the image in front of the work and the ones behind it?”

“Does this really need to be a hologram—could it have worked just as well as a sculpture?”

“Why is the frame so reflective—was it the intention of the artist to distract me from looking at the image?”

Even the most basic or spontaneous observations framed in this manner open up a wide range of significant critical enquiries, which can be evaluated and considered by the artist/maker.

8. Alternative Documents

Holography deals extensively (consciously and by implication) with the ephemeral image, the “not quite there”, the “transient and momentary event”, and the “peripheral view” (Pepper 2018). Acknowledging these significant attributes, work using holography was included in an international exhibition staged in conjunction with the Alternative Document conference, of the same name, held at the University of Lincoln, United Kingdom (UK), in 2016 (Figure 1). The conference call for participation

solicited work which engaged with a wide range of media and approaches, including fine art, live art, performance theory, translation studies, art history, theatre studies, cultural studies, curation, conservation, architecture, and archival studies. If holography was included, it would be because of its engagement with the conference and exhibition curatorial view and not because it was “quite clever” at recording the world around us. There was a declared interest in aspects of the “fleeting event”. In the call for participation, curator, artist, and academic Dr. Angela Bartram wrote, “Beyond most ephemeral artwork, a memory remains in the mind of the observer, and this forms part of the legacy of the fleeting event. However, memory is mostly a personal experience, that shifts, mutates, and fades over time to become distant, different to its origin, and in this way its archival potential is unreliable. To overcome this dilemma, a variety of lens-based archival methods have become the tradition of recording the ‘actual’ event in as far as it is possible” (Bartram 2016).

Holography is often cited as an archival process, with the ability to record and replay incredibly high-fidelity records of three-dimensional objects (Schinella 1973). Therefore, its inclusion as part of this conference and exhibition appears appropriate. What is unusual here is for holography to be treated as an aspect of an artist’s practice and critical investigation, rather than as a spectacular or optical recording oddity.



Figure 1. Announcement for the Alternative Document conference and exhibition, Lincoln Performing Arts Center, University of Lincoln, Lincoln, United Kingdom (UK), 2015. Image used by permission of the symposium organizer.

Following the conference and exhibition in 2016, a series of subsequent exhibitions took place, entitled *Documents Alternatives* (2016–2018). These toured three further arts venues: Airspace Gallery, Stoke-on-Trent, UK; Verge Gallery, University of Sydney, New South Wales (NSW), Australia; and BSAD Gallery, Bath School of Art and Design, Bath, UK.

The result was a transient series of critical observations, manifest differently at each location. Work and artists changed, yet the curatorial stance of the exhibition remained stable. Bartram engineered a framework which encouraged the development of work within and between venues. It valued and stimulated reflective analysis of the work at each gallery and referred back to the original call for participation: “... Recordings are mediated and translated for posterity through the direction of the person holding the device and document their viewpoint and subjective encounter with the work. This creates an archival document open to subjective discussion, as a memorial and work in its own right, and of which alternatives are often sought” (Bartram 2016). Here the “archival document” developed and shifted in response to each exhibition space and the newly developed works around it.

It became responsive within the touring exhibition framework. Again, this is unusual for the medium of holography, which so often presents brief moments of development unrelated to other works around it. This lack of critical “response” may well have been a contributing factor to the less than favorable opinions of critics Kramer and Glueck, referenced in Section 2.

9. Testing in and between the Gallery

My contributions to the *Documents Alternatives* series benefitted significantly from the critical framework in which they were shown, the pressure placed upon each work through the surrounding discussions, which underpinned the associated conference, and the approaches of other artists selected to take part, including Bartram O’Neill, Tim Etchells, David Brazier and Kelda Free, Hector Canonge, Rachel Cherry, Luce Choules, Emma Cocker and Clare Thornton, Kate Corder, Chris Green and Kathryn Owen, Louise K Wilson, Jordan McKenzie, and Rochelle Haley.

The results over three years were four progressive manifestations and approaches to the same enquiry. In my case, these included an initial sculptural installation (Figures 2–4), an edited version, which responded to the volume of the surrounding exhibition space (Figures 5 and 6), photographic representations of the holographic elements within the work (Figures 7 and 8), and illuminated “relics” of the initial installation (Figures 9 and 10). The fifth, and possibly final, manifestation, to be presented in the autumn of 2019, will be an entirely digital, online work. There will be no visible hologram, no artefacts, and no physical debris, only the transient memory and the historical archive of past presentations.

The current four variants of the work outline a prolonged investigation and are “judged” alongside those of the other participating artists at each venue. This extended and intensive “gallery as research” opportunity allows a physical, theoretical, and critical development through adjustments, remaking, and restaging. Within this framework, it is possible to demonstrate the use of holography as an integral contribution to an artist’s developing practice, rather than an unusual manifestation included in an exhibition for visual appeal, unconnected to a curatorial proposition.

10. Progressive Development

What follows are illustrations of each of the four progressive works which make up the *Documents Alternatives* series to date and take the form of reflective, momentary conclusions—a visual and critical “litmus test”, prompted by the exhibition framework which surrounded them.

Work 1: The Alternative Document, Project Space Plus, Three Nine—2016

Three gallery-quality plinths stand parallel to the display wall and support three Kodak Carousel 35-mm slide projectors. Each contains a single slide of a rectangle of light bisected by a thin horizontal line. These images are projected across the short distance between the plinths and the wall. Each of the horizontal lines touch, producing a much larger “horizon” made up of the projected image from three distinct parts of the gallery. This is not a single line but appears to be so.

The center projection is occupied by a digital reflection hologram on the gallery wall, made up of three parallel planes of light, each with a rectangle “cut” out of the center. These planes appear to be “stacked” in front of each other, allowing the viewer to look through the “holes” in each, to the plane located behind. One plane is located behind the holographic plate, the second appears on the plate (the traditional picture plane), and the third appears in front of the hologram between the viewer and the holographic plate. They conform to a model of holographic space outlined in 1989 (Pepper 1989).



Figure 2. *The Alternative Document* exhibition, Project Space Plus, University of Lincoln, UK. *Three Nine*—2016 (columns at the rear of the gallery). Installation including digital reflection hologram and three gallery plinths supporting Kodak Carousel 35-mm projectors. Created by author.

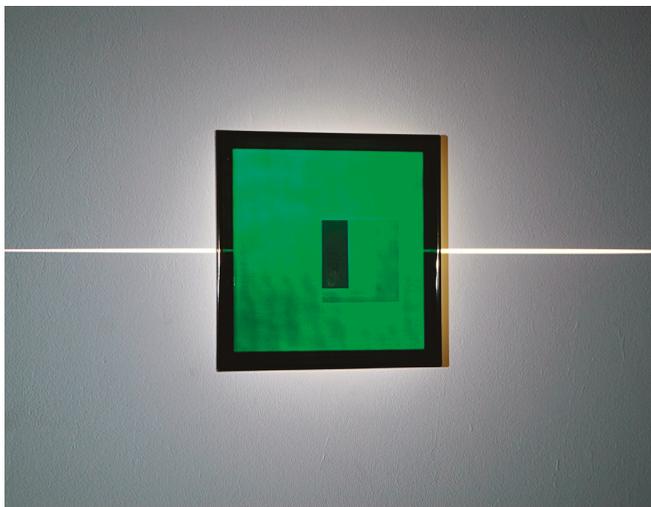


Figure 3. Detail: testing of digital hologram illuminated by one of the three 35-mm slide projectors. Part of an investigation undertaken at Nottingham Trent University’s Fine Art Summer Lodge. Created by author.

Produced to be illuminated, with light shining directly onto the hologram, this differs from other types of holographic display that require light shining from above and at an angle of 45–60 degrees (a more “traditional” orientation). This illumination layout allows viewers to intercept the projected light and “get in the way” of the illumination, which then restricts the display of the image.

The act of viewing prohibits the view. The “document” becomes unreadable when there is an attempt to “read” it.

Gallery visitors are free to engage with the installation from behind, giving a view of all three projections (and the central planes displayed in the hologram), as well as walking between the plinths

and the gallery wall, where they naturally intercept light from the projectors and “animate” or “distort” the wall-based display.



Figure 4. Testing of the interference caused when viewing the hologram and the act of interrupting the projected light used to reconstruct the holographic image. Part of an investigation undertaken at Nottingham Trent University’s Fine Art Summer Lodge. Created by author.

Work 2: Documents Alternatives #1, Airspace Gallery, Three-Nine—2017



Figure 5. Installation of digital reflection hologram and single 35-mm slide projector adapting to the vertical orientation of the Airspace gallery wall. Created by author.



Figure 6. Detail: The bottom edge of the digital reflection hologram and its intersection with the projected “drawn” line from the 35-mm slide projector.

A variant of the original installation (Figure 1), this iteration compresses the configuration to one of the three original projections.

Here, a single 35-mm slide projector illuminates a holographic, wall-based, series of rectangular spaces. Each element in the installation could be considered an object: the plinth supporting its projector, the slide in the projector, the projector itself, and the implied (holographic) spaces visible on, behind, and in front of the gallery wall.

We continually make visual, spatial, and critical assumptions about the objects and materials which populate our surroundings—our documents, our documentation. By attempting to examine the hologram, through closer “looking”, its wall-based visual information dislocates from its presentation. You, as the observer, block the reconstruction of the holographic spaces. You stop yourself from “seeing” and become the “seen”.

Work 3: Documents Alternatives #2, Verge Gallery, Three-Nine 35 mm—2018

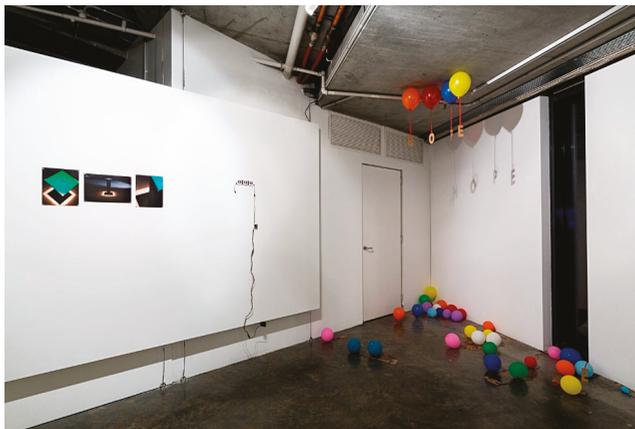


Figure 7. Gallery installation view of *Three-Nine 35 mm* alongside Tim Etchells, *Red Sky at Night*. Image credit: Document Photography and Verge Gallery. Used by permission.

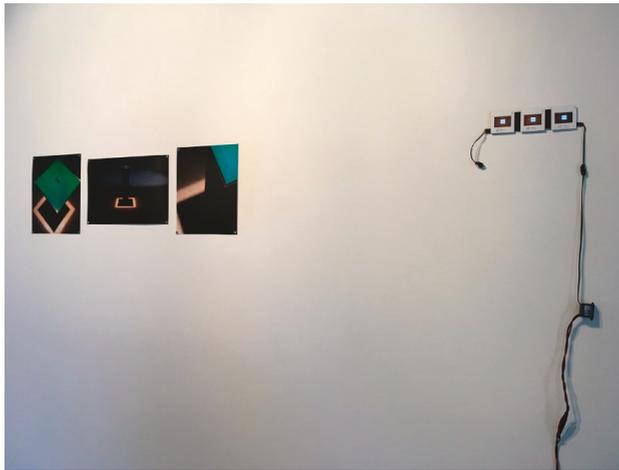


Figure 8. Detail: Three 35-mm slides mounted on electro-luminescent panel with three digital color photographs of the installed hologram. Slides originally used to project light onto Work 1. Image credit: Angela Bartram. Used by permission.

Work 4: Documents Alternatives #3, BSAD Gallery, Three-Nine 35 mm Drawn—2018

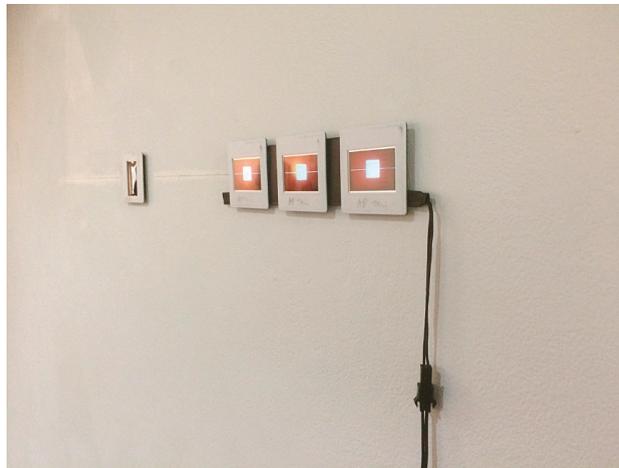


Figure 9. *Three-Nine 35 mm Drawn* has an additional slide included, as well as hand-drawn pencil lines on the gallery wall. Created by author.

Documents Alternatives #3 was hosted by the Art Research Center, Bath School of Art and Design, BSAD Gallery, in conjunction with an accompanying symposium, which focused on artistic process and practice. In the case of my contribution, a workshop exploring the unsupported mark and “drawing” in space, through the interception of projected light, referred directly back to work on show in the gallery. In this iteration, the three original 35-mm slides used to illuminate the gallery wall and central hologram in the first installation (Figure 2) are illuminated from the back, using an electro-luminescent panel. These slides were projected for 8 h a day and, during the exhibition period, became denatured, changing color from black to pink, due to the heat of the projectors used to illuminate them. The “pinking” is evident in these back-illuminated slides, anchoring them within an historical framework

(the impact of the past on the physical nature of the objects—altered by light). In addition, a fourth, unprojected and unilluminated slide, to the left of the others, is linked by a pencil line drawn directly onto the gallery wall, echoing the original line of light projected across the gallery in the first installation (Figure 1).



Figure 10. Detail: *Three-Nine 35 mm Drawn* showing the additional unprojected and unilluminated slide, as well as the hand-drawn pencil line on the gallery wall. Created by author.

11. Conclusions—Achieving the Tipping Point

During its early developmental stages, holography was not exposed to the critical analysis applied to other media and methodologies. This is unsurprising for a visual process which emerged from a scientific and engineering framework and which was quickly identified as a visually spectacular and attractive tool. Emphasis was placed on its novelty, which distracted from its exploration by artists who were attempting to use it within their practice.

More recently, artists and curators developed a confidence allowing them to apply critical analysis to work using holography. The critical questioning which took place in the Aveiro City Museum, as part of a wider PhD research process, and the progressive development of each of the works shown in the Documents Alternatives exhibitions suggest that holography can operate as an integral and considered element within research-informed practice and that there is a willingness on the part of artists and curators to establish a critical platform.

The holography blockbuster exhibitions of the 1970s and 1980s are now valuable historical points of reference, alongside the observations made by the few critics who attempted to examine this emerging medium. Artists continue to work with holography within their practice (albeit very few) and, in doing so, are developing a more identifiable critical basis for their work, which is beginning to attract the same rigor of analysis applied to other media. We appear to have achieved the tipping point.

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Conflicts of Interest: Andrew Pepper is editor of this special *Arts* issue and, to maintain academic rigor and editorial quality, this paper has been independently double peer-reviewed and the decision to include it in this issue has been made entirely by the *Arts* editorial board.

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Article

The Silent Researcher Critique: A New Method for Obtaining a Critical Response to a Holographic Artwork

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Abstract: The purpose of this article is to provide a plausible answer as to whether the Z-axis of holographic space can be used to depict a chronological narrative with an affective impact. This article describes a practice-based holographic arts study in which the author created interactive artworks with family photographs taken from the late 1800s to the present day, and stacked them in chronological order within the Z-axis of holographic space. The artworks were evaluated by different audiences to determine whether the viewer could perceive the new application of holographic space, and whether the artwork had an affective impact. An art critique method used both in Higher Education settings in the UK and in professional art practice, was adapted as a research tool for use in this study and termed ‘the silent researcher critique’. The findings of the project were that audiences had a new experience when interacting with the works and were impacted emotionally by them, however only a group of experts in art and holography were able to identify and comprehend the new conceptual use of the Z-axis of holographic space. This study’s value can be measured by its offering practice-based arts researchers a novel method of obtaining valuable critical feedback from peers and by its contribution to the aesthetic development of the medium of art holography.

Keywords: holography; holograms; digital animated hologram; holographic space; practice-based methodology

1. Introduction

Artists began working with holography as soon as the new medium became available in the late 1960s, attracted by its unique spatial and temporal characteristics (Benyon 1969; Nauman 1968). Holographic space was defined graphically by Pepper (1989, p. 298) depicting the spaces in which a holographic image can appear: behind the holographic plate; floating in front of the plate; or crossing the image plane. Holography can not only enable the artist to choose where to place an object in space, but it can appear to freeze or capture time and show different moments in time situated in the same space (Dawson 1999). These different spatial and temporal characteristics, along with the verisimilitude of the subject matter depicted, have resulted in emotional responses from audiences, particularly those encountering the medium for the first time, who express amazement and disbelief at what they are seeing (Benyon 1980).

This paper describes a practice-based Ph.D. study by the author which produced a body of holographic art work using holographic space in a new way to represent a virtual time-line. Practice-based research within academia relies on the production of a new artefact, or artefacts, and is accompanied by a written argument proving that the work provides a contribution to knowledge (Candy 2006). As is typical of a practice-based research methodology, the author took on many roles during the research process. Gray and Malins have described the role of the researcher in this methodological approach as being three-fold:

- a generator of the research material-art/design works, and participant in the creative process

- a self-observer through reflection on action and in action, and through discussion with others
- an observer of others for placing the research in context and gaining other perspectives. (Gray and Malins 2004, p. 21).

The author's research questions asked: could interactive artworks be created to depict a chronological time-line in space, with images farther back in the hologram representing a period further back in time? Could this new use of holographic space be perceived by an audience, and could the artwork move an audience emotionally, beyond a sense of amazement and disbelief and toward a sense of connection with the work. The artwork produced was interactive, relying on the movement of the viewer to create the four-dimensional image as a result of their interaction. As the viewer was part of the artwork, and the audience's perception of the work was required to answer the research questions and it became necessary to obtain feedback from the viewers themselves. A critique group consisting of the author's peers was used to gain feedback of the artwork produced in the study. The critique was novel in that the author was asked questions about the artwork by the group, but remained silent in response. The process and rationale for the approach is described further in Section 3.

A description of holographic space and time is outlined below and followed by an account of the research methods used in the study. These methods include both the production of new artworks and a critical evaluation of their impact on audiences. This article also includes the results of the study in the form of a description of the holographic artworks produced and an analysis of the artwork by a critique group.

2. Holographic Space and Time

While Pepper defined holographic space to include both the area behind the plate and the area between the surface of the hologram and the viewer (Pepper 1989), it has since been argued that holographic artwork can include other spaces. In this journal, Jacques Desbien describes the 'dispositif' of holography to involve:

... the wall, room, ambient light, the specific optical characteristics and also the viewer. (Desbien 2018)

Other spaces which can be included in the artwork are psychological and conceptual spaces: Richardson (1992) noted that holographic portraits can push or break the proceceptive boundary of the viewer, entering their personal space when the holographic image escapes the frame of the hologram. In her Ph.D. thesis, Mrongovius (2011) describes the affective impact holograms can have causing physical responses in the viewer who is compelled to move to animate the holograms. Artist and holographer Isabel Azevedo has included time, as well as space, within her description of her animated digital holographic artworks (Azevedo et al. 2014). There is a performative element in Azevedo's artwork which includes not only the time taken to view the hologram, but also the time taken for preparation of the artwork, the performance captured in her hologram and the printing of the hologram.

The author's own artwork aimed to build further upon the psychological and conceptual spaces described above to depict a chronological narrative within the Z-axis of holographic space and include the viewer.

3. Research Methods

The author used a variety of different methods to create artworks and to evaluate them. Lenticular images, analogue shadowgrams and a digital animated hologram were produced as part of the study and exhibited to audiences. The analogue holograms were produced with a Helium Neon laser and split beam one step reflection holography process in which light passes through a transparency mounted on a ground glass screen and is recorded on holographic film. The digital image was produced from scanned photographs and a digitized edited video used as textures on plane objects in a

Cinema4D software programme. The animation was output to 2000 jpeg images and printed by Geola, a holographic digital printing manufacturer. The manufacture process which created these works is beyond the scope of this article but is covered at length in the author's Ph.D. dissertation (John 2018).

Evaluating Audience Experience

It is impossible to directly observe the inner feelings of the audience ... being able to explore the "interaction space" involves some form of evaluation with audience cooperation. (Edmonds 2010, p. 2)

The author considered the use of typical methods used to evaluate interactive art: log-data, video footages, interviews, and questionnaires (Morreale and De Angeli 2015; Morrison et al. 2007), audience observation (Bech 2014) and self-evaluation (Mrongovius 2011). The author chose the following methods as the most appropriate for the type and number of viewers surveyed: paper-based questionnaires and on-line surveys; observations of the audience interacting with the artwork, self-evaluation of interaction with the artwork and lastly a silent critique group in lieu of interviews. The silent critique method was introduced to the author in 2014 by the facilitator of an informal contemporary artists networking group called 'Questions'. The Hampshire-based group met monthly to critique each other's work, helping to develop each other's professional practice. While the 'silent student critique' is common in Higher Education (Elkins 2014), the silent critique method had not previously been used in art holography research to obtain feedback on interactive artworks.

A small group of three artists working in film and mixed media analysed and evaluated the author's artwork (including the works shown in Figure 1a,b below) during a critique session held on 13 October 2014. While this appears to be a very small sample size, the Social Scientist Anthony Onwuegbuzie describes this limited number of participants as an acceptable number for a mini-focus group if participants have specialist knowledge (Onwuegbuzie et al. 2009). The group met and responded to the artwork for one-and-a-quarter hours. An audio recording was made of the session by the organiser and the discussion transcribed verbatim by the author as recommended by Elkins (2014). The second critique group was composed of a different audience; nine experts in art and holography. The criteria for the selection of the experts in art and holography included those with doctorates; doctoral candidates; long-standing or award-winning artists working with holography; and university or college teachers working in art and holography. Volunteers were sought during the International Symposium on Display Holography in Aveiro, Portugal (ISDH2018) and three men and six women agreed to help. Two of the nine members of the group had English as a second language.

The critique group met with the author at the Aveiro City Museum where one of the author's artworks was on display as part of the *Art in Holography: Light, Space & Time* exhibition. The author provided transport to and from the symposium to the museum and provided refreshments after the critique session.

The author introduced the group to the silent researcher questioning process. She requested that participants ask her questions about the artwork presented and explaining that she would consider the group's questions very carefully, but not answer them during the session. The structure of the silent critique session was largely unfamiliar to the participants, and at times they found it difficult to phrase their comments as a question. It proved almost impossible for one researcher who did not speak English as a first language; however, it was unclear whether it was a language barrier that prevented the person from doing what had been asked of them. Despite being asked to address questions to the researcher only, the group did discuss the work with one another on occasion. The silent critique group differed from a focus group in two ways: firstly, the researcher was silent during the session and was therefore unable to guide participants to answer research questions which would have been more typical in a focus group. Secondly, in a focus group, discussion between group participants would have been encouraged, however in the silent researcher critique participants were encouraged to address the researcher only not each other (however, in practice this was not always the case).

The session was filmed and audio-taped. The filming enabled a better understanding of artists' views through observation of their body language and gestures, which became an important part of one participant's method of communication as English was not their first language. Filming and recording were done by the author's fellow researcher Tove Dalenius.

As the study included participants, it required and obtained ethical approval from the Art, Design and Humanities Faculty Ethics committee of De Montfort University. The author used archival images from her own family in which individuals are identifiable. Permission was obtained from family members to use their photographs, film footage and precious objects in the artwork and to retain the photographs indefinitely. Other areas of concern regarding the ethics of the study included: the gathering of information from or/and about human beings through on-line questionnaires; observation of human behavior, and the recording of focus group (critique) sessions. The critique session participants were notified of the following in an introduction:

- that recording equipment would be used and that the discussions were to be transcribed
- that anonymity was strictly preserved,
- to whom the information they gave would be supplied to and the purpose for which it would be used
- that their co-operation in a research project was entirely voluntary at all stages
- that the film and audio recording of them was to be destroyed after five years.

Participants signed forms to agree to take part in the research process. All the participants were given the author's contact details and were made aware of how to see the results of the research process. The comments of the participants were anonymised and each contributor was assigned a letter of the alphabet to distinguish their remarks from one another.

The process of evaluation using the silent researcher critique method resulted in a wealth of qualitative data, which was coded, and themes generated and analyzed using a simple general inductive approach. The purpose of the inductive approach was "to allow research findings to emerge from the frequent, dominant, or significant themes inherent in raw data" (Thomas 2006). The transcribed text was read carefully a couple of times to identify themes and categories and this enabled the author to make links between the evaluation aims and the results from the raw data. NVivo Qualitative data analysis software was used to speed up the coding process with evaluation objectives providing a focus for the analysis. To help with creating codes and themes Dalenius, was trained in rudimentary social science methods and assisted with the holography critique.

4. Results

The results below include a description of the artworks produced, and the results of the evaluation of the works by the critique groups with a focus on the last critique. Photographs of the animated three- and four-dimensional images are shown below for illustrative purposes only as it is very difficult to visualize these artworks in two dimensions. Figure 1a,b are of the monochromatic analogue shadowgrams. Figure 1a *Great Great Grandfather* depicts a holographic image of a man, contained within an antique compass, striding along with a walking stick. The image looks to have been taken in the 1940s. The transparent holographic film on which the image is produced is placed on top of the glass protecting the compass needle which is clearly visible beneath it. The image of the walker appears to be sunk beneath the glass existing in the same space as the compass needle. Figure 2b depicts two portraits of the same woman 50 years apart. A transparent hologram of a photographic portrait taken in the 1940s sits on top of a digital photographic portrait. The earlier holographic portrait is sunk beneath the surface of the later photograph.

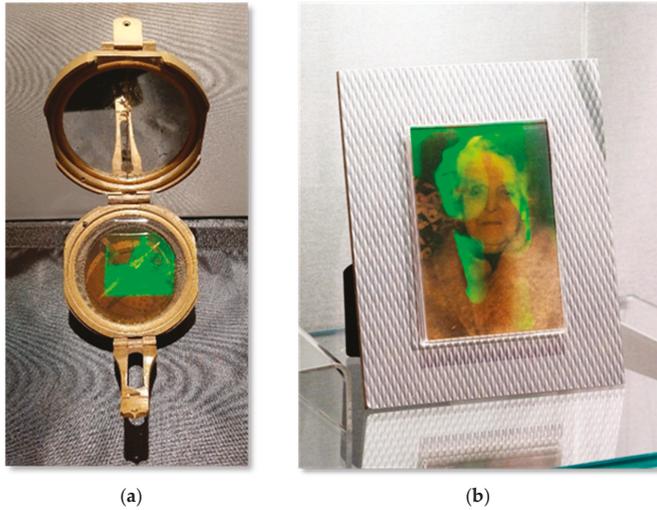


Figure 1. (a) *Great Great Grandfather* 2014, mixed media with reflection hologram, 8 cm × 20 cm, P. John and (b) *Great Grandmother*, 2014, mixed media with reflection hologram, 12.7 cm × 15.2 cm, P. John created and photographed by the author.

The first two holograms in Figure 1 *Great Great Grandfather* and *Great Grandmother* were shown to both the small group of contemporary artists working in film and media in 2014 and to the group of experts in art and holography at ISDH2018. To see the holograms, the viewers had to move the artworks around in order to illuminate the embedded holograms at the correct viewing angle. The comments from the artists focused more on the emotional impact of the work and of the medium, rather than the content of the holograms. The artists were unable to determine differences in the depth of holographic space used in the works. As a result, the author chose an audience of experts in art and holography to evaluate the last artwork produced in the study.

Passing Time, Distant Memory shown below in Figure 2a,b was created during the very last phase of the study and critiqued by the art and holography experts only. The digital animated hologram was hung and lit as part of the exhibition in City Art Gallery, Aveiro, Portugal. As the viewer moves laterally in front of the hologram from left to right, the photographs swing in an arc to show spaces and distances between them; the images on the left become obscured by those on the right-hand-side as if the photographs were solid. The images farthest from the viewer on the left-hand-side of the image depicted older photographs and these were sunk deeper within the Z-axis of holographic space. The image, an animated video on the far right-hand side was the most recent. Seven seconds of footage taken from a wedding video were edited to produce an animation in which the bride is shown to speak and laugh as the viewer moves. The video sits on a virtual surface which projects in front of the image plane of the hologram, protruding into the viewer's space.



Figure 2. (a) First view of *Passing Time, a Distant Memory*, 2018, digital animated hologram, 65 cm × 25 cm, P. John. (b) Second view of *Passing Time, a Distant Memory*, 2018, digital animated hologram, 65 cm × 25 cm. Produced and photographed by the author.

The purpose of the final silent researcher critique was to determine whether the audience could perceive and comprehend the concept that the Z-axis of holographic space depicted a chronological narrative; whether the viewers had a new experience in viewing the work; and whether it had an affective impact. The results demonstrated the following: that the experts thought that the artwork was novel; depicted images and memories within holographic space in a new manner; and had affective impact. They described their experience of the work as follows:

“A new way to present the past.” (Expert I); “You are sinking memories into holographic space.” (Expert G); “I felt sad when I looked at the image.” (Expert A).

The audience of experts recognised that they were part of the time-line and that the Z-axis of holographic space included their own present time and space:

“... if we’re thinking we’re dealing with a timeline are we were part of that line by viewing the work?” [Laughter] (Expert B); “Okay. I mean it’s about this moment. It’s about this very particular moment.” (Expert D).

The experts discussed different concepts of time inherent in the work they were shown and included their felt experience of time and the concept of linear time.

One of the study’s aims was that the work should have an affective impact. During the silent researcher critique, participants reported feeling sadness and nostalgia. However, as the critique

continued enabling people to talk without discussion, other emotional responses to the works became evident: there was slight discomfort, and then when the group broke the 'no discussion' guidance there was disagreement. Two experts expressed that they distrusted that the family history included in the artwork was authentic. A sense of tension during the silent researcher critique was relieved with laughter when there was a suggestion by one expert that the family in the artwork was not actually the author's and that the narrative presented as authentic was fictional. Another area of discomfort was due to three of the art and holography experts disagreeing with one another regarding issues of metaphysics and physics. Two participants shared concepts of objects containing memories, or the essence of the person that they related to. One art expert jokingly said that the objects contained ghosts, and another, whose training had been rooted in science, firmly disagreed. Two contemporary artists in the pilot 'Questions' session evaluation had discussed the same concepts of objects containing memories; however, the research artefacts did not contain the author's memories; most of the photographs included in the artworks were taken before the author was born. Instead, the photographs suggest memories, someone's memories.

5. Analysis

This section analyzes both the artworks produced, and the silent researcher critique method used to evaluate audience experience of the artworks. The holograms all used the Z-axis of holographic space to depict different time periods. Images were sunk into the depth of holographic space to show a period further back in time as illustrated in Figure 3 overleaf. The dotted red line depicts the present moment, the space behind the holographic image plane depicts the past and the space between the plane and the viewer depicts the present.

Experts in art and holography were able to determine how the Z-axis of holographic space was being used to depict different time periods and a chronological narrative.

The artwork had an affective or emotional impact on its audience, causing viewers to move physically to view the works and interact with them, and declare an emotional response, beyond that of mere wonder. Those unfamiliar with holography more readily expressed their emotional responses.

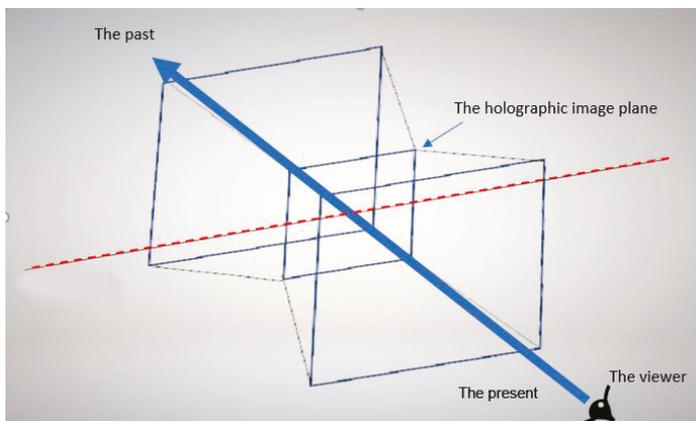


Figure 3. Depiction of holographic space including the Z-Axis marked with an arrow to delineate the structure of a chronological narrative. Illustration by the author.

The benefits of using silence during both critique sessions were evident in that members were given the opportunity to finish their thoughts when the researcher did not answer back, and when posed as a question, participant comments were carefully considered and formed. Silence is recognised to be a useful interview tool when used by a facilitator, enabling the participant to complete their response (Lerpiniere 2015). The silent researcher critique method avoided the need of either participant

or researcher to feel defensive in preparing a response and the researcher was able to concentrate on listening. The process enabled a depth of engagement between the artwork, the researcher and the participant in the critique. Lastly, the process ensured that the viewer was in control of describing their experience, even if it did not relate to the evaluation aims and this was both a benefit and drawback of the method. The researcher was unable to steer the discussion if evaluation topics relevant to the aims and objectives of the project were not being covered, as is possible with a focus group.

It could be argued that the length of time for the second critique of 25 min was too short: In his *Art Critiques: A Guide*, Elkins (2014, p. 27) describes appropriate timings and structure for a critique; which has, he argues, a recognisable start, finish and end: "A very simple reason why some critiques don't make sense is that they are too short. Even an hour can be barely enough to get acquainted with an artwork." However, the critique did make sense despite being limited because the experts in art and holography were already acquainted with the artwork having seen it on display previously and Elkin's critique structure also describes a situation between a teacher and students, while participants in this research process were all experts. The shorter critique length did not prove problematic as there was no sense that the session was unfinished, the questions from participants came to a natural end.

Other potential limitations of the evaluation process were more general: Social Scientist David Thomas points out that the interpretation of qualitative data is influenced by the evaluators:

"Inevitably, the findings are shaped by the assumptions and experiences of the evaluators conducting the study and carrying out the data analysis." (Thomas 2006, p. 240).

The author learned basic evaluation methods used in social science to ensure a robust approach, and Delanius checked both the transcript and the coding produced by the author as a result.

Overall, the silent researcher method proved a valuable method of obtaining thoughtful feedback from peers in a concise, efficient manner.

6. Conclusions

The research questions asked during this study were answered: the new artwork described above was able to use the Z-axis of holographic space to depict a chronological narrative; the new use of holographic space could be determined by an audience of experts in art and holography and the artwork had an affective impact on all the audience groups surveyed. The silent researcher critique proved a suitable new method to determine that research goals were met, and it will be used by the author when appropriate to evaluate the success of future artworks and exhibitions. The silent researcher critique may also benefit other practice-based researchers who need to obtain feedback from peers. A summative evaluation of audience experience was a necessary part of the research process both because the viewer produced the interactive artwork through their movement in front of it, and because their personal experience was needed to determine that the research goals were met and a contribution to knowledge confirmed (Edmonds 2010). The use of holographic space was perceived and described as novel by experts in art holography and it can therefore be argued that the research, which included both the production of new artworks and accompanying text, has contributed to the aesthetic development of the medium of holography.

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Article

Material Light—In the Realm of the Photon

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Abstract: The artist discusses his work and concepts within the context of the true hologram. He examines the character and attributes of the holographic medium that can assist in the evolution of human perception. Artists and their creative expressions have always had a place at the forefront of change, catalyzing ideas into perceptual evolution. Artistic endeavors that continue to incorporate light as a material will foster the evolving field of the hologram as fine art and influence how light is perceived and used within the expanding world culture.

Keywords: light; photon; nano-interferometric; light–space–time phenomenon; hologram; material light; holographic space; wave interference; multi-dimensional

1. Introduction

Light is, at least to me, mysterious—because on one level, it really defines our reality. It's maybe the most defining characteristic of our reality. Everything we see, how we perceive reality, is based on light bouncing off of objects, or bending around objects, or diffracting around objects, and then being sensed by our eyes, and then sending signals into our brain that create models of the world we see around us. So it really is, almost, the defining characteristic of our reality. But at the same time, when you really go down to experiment and observe with light, it starts to have a bunch of mysterious properties. And to a large degree it is not fully understood yet.

—Excerpt from Sal Khan at Khan Academy

1.1. *What Is a Hologram?*

The Grecian etymological root for hologram is 'whole message' or 'whole writing'. Every point-perspective within the hologram contains the entirety of the light information generated within the recorded subject's interaction with laser light. If a true hologram is broken then each piece, when illuminated with laser light, describes the entire original subject from that unique point or angle of view. Holograms create a record of light originating from a monochromatic process. Any subsequent illumination of the hologram with white light diffracts that white light, revealing an additive color palette present within that white light.

1.2. *The Most Famous Hologram That Is Not a Hologram*

The word hologram is misunderstood and misused in contemporary culture. The confusion runs as deep as the difference between reality and a magician's sleight of hand. An online search of the word hologram results in pages of digital video display systems touting holograms of dead celebrities. These video display systems are based upon a "Pepper's Ghost" illusion and have next to nothing in common with holograms, nor do the majority of other related online listings. Princess Leia of Star Wars' fame is only a cinematic special effect. Yet she is probably the most famous hologram that is not a hologram. The misunderstanding and misuse of the word hologram contributes to the devaluing of the hologram, especially as an art medium.

Illusions fool us—we make them up in our minds. An illusion is an act of deception. Some optical illusions are interesting to observe, but an illusion can also point to an erroneous belief or false perception of reality. Even within the field of holography, some professionals refer to the material light forms created by true holograms as illusions. I refute this perception based on a simple example: If you make a true hologram of a lens, that hologram will manipulate and restructure the light in the exact same manner as the originating lens when illuminated with that same laser light. If that hologram of a lens is then illuminated with white light it begins to reveal the character of the illuminating white light. The hologram acts like a prism by separating the white light into spectral colors that reveal the realm of the photon. This phenomenon is the essence of the hologram and demonstrates its inherent character. Holograms exist as an intermediary between our material existence and the mysteries held within light.

I perceive true holograms as one of the most beautiful and elegant discoveries in human history. They transform light—often perceived as non-material in character—into a tactile, multi-dimensional, and ethereal creation of material light. They are not illusions. They are true manifestations of light as material that call out to be experienced.

1.3. Holograms and Their Source Information

I define holograms as existing within two families: True holograms and illusionary holograms. At their foundation, true holograms are multi-dimensional manifestations of material light. The technique used in this process begins with a field of interfering coherent laser light. This light field then interacts with human-scaled three-dimensional subject matter. This interface translates the 3-dimensional content into a multi-dimensional field of light information. The accumulated laser light information is then recorded onto a glass plate coated with light-sensitive emulsion. The resulting light archive—the hologram—contains the content of the multi-dimensional laser light field. This hologram contains an extraordinary level of detail, quintessential to the realm of the photon. When you view a true hologram you are experiencing it in the present as well as seeing the period of time in which it was originally created. This ability to record time is a function of the light-space-time phenomenon. The light used to illuminate the hologram is restructured by that hologram, duplicating the time of its origination. Holograms are tangible, readable archives of light information that have been rendered directly from the realm of the photon.

Illusionary holograms originate from two-dimensional information bundles, primarily generated using digital information. These holograms use two or more sets of stereographic data to develop a stereoscopic illusion that the mind interprets as three-dimensional space. These stereo-holograms have the ability to display animated imagery—reproducing an illusion of time and depth. This enables the creator to fabricate a stereoscopic view manipulating a purely perceptual reality. This type of hologram is easier to realize as the needed two-dimensional source information for their production can be digitally produced.

The artworks I create are all one-of-a-kind true holograms produced using holographic emulsions developed and individually formulated in my studio. I view these emulsions as having a painterly quality. The varied formulas of emulsions I blend are analogous to an artist's paint and color palette. I work with laser light as if it were my brush. Both of these elements are integral in the methodology of content and process within my finished works. To add another layer of creative manipulation I sometimes paint, drip, and carve the emulsions on the glass substrate used in the finished works. I also integrate textured laser light during the exposure of the emulsions to texturize the material light forms—increasing their material context. Because of the simplicity of the holographic methodology I utilize, my artworks exhibit 180 degrees of parallax viewing. This broad parallax makes possible a metamorphosis of material light forms and color that can be seen from anywhere within visual sight of the artwork. I see this kinetic viewing character infused with multi-dimensionality as important elements in the evolution and appreciation of true holograms as a fine art medium.

1.4. Early History of Holograms as Fine Art and Beyond into Quantum Holography

In 1968 the American artist Bruce Nauman produced a series of holograms entitled “Making Faces (A-K)” (Nauman 1968). This series were the first holograms created by an artist of prominence. Nauman’s holograms were recorded in the infinitesimally small time frame of approximately twelve nano-seconds. In this almost instantaneous exposure of the holographic emulsion, Nauman physically articulated his body and face into distorted facial expressions. He said about these contortions “I guess I was interested in doing a really extreme thing” (Nauman 2003). During the twelve nano-second exposure the laser light entered the surface of his skin, potentially integrating with his DNA, and archived its composition into the laser light via the light–space–time phenomenon. This laser light reflected from his body recorded its light information holographically into the light sensitive emulsion. DNA has a diameter of approximately 2 nanometers (Wikipedia 2019). This is only a factor of 300 times smaller than the wavelength of light used to record the holograms of Nauman. A photon of laser light, being smaller than an electron, is a factor of more than one million times smaller than DNA (Quora 2017). Considering the immense information storage capacity of photons (Emerging Technology 2016) within a field of laser light and combining that with the nature of the true hologram and its ability to record the entirety of the subject from an almost infinite number of point locations across its dimension, I hypothesize that the holograms of Bruce Nauman contain a composite holographic recording of his DNA. Currently I know of no device that would allow this DNA information to be retrieved. I view this series of holograms as one of the most profound artifacts created within the sphere of fine art. The recording of this instantaneous moment combined with the potential to document Nauman’s DNA exemplifies the realm of the photon and the true hologram. Between 1966 and 1970 Nauman made several artworks in which he used his body to explore the role of the artist—and explore possibilities within the context of art to investigate psychological states and behavioral codes. Who better than Bruce Nauman to potentially be the first artist to convey the truth of his physical composition infused within the light information recorded in a true hologram?

2. A Discussion of Artworks as Pollinators between the Terrestrial and Photonic Realms

2.1. Spherical Light Series: 2000 to Present

The “Spherical Light” series (Figure 1) investigates the multi-dimensional expression of the hologram. These works encompass the realm of the photon interpreted through the true hologram as an expressive, immersive medium. The series began as an exploration into the impossibility of creating a two-dimensional flat hologram. Upon completion of the first piece, the realm of the photon began to reveal itself to me. As I moved around the piece an extraordinary polychromatic palette became evident. I realized that what I was observing was an elongation and layering of multiple color spectrums over one another. This palette of light expanded my vision of how I could use the medium of holography. I realized it could translate light’s mysteries into the sphere of human existence. The work of Agnes Martin came to mind. Her work in exploring white and its disassembly into constituent colors—as evident below (cut) in “Untitled #2” (Miranda 2016) inspired an expansion of my insight and strengthened my explorations within the realm of the photon.

Based on my newfound realization of color, I then added dimensional content to the subsequent works in the series. I then genuinely began working in the multi-dimensional real-space of light within the medium of holography.

At first glance, the observed dimensional quality of these works is exceptionally subtle. They appear to be flat fields of color. By moving around the artwork its polychromatic character is realized. This trait is the fingerprint of the full-spectrum composition of white light. Through patient viewing an initially indistinct dimensional form floating within the boundaries of the artwork is discovered. With close examination this nebulous volume possesses a tactile material quality. Subtle textural keys begin to emerge assisting the viewer in spatially defining the multi-dimensional rendering of this tactile field of material light. Continuing to move—broadening the exploration of the artwork—a

transformative morphing character is recognized. What is discovered is a curved form within the hologram. With further observation this form evolves into a fractional section of a large spherical form. This sphere is spatially located deep within the artwork. In my comprehension this spherical form may have a diameter of 30 to 40 feet. Conceptually, this hologram contains the entirety of that dimensional sphere. This exemplifies the definition of the word hologram (whole message). I see this spherical light form as a portal into the realm of the photon that can be perceived with the naked eye.

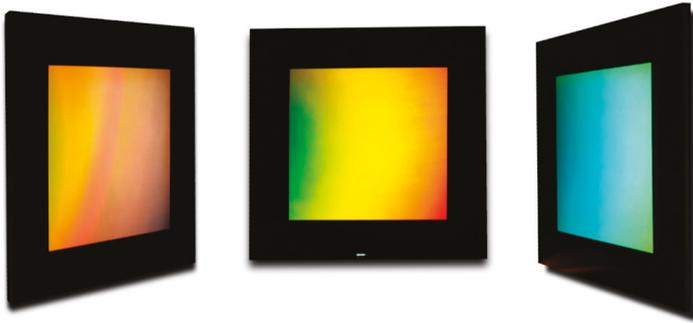


Figure 1. “Apollo” Spherical Light series, 2001. Three views of a single artwork. 54 cm × 54 cm, created by the author.

2.2. Acceleration Series: 2002 to Present

The “Acceleration” series of artworks (Figure 2) addresses the need to accelerate our perceptual evolution to keep pace with our technological revolution. At the time of initiating this series I was reflecting on the work of Joseph Albers’ “Homage to the Square” (Albers 1951). Albers had explored halation, the phenomenon of edge contrast created by color-frequency light-wave interference. The holograms in this series were initially conceived to explore halation. They are compositions of two rectangular forms. In these works one rectangular form occupies a holographic space in front of the glass surface of the hologram while the second rectangular form resides behind the rear surface of the hologram. After the first holograms were made it became apparent that halation did not function within the multi-dimensional context of these works but the use of the rectangle remained a useful tool within my work. What became apparent as the two forms spatially move across each other was their colors and forms cross-pollinated, creating a third polychromatic light field of color and shape. The contours of this light field morph in shape, corresponding to how the two forms spatially overlap. The vivid color these forms present is a result of color mixing as the two rectangles spatially interact. These vibrant colors have their origin within the additive color palette inherent to this process of holography. The dimensional periphery of the light field exhibits a nebulous character, but with contemplation and imagination this subtle dimensional space reveals its multi-dimensional character and form.

Upon close examination and with total visual immersion within the rectangular form residing in the holographic space in front of the glass surface, this initially small rectangle increases in dimension filling the entire physical area of the artwork. The participatory content of total visual immersion within a field of material light can be a perception-altering event eliciting a degree of mystery and wonderment. These works act as portals assisting to increase the understanding of the conceptual territory of the hologram, the realm of the photon, and our tactile physical existence. My intent in these works is to stimulate a degree of physical and intellectual inquiry. The juxtapose states presented by the artworks, material as solid and material as light which possesses a multi-dimensional character, enabling comprehension of physical and non-physical existence to expand, evolve, and to be put into practice.

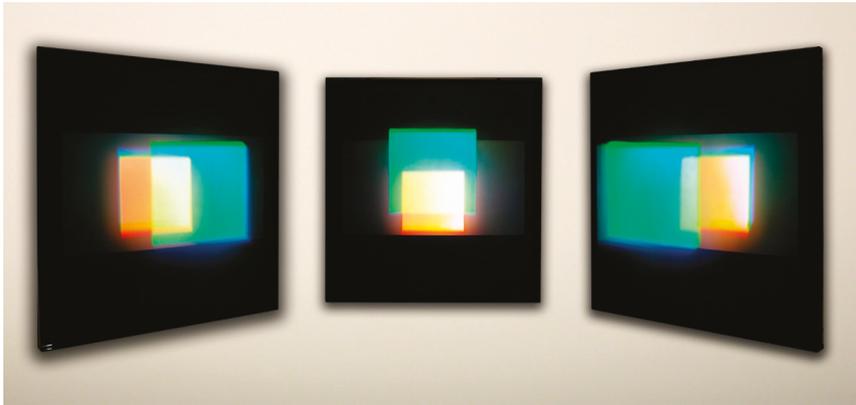


Figure 2. “Acceleration #4” Acceleration series, 2014 Three views of a single artwork. 63 cm × 53 cm, 2014, created by the author.

2.3. Quantum Series: 2004 to Present

These artworks (Figure 3) are a tendrils originating from the Spherical Light series. The “Quantum” series cultivates a visual analogy as well as a potential actual instance of quantum states—a system that allows one single photon to be in two different locations at the same moment (Folger 2005). The series utilizes a system of controlled chaos. During the process of coating the light-sensitive holographic emulsion on the glass plate, centrifugal force combined with serendipitous and intentional aberrations result in holographic emulsions patterned with physical artifacts. These patterned fields of aberrations contain bubbles, have a dimensional surface texture, and are delicate in appearance. These patterns convey an abstracted but system-based motif. In the finished works the emulsion aberrations create a tangible solidity embedded within the piece. The holographic shadows of these aberrations occupy the holographic space in front of the glass surface of the hologram. The entwining of the physical emulsion aberrations with their holographic shadows creates a holographic amalgam. The commingling of the two states of the physical and the holographic, reference quantum states. Coincidentally, this amalgam resembles a cosmic nebula. This blending of light as material and physical matter exemplifies the conceptual holographic sphere of perception. I view these works as doorways into an increased understanding of our quantum actuality, both symbolically and theoretically.



Figure 3. “Driving Through Smoke” Quantum series, 2014 Three views of a single artwork. 56 cm × 53 cm, created by the (cut) author.

3. Personal History within the Medium of Holography

After 10 years of sculpting metal as a sculptor/jeweler in the framework of the pictorial, I saw my first hologram in 1982. Four years later I opened my first holographic studio and continued to make holograms with pictorial content. In 1994 I experienced an exhibition of Bruce Nauman's "Clown Torture" (Clown Torture 1987) at the Walker Arts Center in Minneapolis, Minnesota. My initial response to the work was revulsion. I noticed a similar reaction from the others who had entered the gallery, most of whom left the gallery shaking their heads in disgust. At that moment, I realized the power of art to elicit a strong physiological and psychological response. One of the primary properties of holography that interested me is its ability to stimulate imagination and curiosity in the viewer. Experiencing "Clown Torture" has influenced my work ever since.

In 1996 I realized that light and the mysteries it holds should be the basis for my creative work. I then began to conceptualize the process of sculpting light and shaping photons into dimensional forms. I continued my studies surrounding light phenomenon and how they manifest in the environment. These included the Aurora Borealis, rainbows, sundogs, and light pillars.

Halo is a term used to describe a ring of light that forms around the sun or moon. I utilized the knowledge of this phenomenon to begin the "Halos" series of holograms in 1996. I used a minimal geometric ring form made of steel as the subject to initiate the conveyance of light's narrative. My intent was to engage the audience in the ideas surrounding light as a material. The reaction was very positive. The experiential content of these works was an added event that I had not fully anticipated. The viewers became tactilely interactive with the golden ring of light that was occupying the holographic space in front of the surface of the hologram. As people attempted to hold the material yet non-material ring of light I sensed expressions of delight. In later conversations about the work, amazement and mystery were common topics. I then realized the importance of integrating the individual human experience when presenting of the story of light through my work. Subsequently my content within the halos series expanded to laminating multiple holograms of the single ring into compositions consisting of multi-dimensional colleagues, utilizing up to three rings, and encouraging a tactile interaction.

This experience confirmed one of the most interesting and unique properties of this medium. True holograms, with their intrinsic content of mystery, have the ability to evoke a physiological and psychological response. I see this response as being similar to what Nauman's "Clown Torture" (Public Delivery 2019) evoked but having the opposite character of curiosity and sense of wonder. Other mediums such as virtual reality, 3D movies, or James Turrell's "Afrum 1" (Turrell 1966) a light projection work, are able to kindle similar responses. These are all illusions created within our minds through visual cues. I view illusion as removing the potential for imagination by generating fantasy—they do not expand our awareness of the world. By using the medium of the true hologram I hope to assist in the acceleration of our perceptual evolution into an inclusive, holistic system.

A significant motivation within my artistic practice is to encourage and develop a deep appreciation and understanding of light. It has created and sustained life for eons. We have delighted in its beauty through the spectrum of its color composition. Light as a photon exists as energy. We now exist in a world in which humans are not in equilibrium with the natural world. This imbalance can be resolved by developing a deeper and more integrated relationship with light and the energy that it transports. Through the creation of my holographic light-based artworks I aspire to bring into reality an evolution of human perception. This profundity of thought could result in an awakening, encompassing and developing a methodology that embraces a holistic understanding of light, its mysteries, attributes, and the appropriate use of the solar energy that is supplied to us on a daily bases.

4. Conclusions

Holograms are truly extraordinary. They exist as an intermediary between our terrestrial existence and the mysteries of light. My holographic artworks transform light with its non-material character into multi-dimensional and tactile creations of material light. In these works I use light as a material, sculpting photons into a luminous essence of polychromatic color and mystery. They exhibit a material

yet ethereal nature that invites examination and exploration. They are intrinsically beautiful and captivating. The experiential qualities presented in my artworks establish an environment conducive to addressing concepts within the light–space–time phenomenon and the mysteries intrinsic to light. I feel that the true holograms can provide a platform for altering awareness within an individual’s sense of reality. This perceptual expansion can result in an evolution in individual perception, initiating a deeper understanding of the realm of the photon, and holistically integrating light and the energy it carries into a sustainable future.

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Definitions for Clarity and Contemplation

Realm of the Photon	The synergistic totality of all energetic light radiation.
The light–space–time phenomenon	Light as energy, precisely delineating space and material composition, traveling at the speed of light, in the vehicle of time. The photon only exists in the present and holistically determines the totality of our future on earth.
Holographic space	The field of non-physical space that resides outside the boundaries described by the physical mass of the hologram.
Material light	Light as material, infused with time, fabricated into dimension. It is a manifestation of the light–space–time phenomenon. It physically exists within the holographic space.
Multi-dimensional	A region or quanta of energy described as existing within wave particle duality, blanketed by numerous dimensions, time being the fourth dimensional element.

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Article

The *Dispositif* of Holography

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Abstract: The French word *dispositif*, applied to visual art, encompasses several components of an artwork, such as the apparatus itself as well as its display conditions and the viewers themselves. In this article, I examine the concept of *dispositif* in the context of holography and, in particular, synthetic holography (computer-generated holography). This analysis concentrates on the holographic space and its effects on time and colors. A few comparisons with the history of spatial representation allow us to state that the holographic *dispositif* breaks with the perspective tradition and opens a new field of artistic research and experimentation.

Keywords: *dispositif*; synthetic holography; analog holography; holographic space; time and colors; multiple perspective; kinetics; chromaticity

1. Introduction

“One can never experience art through descriptions. Explanations and analyses can serve at best as intellectual preparation.”

(Moholy-Nagy 1928)

In 1970, Jean-Louis Baudry introduced the concept of *dispositif* in cinema theory (Baudry 1970). He analyzed the relationship between the spectator and the cinematographic representation through its technologies, settings, projection conditions, etc. Since then, this concept has spread in cinema theory and offers some interesting insights for those of us who are interested in the artistic potential of holography.

While the French word “*dispositif*” is usually translated in English as “apparatus”, in French it has a broader meaning, especially in philosophy and art theory. A *dispositif* is a set of elements, devices, parameters and relations that constitute a scene, a place, a situation or an event. In any case, the *dispositif* is comprised of the apparatus and the display, as applied in given circumstances, but also the image production and presentation conditions, the content and even the viewer himself. A *dispositif* will determine the optical, the geometrical, as well as the cultural characteristics of a representation, a presentation and an observation of images. Whereas the basic holographic display may be as simple as a light source and the hologram itself, which is a high-resolution photographic emulsion, both placed at specific angles to each other, its *dispositif* also comprises the wall, room, ambient light, the specific optical characteristics of the hologram, and also the viewer. Holograms break with our tradition of graphic images made of pigments and marks on surfaces, or from light projected on screens or even pixels. Not only is holography a new media, it also has an approach to image making, a physical and optical foundation, a production process, display parameters and visual effects, which are completely different from any other imaging technology since the beginning of art. Consequently, the holographic *dispositif* presents an altered temporal and spatial coherence that can be manipulated by the artist. Perhaps initially unsettling to the viewer, the artist soon sees the possibility of new visual effects and narrative tools.

The purpose of this article is not to explain the technical characteristics of holography; it is easy to find books and resources on the web for that information. Rather, my intent is to present a few features

singular to the holographic *dispositif* that have a decisive impact on its aesthetic and artistic production and reception. My own experiments in synthetic holography (computer-generated holography) were aimed at analyzing these very features. As an art historian and artist, my work is based on a blend of historical research and artistic experimentations, testing observations and ideas from art history as well as my own, then elaborating concepts from this process. Thus, the end result of my holographic work is not simply artistic expression, but rather the developments of concepts and analysis.

The characteristics of holographic images that I explore can be applied to analog optical holography. However, some effects can be difficult to achieve without computer-generated content. The main difference between analog and synthetic holography is the source of the image. The first uses an optical setup to record the light wave's interferences from an object, while the second requires a similar optical setup to record the interference patterns of a set of computer-generated images, each image representing an angle of view on a scene. Consequently, synthetic holograms are composite images that show a partial view of space, but this process offers to the artist easier access to an array of visual effects by means of computer graphics programs.

Although further experimentation and analysis is greatly needed, there are three formal elements of the holographic *dispositif* that one must consider in both the creation and in the critique of art holography: the holographic space, time, and chromaticity.

2. Space

Hundreds of years of spatial representation using linear perspective led us to accept the cyclopean model in which everything is seen from a single point. The viewing hole in Filippo Brunelleschi's *tavoletta*, the single point of view used by Leon Battista Alberti (1404–1472) in his perspective method, and all the subsequent perspectivist developments are a demonstration of a dioptrical approach to the representation of three-dimensional space. Like projecting a scene through a lens, light passes through the focal point. Even in photography and its correlates, the cinematographic camera or the virtual camera in computer graphics software, the single point of view is imposed. It is an egocentric position, the center of the world. Perspective is a shackle. The holographic space breaks with this geometric convention.

In my synthetic hologram, *Tractatus Holographis* (2005), I presented a fictitious 16th century treatise on holography (Figure 1). Written in Middle French and containing animated 3D illustrations, a page turns when the viewer moves laterally. On the first and second page, the traditional perspective model is presented with its pyramidal field of view emanating from a single point. On the third page is a short explanation of the holographic setup and on the fourth page is an illustration of the holographic space as two joined truncated pyramids (for an analysis of the holographic space, see: [Pepper 1989](#)).



Figure 1. *Tractatus Holographis*, 2005. Two views of the synthetic hologram, 60 cm × 40 cm, created by author. (see: <http://www.i-jacques.com/tractatusen.html>).

The traditional perspective model places the viewer in the center of the world at a pivot point from which a single angle of view is projected on a plane. Instead, by reconstructing the light waves originating from a scene, holography creates a field in which the viewer can move freely and observe

the hologram content from many angles of view. The holographic *dispositif* transfers the pivot point to the hologram window and, therefore, expands the viewer's freedom of observation.

This is an important feature of the holographic *dispositif* that has significant consequences on its aesthetics and creative possibilities. The multiple perspectives of this continuous parallax optical system are what will usually define the holographic space as three-dimensional, or "3D". As an artistic representation, it means that what you see from here is different than what you see from there, that the frontal centered axis of view is only one angle among many others. Content can become variable with the viewer's movements without cinematic or mechanical animation.

In fact, this three-dimensionality affects the construction of a scene for holography in an unexpected manner. Voids occupy real optical three-dimensional spaces that determine the visibility of forms and the spatial relationship with the viewer. In the composition of a 3D holographic image, voids are not simply emptiness; they are volumes of space that are constructed by the artist to make "this" visible from "there".

Production techniques and the direction of illumination define whether the holograms are "transmission" or "reflection". Differentiating between these two types of holograms, Stephen A. Benton and V. Michael Bove, in their book *Holographic Imaging* (Benton and Bove 2008), present the analogy of holograms that are "windowlike" for transmission holograms, and "mirrorlike" for reflection holograms. Most holograms exhibited in art are "reflection holograms", which means that they are illuminated from the front. While these two categories refer to the orientation of illumination in the holographic process, this analogy can be extended to the holographic *dispositif*. Moving in front of a hologram, the viewer will see a variation of perspectives similar to the perspective variations that we see when we move in front of a mirror. Moreover, when we look at the history of the art of spatial representation, the mirror is sometimes referred to as an ideal. Alberti suggests using a mirror as a visual tool. The architect and sculptor Filarete (c.1400–c.1469), commenting on Brunelleschi's experiment on perspective, writes: "It is certainly a subtle and beautiful thing to discover how to do it by rule from what the mirror shows you". And for Leonardo Da Vinci (1452–1519), the mirror is "the painter's master". From a dioptric model, holography seems to reach into a catoptric model. While we can establish a comparison with images of the 2D world or sculptures of the 3D world, the holographic space is different because it is essentially an optical field in front and behind the hologram plane. When, in the 1990s, 3D computer graphics became accessible, it was often said that the artist had to think in 3D. In holography, the artist has to think spatially.

3. Time

The holographic *dispositif* establishes a distinctive spatial structure. However, the holographic space has an important impact on the representation of time that is more peculiar than any other imaging technology. In physics as well as in philosophy, space and time are interlinked. This is not different in holography and it is an important characteristic of my experiments. In my *Tractatus Holographis* hologram, a page seems to turn when the viewer moves laterally. In *Graphis* (2009) (Figure 2), texts in Arabic, Chinese, Latin, middle French, Greek and other content elements appear and disappear and the whole scene changes in synchronization with the viewer's movements.

In most of my synthetic holograms, there are more than a thousand computer-generated images with small variations that trigger content transformations in accordance to angles of view. This multiplicity of images allows us to introduce variations in the sequence that will result in kinetic effects when the viewers move in front of the hologram and see these variations. It is important to note that this is not cinematographic animation, but rather kinetics. Movements and transformations of content are synchronized and dependent on the viewer's movements. A form moving down, when the viewer walks toward the right, will appear moving up when the viewer moves left. Thus, holographic kinetics is reversible. Moreover, the speed of this moving form will be controlled by the viewer's speed, and if the viewer stops, the kinetics will stop too. In fact, we cannot even talk about speed or "x frames per second" in synthetic holography. Kinetics is a relationship between the content variations and the

viewer's movements. It is space + time. This creates the possibility of temporal distortions, such as "time-smear", a deformation or blur, resulting from harsh variations in the content (Figure 3). In most cases of time-smear, our two eyes do not see the same thing at the same time. This can twist, warp or contort the form. Depending on the configuration, the kinetic form may be stretched and apparently smudged. Temporal distortions are often seen as defects; however, this distortion may offer interesting artistic experimentations for artists.



Figure 2. *Graphis*, 2009. Five views of the synthetic hologram, 3 m × 60 cm, created by author. (see: <http://www.i-jacques.com/graphisen.html>).

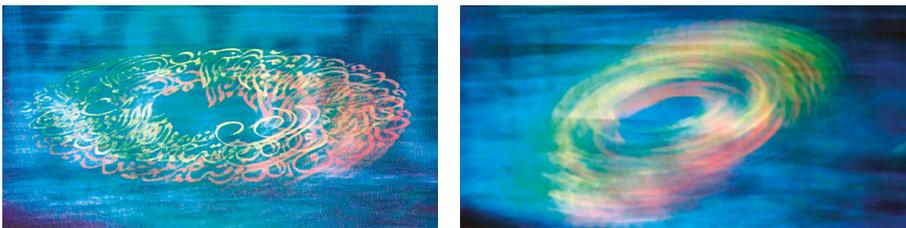


Figure 3. Time-smear of a rotation in *Graphis*, 2009.

Furthermore, multiple perspectives have an impact on the personal temporal relationship between the viewer and the content. While exhibiting synthetic holograms with some kinetics content, I noticed that the temporal relationship becomes an important part of the viewer's aesthetic experience. You may want to create a holographic artwork with a linear narration that can be viewed from left to right, but you do not control the viewer's movement. Contrary to cinema, people are free to move, look from the center, the left, moving from here to there . . . What you see from the right part of the holographic space can be different from what your friend will see from the left part . . . at the same time. The image

you see is your view and only yours. All other views are a different perspective. Thus, people often chose a particular angle of view, a personal space.

While the artist composes a space, time belongs to the viewer. Linear narration is shattered in holography. Visual information and its discursive attributes are contingent on spatial synchronization between elements and the viewers. Alignments, juxtapositions, superpositions, colors, transparent and reflective objects, directional vectors and focus points—all these formal elements and their significations can vary with multiple views and the spatial interactivity that holography provides. In a recent hologram, *Maze* (2018), I tried to use this spatiotemporal characteristic in the solution of a visual puzzle (Figure 4). The only way to solve this labyrinthine composition of stairs is for the viewer to move laterally and change viewing angles so that some parts of the stair's structure will appear or disappear. The movements of the viewers' bodies, the movements of their gazes, and the hologram's kinetics all contribute in this interactive hologram. "*Tempus non est sine motu*" (Time does not exist without motion) (Bacon 1267).

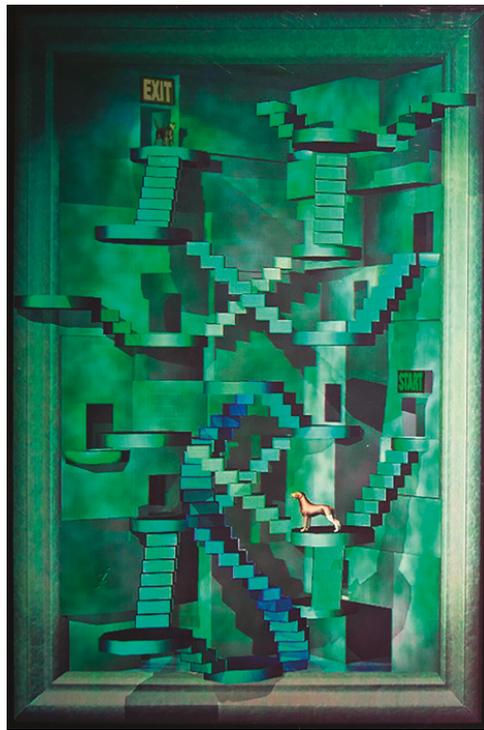


Figure 4. *Maze*, 2018. Synthetic hologram. 40 cm × 60 cm, created by author.

4. Chromaticity

We often forget that all our image displays have limited color ranges. Colors in paintings, photography, cinema, videos and computer screens have a smaller gamut than what is in nature's visible light spectrum. This is also the case in synthetic holography since the source images are computer generated; hence, the colors of a synthetic hologram derive from the standard RGB model used in these electronic displays. Still, the holographic *dispositif* will allow the artist to produce several chromatic effects synchronized with the viewer's movement. However, here analog holography seems advantageous when comparing the two processes. Red, green and blue lasers have a wider gamut than electronic displays and other color mediums. By using diffraction in the reconstruction of the

interference pattern, the holographic *dispositif* enters a chromatic field distinct from the traditional reflective or transmissive mediums. In many holographic artworks, these interactive light and color compositions are not achievable with any other medium.

Sometimes, these chromatic compositions are on the frontier between abstraction and figuration, as seen in the works of Rudie Berkhout or August Muth. They are true chromatic manipulations of the light spectrum. The holographic space tends to objectify content and allow for intentional ambiguity; color fields become volumes that display ethereal, optical and geometrical characteristics. Again, holography becomes a distinct medium that opens on a new form of “light painting”, where chromaticity is manipulated in its very foundation.

5. Conclusions

Dependent on scientific developments and on access to expensive, complex and fragile equipment, artistic experimentations in holography are often difficult to grasp. Beyond all difficulties related to holography, accessibility is the key, not only for artists to produce holographic artworks, but also for people to see holograms in galleries and museums. Too often I have heard comments reducing holography to a technological curiosity or gadget. Obviously, this view is limitative and superficial. It ignores the singularity of the holographic *dispositif* and its impact on our relationship, physically and emotionally, with space, time and color. Furthermore, it obliterates the transformative nature of holography in the context of our history of artistic representation.

The artistic images that we create using various mediums, from painting to computer graphics, from photography to Virtual Reality, from cinema to its expanded forms, are all based on a long geometrical tradition. Holography is only a few decades old and distances itself from this tradition. Showing my holograms to people unaccustomed to the particularities of the holographic *dispositif*, I often had to tell them to move to appreciate the depth, the kinetic effects, the distortions, the variations. Viewers often approach a hologram the same way they do with any other 2D image displays, from a fixed single angle of view. In his text on *The cinema of attraction*, Tom Gunning identifies the early years of cinema as a time when the main objective was to show something in a different manner than theatre. Since its beginning, a lot of holograms have been “holograms of attraction”, showing basic 3D or a peculiar visual effect. Much experimentation is still needed to develop a new visual language based on the attributes of the holographic *dispositif*, and artists must create new narrative forms that take advantage of its functions. Looking into the holographic art of the past decades, and the recent developments in technological and aesthetical possibilities that it offers, I think that we can apply to holography what Gunning states about cinema: “Every change in film history implies a change in its address to the spectator, and each period constructs its spectator in a new way.” (Gunning 2006).

Holography opens a window on an optical field breaking with centuries of imposed points of view and linear narrative forms. Moving from a dioptric model to a catoptric model, and then to a diffractive model, holography reaches into a new world of image making, where light, space and time are tangible materials.

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Essay

Speaking Volumes: Studying Depth in Holographic Narratives

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Abstract: This article investigates a decision every holographer makes: where to place light-forms along the z-axis, given the power of light imagery. This choice governs what sits behind the plate, what is on the surface and what projects in front of the plate toward the viewer. After considering ways that the placement of imagery sets the stage for viewers to respond to a holographic narrative, examples are offered from a series of reflection holograms. These examples are drawn from a continuing creative practice which explores aspects of narrative within the unique parameters of holographic volume.

Keywords: holography; hologram; luminous imaging; perception; illusion; 3-D; three dimensions

1. Introduction: Picturing the Z-Axis

Even forgetting high-school algebra, most people can navigate locations using the x-axis and y-axis of Descartes' coordinates. By contrast, many are less at home traveling the z-axis, especially without signposts. Holographers, however, quickly learn that the z-axis is where the magic happens. Light imagery can attract and engage the viewer by leaping out of the frame, defying the norms of a two-dimensional picture.

In the visual arts, narrative is usually constructed as a sequence of images, where viewers extract meaning by following a line from left to right on the horizontal x-axis, then down the y-axis to the next line. In a graphic novel, for example, the page may be split into a number of panels. Narrative events may pop out of one frame into another to expand a moment or heighten dramatic effect. A hologram allows the viewer to move away from the surface: we have two options along the z-axis in addition to imaging on the surface. On one hand, we can push imagery away from the viewer, behind the framed surface; on the other, we can bring the image in front of the surface, and thus more directly toward the viewer.

A hologram may be imagined either as a phantom representational image or as an abstract volume of color. In either case, the light-form of an object gets separated from its concrete material origin via a world of lasers and laboratories. The result is a weightless dimensional image that observers can see but not touch, stretching the limits of believability and provoking wonder.

While I was teaching at the School of the Art Institute of Chicago in the 1980s, I took a group of my students to the Chicago Holography Museum¹ run by one-time ice-skating champion Loren Billings. Afterwards in class, one student said, "Holograms are so cool to look at. But if I saw an exhibit of the actual things on pedestals, I doubt that I would be impressed." That student's concern led me to question what was compelling about creating a light-form to represent an object. In a way,

¹ Ironically, the Museum of Holography was housed in a former coffin factory and offered a lugubriously elegant exhibition space in the forgotten West Loop, soon to acquire reflected glory from Oprah Winfrey starting her media empire across the street. Some accomplished holographers worked in the basement there, notably Ed Wesly, Doug Tyler, Melissa Crenshaw, Larry Lieberman, Steve Smith and Rick Bruck.

holography reminded me of synecdoche—the way language works when a word stands in for a physical item (Eco 1995).

I became curious about how words inhabit the transitional border between thought and matter, especially when meaning radiates in other than straight lines. I studied charts, maps and diagrams, where the reader roams the x and y-axes, discerning fresh meaning in a personal discovery sequence. As a result, I made a series of large holograms where text and found objects float in volumes of color—non-linear narratives in a teasing relationship with science. Drawn shapes, words and shadow objects slid through each other, changing with each step and dip, as well as changes in illumination.

This work in turn led to a series of environments and performance pieces where holograms acted as focal elements in walk-through spaces. The public drove the narrative as their movement triggered changing light, video and sound. As a security guard near one of the installations remarked about holograms on slowly revolving bases, “I keep seeing new things. You got a lot of picture in the one frame.”

2. Why an Image Made of Light Is Special

Making a hologram transforms an object into a light-form. When the light-form image floats in front of the holographic surface, which functions as a frame or window, it affects viewers in two ways:

1. The image appears closer to viewers than the frame, approaching them from the same side of the glass window.
2. The image is weightless, an apparition.

When viewers question what they perceive as a weightless apparition, they often swipe a hand through the ghost image, attempting to make sense of the experience. In some works, a physical object is aligned with a holographic phantom so the contradictory images inhabit the same space. In the seminal work *The Meeting* by artist Rick Silberman, the phantom bowl of a wine glass is supported by an actual broken glass stem.

The ethereal image can feel like a personal vision, compounding the feeling of mystery. In galleries, viewers often point at a holographic image to share it with a companion, only to realize that the companion does not see the same thing, and may not see anything at all, until they align their point of view or even swap places.

Psychologists Dacher Keltner and Jonathan Haidt investigate awe as a moral, spiritual and aesthetic emotion, suggesting that, “Supernatural causality-based awe—as one might experience if they saw an angel, a ghost, or a *floating object*—will be tinted with an ‘element of the uncanny,’ which can be terrifying or glorious depending on the source” (Keltner and Haidt 2003).

Because the holographic image is a floating object built of light, the potential awe-effect on the viewer deepens. In 1972, in the early days of display holography, Robert Schinella’s hologram of a life-sized hand dangling jewels reached out of a store window at the Cartier Fifth Avenue flagship. Crowds and news crews gathered. One passerby even swung at the image with an umbrella, calling it “the devil’s work” (Marion 1974).

When the hologram converts matter into a glowing object, it seems to satisfy the itch to share beliefs, as if a viewer were to inhabit a waking dream that can be experienced by others. As Rudolf Arnheim wrote of Rembrandt van Rijn’s work:

When the source of light is located inside the picture, the meaning changes. Now the life-giving energy establishes the center and the range of a narrow world. Nothing exists beyond the corners to which the rays reach.

Light seems to originate within the object at an indefinite distance from the observer . . . The indefiniteness of the outer surface endows his glowing objects with a transfigured, immaterial quality. (Arnheim 1954)

Light effects similar to what Arnheim describes are woven into holograms. Of necessity, the image glows, drawing our attention to the light. Light is especially captivating in the third dimension, perhaps because viewers focus along the z-axis as the image appears to approach them. The power of the luminous object opens the door to visual representation of abstract ideas. In Jorge Luis Borges' *The Aleph*, the narrator recounts an instant of time when encountering a luminous entity:

I saw a small iridescent sphere of almost unbearable brilliance. At first I thought it was revolving; then I realized that this movement was an illusion created by the dizzying world it bounded. The Aleph's diameter was probably little more than an inch, but all space was there, actual and undiminished. Each thing (a mirror's face, let us say) was infinite, since I distinctly saw it from every angle of the universe. (Borges 1973)

Hologram viewers are primed for the narrative power of a light-form, especially when that light-form defies logic floating in front of the surface on the z-axis—it is as if they see the world in a grain of sand.

3. Image Plane Location in the Lab

One of the basic decisions when making a hologram is where to locate the recording film in relation to the object or imagery being captured. The physical boundary of the holographic film-plane can define three zones where imagery will appear:

1. Behind the plate;
2. At the film plane;
3. Hovering in front, projecting into the viewers' space.

Rosemary Jackson, founding Director of New York's Museum of Holography, summarized the technical terms for the viewer's experience:

A holographic image can project in front of the plate (a real image), in back of the plate (a virtual image), or it can straddle the plate (an image plane). (Jackson 1976)

We will examine these zones one at a time, considering spatial location as it affects how viewers perceive narrative in each area.

4. Behind the Plate

Trapped behind the holographic plate, we find a territory already familiar from *wunderkammers*, dioramas, Cornell boxes², stage sets and the science of perspective. Governed by the right-reading orthoscopic image, its volume obeys all the viewing rules of the world outside the hologram as if looking at a scene through a window or into a box from the position of the voyeur. By locating the imagery behind the film plane, the holographer grounds the recorded scene with an air of authority. The scene behind the plate reflects a moment in that past that has since disappeared. Viewers peek into a window at a space they can never enter and never touch, as if it were a memory.

5. At the Film Plane

When imagery is located on the surface of the recording medium, the hologram takes on a one-to-one correspondence with the world. For one spatial instant, it acts like a photographic plate. In a photograph, the camera lens works by matching each point of reflected light with a point of light on the film (or recording sensor). Although the camera lens re-forms the external image upside down

² A highly innovative artist, Joseph Cornell collaged printed ephemera and found objects into lyrical box constructions. His work and related documentation are archived at the Joseph Cornell Study Center of the Smithsonian American Art Museum, Washington, DC. <https://americanart.si.edu/artist/joseph-cornell-995>.

and backwards, the image is re-flipped into right-side-up and left-right-correct viewing when printed, paralleling the way our brains flip the inverted images that land on our retinas.

In holography, the plate itself becomes many lenses, so we get the added bonus of the pseudoscopic image, not just upside-down and backwards, but also inside-out—a swimmy mold of the recorded scene (Abramson 1981). Holographers juggle technical tricks of the trade by illuminating the plate to study the virtual or real-looking image and then flipping the plate around to see the pseudoscopic image. One dot of laser light on a master hologram of, say, a face re-creates a sharp image from a single point of view to guide positioning for x and y framing. When holographers illuminate an entire master plate, the sharp one-point image turns to blurry soupiness from the scattered light of many points of view merging and seen simultaneously.

At first glance, this haze of the “real image” is a fuzzy mess, although optics terms this haze of light as “real” because the light is a focusable projection. As the holographer moves a white card parallel to a master plate closer and then farther along the z-axis, we can hunt for the focus of, say, a nose, then back away an inch or two to where the eye is in focus, then move the card farther back and hunt for an earlobe. If we put the image-plane at where the eye is in focus, that eye will be bound to the film plane, with the nose poking through the plate.

6. Hovering in Front

Here, light takes on its own form in front of the holographic window, tempting viewers to reach for an image that is not physically there. They fall for the enchantment. At first, they may be disoriented, but then they often are delighted that they cannot touch what they can clearly see.

It can be elusive to judge how far an image intrudes into the viewing space. It is as if tape measures were abandoned at the image plane. What feels like an inch can turn out to be 4” or 5” when measured, likely because the light wavefront reconstructing the hologram may curve differently from the recording wavefront. It is similar to projecting a picture onto the surface of a balloon and then the viewer stepping inside the balloon to see it. This difference in the wavefront may also make the image appear to swing as the viewer moves from side to side to see the depth of the imagery. Imagery in front of the plate appears to slide away from the direction the viewer is moving. As the viewer moves right, the projection appears to move left. Thus, grabbing at the image leaves the viewer with an empty hand.

Both holographers and stereo photographers often avoid the edges of the plate for front-projecting imagery. At the edge, an object floating in front of the window appears to collapse back on to the film plane, tethering the 3-D to the two-dimensional frame. The projected image seems to need air around it to lift it away from the surface. Curiously enough, it appears that this knowledge has not passed to 3-D moviemakers, so we can find many cases where the frontal projection takes on an invisible convex screen on which the sides of a flurry of particles in motion seem to curve away from the viewers’ eyes. For example, as the bats swarm in *Batman*, the 3-D effect is most pronounced at the center, well away from the edges of the screen.

It can be tempting to dazzle viewers with tech wizardry by launching imagery as far as possible off the film plane toward the viewer. However, experience teaches holographers that defining the edges with focus enhances viewers’ depth perception.

7. Narrative

Holographic artist Jacques Desbiens states that “Linear narration is shattered in holography” (Desbiens 2019). The holographic artist may choose to resist the tyranny of one-point perspective. The artist may resign as “dictator of a single viewpoint” and accept the challenge to become a “framer of possible views”. My work embraces this role, leading me to make holograms of ideas instead of things. The author shares a space with viewers. They may combine story elements again and again to yield fresh lines of personal meaning and narrative. By thinking of the hologram as a mirror with a memory, I want to encourage an intimate dialog with narrative depth. With these z-axis thoughts in mind, I worked on three reflection holograms.

There are three women in this hologram, one in each of the three zones for z-axis placement discussed below (Figure 1):



Figure 1. *Speaking Volumes*, reflection hologram, 2001, 20 cm H × 25 cm W, created by author.

Behind the film plane, on the left, grounded in history, an academic view of Madonna in an art book, an idealized woman enshrined for viewing and study, a relic of the past, recalling imposed beliefs and modeling subservient behavior for women.

At the film surface, on the right, the historical image is matched with the living ghost of a woman's face, inhabiting the right-hand pages with her eyes masked. She is visible but is blinded, trapped in the present moment, looming out of the page.

In front of the film plane, the hand of a third woman holds up a magnifying glass that casts a shadow on the Madonna. We see only her hand, but we can peer through the lens, suggesting her careful examination of how the canon served to determine and accordingly oppress the space occupied by this idealized woman.

In *Open book* (reading between the lines), (Figure 2) a pair of holographic plates are mounted in one frame tilted slightly toward each other, like pages of an open book. On the left "page", shredded paper bits are suspended in all three zones of the z-axis, around and inside the baby's head which also occupies the 3 zones, slightly behind the film surface, through the surface and out in front of the plate. The mother lifts her child up into the cloud of floating pieces. The position of her fingers curving in front of the plate echoes the edges of the pages falling on the right side of the diptych.

On the right "page", drops of milk fall in lines just behind the film plane at the top, then on through the pages of an atlas until, at the bottom, they fade floating in front of the frame, approaching the viewer as they fall out of sight. The milk raining through pages of an atlas alludes to ancient searches for a nourishing home in dry terrain.



Figure 2. *Open book (reading between the lines)*, reflection hologram diptych, 2001–2008, 40 cm H × 60 cm W, created by author.

The hologram, *A device for the lifting of gravity (again)*, 2008, (Figure 3) is illuminated by projected light from a security-camera feed to display live, moving imagery of viewers' feet as they walk past the installation. The three-dimensional imagery recorded in the hologram is of animated fire. The combination of the live projection and the animated holographic image allows viewers to "walk" through fire, reminiscent of medieval trials of witches and saints walking through a bed of red-hot coals. The real-time video of the viewer's feet anchors the "now" with the flames licking just behind and in front of the plate, extending the time-based narrative into space. Viewers recognize their feet almost instantly, often commenting "that's me" at the image of their feet lifted to face them at eye level. They scuff their feet and then turn away, looking over their shoulders to make sure their feet follow them. One viewer even searched for the camera at the floor level in order to rub hands together to pretend-warm them in the phantom flames. Such acts of viewer participation show how the spatial flux initiated by a hologram encourages a narrative response.



Figure 3. *A device for the lifting of gravity (again)*, 2008, reflection hologram 30 cm H × 40 cm W, video projection of live security camera, used by permission of David Licht.

8. Observations

I began my quest for narratives in holographic space with big charts, maps, and diagrams of pseudo-scientific phenomena floating in volumes of color. The large holograms and installations enveloped the peripheral vision of viewers with the power of scale. In the three works illustrated here, I seek to fill the holographic space with deliberate, contemplative content on an intimate scale. These works draw on a sensitivity to light in the third dimension to evoke past and present, reaching out for engagement on the z-axis toward the eye of the beholder.

9. Conclusions

At first glance, z-axis decisions may appear to be matters of technique. In practice, however, the holographic plate serves as a boundary with strong narrative potential. A scene with objects set behind the plate evokes distance as being in the past—beyond the reach of viewer influence. Imagery at the plate itself approaches a photographic context, corresponding point-to-point with the world. Sandwiched between the past and future, the plate anchors the viewer in the present moment. Light-forms hovering in front of the holographic plate escape the fixity of gravity and encourage viewer involvement. As viewers reach for the light-form, they cross a bridge to a world of fiction. Weightless 3-D images become messages in a holographic bottle. By tapping into the power that the uncanny light-form can provoke, artists may break a glass barrier between mind and possible futures. Time and timelessness are simultaneously promoted by the holographic artist, who is already shaping a range of possible narratives as the three spaces along the z-axis converse with each other.

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Essay

Holographic Reconstruction of Objects in a Mixed-Reality, Post-Truth Era: A Personal Essay

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Abstract: The ephemeral holographic image is an appropriate medium to express the nature of reality and illusion, an early interest I explored with trompe-l'œil painting. To make a representational hologram, one needs a worthy object to copy, and one that is hand-made by the artist adds to the unity of the work. The resulting copy physically resembles the original, and when both are placed together in the final composition, the material object now has an immaterial, metaphysical presence one could identify as soul. In this paper, I present a recent artwork that exhibits these characteristics, and the theme of *Reality, Truth and Lie* is firmly placed within the current political context. The historical background to my work, relevant aspects of the technical process, and closer analysis of the ambiguities inherent in the hologram are all noted in my narrative, and I add my own personal comments and opinions. One invaluable source has been the published accounts of other artists/holographers who describe their own experience in holography, a medium that fuels ideas rather than being only a tool to express them.

Keywords: holography; narrative art; metaphysical; perception; illusion; political art; mixed reality

1. Introduction: A Pre-Holography Context

In my practice I interweave reality and illusion, truth and lie. I favor the illogical, the primitive, and the mysterious—facets of our existence that oppose the rational and the material. The holographic image is a sculptural entity, a volume of light that occupies space. It is fragile, fleeting, transparent, and weightless; it embodies both the physical reality of the original object and its altered, transcendent state. The hologram is, in effect, both the Real and the Abstract, the body and the soul (Figure 1).



Figure 1. *Anthropos* (2017–18) holograms (blue), clay figures. Detail of work in progress.

The artworks I made in the 1980s included three-dimensional assemblage that displayed little regard for longevity or collectability, as actual process was what mattered, not the end-product. This approach

to making sculptural art was in keeping with the Process Art movement (Artspace Editors 2013) of the sixties that evolved into post-minimalist “sculpture-in-the-expanded-field”, as art critic and theorist Rosalind Krauss (1979) described it. Certain aspects of the movement appealed to me, such as the use of unorthodox materials and the anti-market stance, but I could not accept the call to dematerialize the art object (Lippard 1970) and embrace a conceptual art that depended upon thought and theory alone and not the physical craft of work made by hand. Examples below illustrate two of my early works created with materials similar to those I use in holography today, especially the box format. They also reflect the beginnings of an exploration of themes based on personal experience. I did not actively seek political or social issues for these themes; they entered my life uninvited, as they still do now. In 1967, during the Vietnam War, my husband and I chose to disregard his U.S. military draft notice and we moved from Ohio to Canada. Within the practice of art, as with life, sometimes difficult decisions must be made, and it is necessary to let the Muse guide us.

Woman in White (Figure 2) was one of a series of boxes containing xerox-printed photos and small objects embedded between the transparent layers. A space existed between the transparencies, so when the viewer moved in for a closer look, a shift in spatial relationships caused a slight stereoscopic effect which rendered the image as having volume and even an impression of movement. This is my interpretation of the piece: White is the innocence of my First Communion dress when I reached the age of reason, my nursing uniform, my wedding dress inside a burial piece I created for it on a Lake Ontario beach, and white is the Shroud of Death. This work recalls Dicken’s Miss Havisham in her attempt to freeze time and return to the past, something neither she nor I could do.



Figure 2. *Woman in White* (1980). Found box, dust, photos, spider webs, and mouse bones.

The second work *Replica* (Figure 3) has none of the structural elements of *Woman in White*, but thematically arises from the same intention, an exploration of reality and illusion, this time using painted trompe-ciel. As a studio painter, I often used my own photos as reference for painting landscapes, these being my ideal, ordered version of the world. Walter Benjamin’s essay *Art in the Age of Mechanical Reproduction* gave me a theoretical understanding of the idea of the original and its copy, but what would a large replica of an object look and feel like so I could compare? I found an old door in Toronto street garbage, thinking at least it would be a good exercise in matching paint color. I then attempted to accurately reproduce the door not only as a painted image but as a painted object. Something unexpected happened in that process that influenced the course of my practice.

When I finished and took a fresh look at both door and canvas together, I experienced what I can only call simultaneity. Here were two opposing realities, two states of being, visible together in real time. It was as if a crack appeared in my world, and I had stepped into it. Was that the experience of art? Or perhaps I finally understood a paradox of physics, that matter and energy, body and spirit, could coexist in the same space. This may have been the beginning of my work in holography, or at least the spark that would later ignite the flame.



Figure 3. *Replica* (1982). Found door (left) with painted canvas (right), each panel 63 cm × 165 cm × 4 cm. Collection Butler Institute American Art, Youngstown, Ohio, USA.

2. Entering the Holo Zone

I saw my first hologram around 1983 in Toronto; I do not remember the exact venue, but the image has stayed with me for more than thirty years. *Portrait of Lad* (1982) by Canadian artist Stephen Cruise¹ was a hologram of a small transparent meditating Buddha, his internal rib cage and bones visible in the hologram. This image that hinted of other immaterial dimensions inspired me to master the medium. Cruise recently provided me with details; he produced it at Fringe Research Holographics in Toronto, a lab and exhibition space (Interference Gallery) that was run by artists David Hlynsky and Michael Sowdon. Cruise writes: “At the time the set-up to produce the hologram was the Whole Earth Catalogue method, a big sandbox on inner tubes and mirrors glued to PVC pipes. We did it in the early hours between the passing of the King St. streetcars—their vibrations gave us no picture. I was fresh back from four years away (Korea and Japan) with a pile of sketch books (drawings and collages, one done every other day) and continuing zazen from my practice/study in Tokyo of Soto Buddhism with Nishijima Sensei.” Cruise added an aside in this email to me: “Just googled Fringe Research—it’s the name of a hair salon in the same building at King and Dufferin.”²

After a few workshops and artist-in-residencies, I felt prepared to work on my own. In 1990, at artist Doris Villa’s Hope Street lab in Brooklyn, the holograms I made from small plaster and clay

¹ <http://www.stephencruise.com> (accessed on 6 July 2019).

² Cruise, email correspondance. 6 July 2019.

objects reflected a change in my practice, and for a month I worked day and night, sleeping in a corner of the lab, immersed in this new direction.

3. Exploring Attributes of the Medium: Navigating the Maze of Possibilities

The master/transfer method of making a hologram results in a clearly defined image if recorded from carefully chosen models, and the process offers some flexibility in the lab for positioning this object in space or making color adjustments. During the next stage of building the mixed-media environment, other perceptual elements can be manipulated for additional illusory effects.

The holographic element in Figure 4 floats above the physical bone, behind the plumb line but in front of the photo of the hallway on the back wall, on the same plane as the “economy” plaque. This secondary illusion of distance extends the space, presenting the viewer with another ambiguity and a reminder that photos do not always represent truth. In Figure 5 the holographic image is still behind the image plane, but the figure appears to be behind the photo of a window in the brick wall; a perceptual illusion re-enforced by the viewer’s preconception that the figure must be part of the photo and could never be floating in front of the building.



Figure 4. *Economy Box* (1992), 43 cm × 33 cm × 12 cm.



Figure 5. *Hope Street* (1990), 30 cm × 20 cm.

Artist Martin Richardson noted these visual ambiguities in his own mixed-media work when he combined holograms with photos and actual objects in the same space. He writes: “the holograms provide an illusion of space receding beyond the actual plane of the framed glass; this is immediately countered by the flatness of the photographic image.” He notes how the viewer will accept the content

as 'possible' and finally will accept the illusion. "Needless to say," Richardson adds, "many viewers find this acceptance troublesome. People often reach out and touch holograms to test the reality of their vision" (Richardson 1987). When confronted with opposing facts and ambiguities, viewers either learn to look closer and think about what they are actually seeing or simply choose to ignore disturbing situations as "troublesome".

Public understanding and acceptance of the illusion of holography is less an issue than it was even a decade ago. Both technical and artistic quality of the work has improved, and gallery and museum curators recognize that promoting holography as a medium of light places it in the context of artists James Turrell and Dan Flavin. What an artist deems as art, and whether the public accepts it as art, is dependent on the current value system of the culture in which they live. Art historian Alex Potts (2000) notes that when Neoclassical sculpture of the 18th century was introduced to viewers accustomed only to a two-dimensional pictorial space (which included sculptural relief), they could not adapt to walking around and observing the new three-dimensions. Potts provides a full account of, and a reason for, a very negative public response: aesthetic appreciation was so intimately linked to the formal organization of the artwork that beauty could only be recognized in two-dimensional works with a formal pictorial space. A heap of marble in the middle of the room was ugly and having to walk around this so-called *art* was a further assault on one's sensibilities. Holography may have survived the kitsch-stage in its development, but there still may be the bias as expressed by artist Eduardo Kac (1990): "Holographic art will only earn the consideration it deserves when trained and untrained observers alike can look at a hologram and not be haunted by spirits, specters, apparitions, phantoms, and other supernatural beings of critical discourse". Kac's article is an excellent source for understanding illusion and representation in holography, but it is my view that an artist can use this powerful element metaphorically as a positive force. Whether a work is seen as art or craft is not my concern, and if the "untrained observer" finds delight in the holographic image, that alone may be enough to lead to further thought, further questions.

I am aware of the implications of describing my holographic images as having soul or another dimension; we have not yet found—or possibly lost—the words to describe that part of our nature. There have been times in history when people believed in gods and the afterlife, when painted illusions and the possibility of other realms of existence were accepted. Near Pompeii, Roman Second Style frescoes give the illusion of an exterior garden, complete with walls and openings. There is one theory that because these illusions are painted only on bedroom walls, their function may have been to allow the sleeper to access another dimension—the world of the dead. There is two-way traffic; the spirits of the deceased could enter the rooms and dreams of the living (Owen 1989).

Transitional States (Figure 6) contains some of the holograms from my Hope Street Series. The tone is meditative and dream-like, and the title refers to an electron's quantum leap from one energy level to the next. The final artworks are intimate metaphysical worlds viewed through windows, fragile beings suspended in space, and lost souls in transition. Artist Shunsuke Mitamura spoke of the aura of the hologram that encompassed his experience of working in this medium, "I feel that the creation of the universe, the big bang, corresponds in holography to the moment of meditation in a darkroom when everything stops and the shutter is pressed." Mitamura (1989) views holography not only as an image-making process but that it also functions as a source of ideas, as an "image-stimulating mechanism." He confesses, "I secretly refer to this process as 'holosophy' a compound of 'holography' and 'philosophy'". The hologram, if used by the artist in a manner that reflects his or her philosophy and experience of life, comes close to Art's origin and essence. We are transient, fallible creatures, and our souls pause for a moment in the journey to scratch those marks that affirm the only truth that one can know for certain: I exist. From writer Gabriele Guericco:

Whenever we look at an artwork and try to envision the dimensions of life embedded in its images and form; whenever we think of an artist as a concrete individual as well as a presence in his or her work; whenever we conceive of artistic phenomena as manifesting living qualities and unfolding a sense of humanity, singularity, and identity in the making, we enter

into a moment of consciousness in which and for which art is revealed vis-à-vis existence. (Guerico 2006)



Figure 6. *Transitional States* (2009). Three holograms, each box 43 cm × 33 cm × 12 cm.

4. Returning to the Source: Creating the Original Models

I began making clay figures in the early 1990s, when I worked as a nurse in a hospital in Arizona, just before the start of what the Americans called Operation Desert Storm. The deadline for withdrawal of Iraqi forces from Kuwait had come and gone, and the bombardment began. Televisions carried the play-by-play in the hospital rooms as I went about caring for my patients, and on days off I went to the galleries in Scottsdale to look at art. One day I stood before a small sculpture of a naked man crawling out from a hole in a mound of clay. It was an artwork based on a Hopi creation myth that we are living in the Fourth World, on the threshold of the Fifth. In each of the three previous worlds, humanity was destroyed by destructive practices and wars. In one Native American version, ours is now the Final World.

The lying figure (Figure 7) with one arm crossed over its body had characteristics similar to the Greek Cycladic figurines. Made of inexpensive materials, they functioned as votive objects and as gifts in social occasions. Following this tradition, I cast plaster multiples that became my muses; they sat on windowsills in the sun or lay hidden in a friend's pocket, an amulet that gave comfort to the hand that reached in to hold it. Others were made of clay and fired, and if I wanted to make changes, I made a plaster copy from a mold and recast it. This all took time, and the figures acquired personalities; a hologram made from one of my little people was not merely a copy of a static form. The final transformation of the figure into the holographic image added an ephemeral element to the original object when I placed them together. Through the interface of object and its virtual counterpart, the original was enhanced; it now appeared to have soul. The effect was best described to me in a more technical manner by artist/holographer/friend Jacques Desbiens:

The hologram creates a presence but no substance, except as light and meaning. This object/image ambiguity is fundamental in holography because it creates a tension between real and virtual far more obvious than with any other medium; it is found in many holographic artworks. On the other hand, within your containers and boxes, the illusory images are associated with the real object. Material object + light object. So all objects become ambiguous.³

³ Desbiens, Jacques. Personal email correspondence. 29 March 2019.

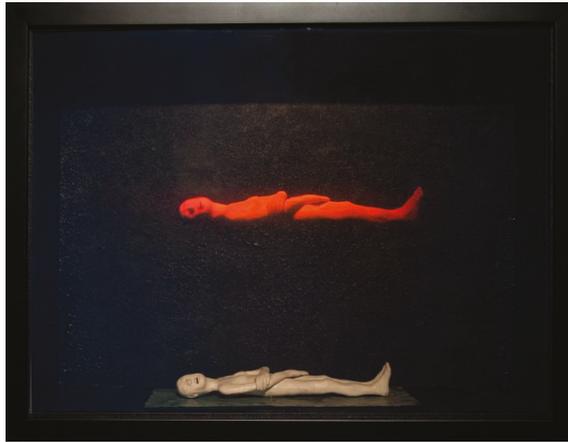


Figure 7. *Body and Soul* (2008). Reflection hologram, in box with model, 40 cm × 30 cm × 10 cm.

5. Anthropos: A Final Artwork

In *Anthropos* (Figure 8), actual figures interact with immaterial holographic ones. The merging of these two states, reality and non-reality, creates an environment all too familiar to an observer of the current American political climate. *Anthropos* is a roman à clef, a story with a metaphorical key, a political representation with irony in the spirit of traditional commedia dell'arte.



Figure 8. *Anthropos* (2017–18), reflection hologram, metal box, 25 cm × 25 cm × 10 cm, clay figures 6 cm.

Inside the metal container, a vintage US Army Ration Kit, there are 10 terracotta figurines and 10 holographic ones. The models for the holograms were clay figures that are allegorical representations of death, one being the danse macabre of the middle ages. The cast of blue holographic characters are all smiling and playful, as if enjoying some great cosmic joke at the expense of the mortals. My point of reference was the description of daimones by the Greek poet Hesiod in *Works and Days* (700 BC); these spirits were sent by the gods to keep watch over human beings to prevent them from doing evil.

The word anthropos literally implies one who is capable of higher thought and could attain the state of moral virtue, arete (Greek: ἀρετή), where full potential can be realized.

Using my clay figures, artist August Muth and his team at The Light Foundry in Santa Fe produced two holograms, and both were installed the following month (June, 2017) at the annual Currents New Media Festival in Santa Fe, New Mexico. My primary intention in exhibiting is an artistic one, to present an effective use of the medium; this was a rare opportunity to present art that referenced a current political concern and to exhibit it so quickly. This meant that viewers could more easily make the connection between the artistic fiction and the reality of the American political scene.

In the first version, the actual figures in the box are the same ones that were used to create the holograms, so they were visually similar. After I had the hologram in hand and Donald Trump had been in office for a year, I made new clay figures which offered a stronger contrast to the holographic images and in turn strengthened the metaphors. The painted figures were personifications of greed, lust, and power. The archetypes included the General, the Church, and the Fool, who, in the medieval Saturnalia, becomes King when the world is turned upside down. The work *Anthropos* references many sources of political theatre and art with a moral message, including a Brueghelian Last Judgment with overtones of the Seven Deadly Sins. Concurrently, I made a small series of paintings that reflected the confusion, anger, and fear evident in the rallies during the presidential campaign and its aftermath, and two of these were exhibited as a diptych next to the hologram *Lost Souls* for the exhibition (see Figure 9).



Figure 9. Installation view, “Currents New Media” (2017), Santa Fe, New Mexico. Left: *Civil Discourse* (2016–17), two acrylic paintings on wood panels each 25 cm × 25 cm. Right: *Lost Souls* (2017), Dichromate Gel (DCG) hologram, 46 cm × 30.5 cm × 5 cm. Photo used with permission of The Light Foundry, Santa Fe, N.M.

The final hologram in this series, *Lost Souls* (Figure 9), features multiple holographic figures looking up from an enclosed space. There are no actual objects, only dream-like virtual images that shift positions and change color as the viewer walks by them. They are the lost souls, collateral damage of our times, an era of intolerance, power, greed, and inhumanity. This artwork acknowledges their presence and records their passing.

In conclusion, artist Ai Weiwei gives us a definition of art that is fitting for our time:

Art is a social practice that helps people to locate their truth. (Ai 2019)

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