Moving through a multiplex holographic scene

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Abstract. This paper explores how movement can be used as a compositional element in installations of multiplex holograms. My holographic images are created from montages of hand-held video and photo-sequences. These spatially dynamic compositions are visually complex but anchored to landmarks and hints of the capturing process – such as the appearance of the photographer’s shadow – to establish a sense of connection to the holographic scene. Moving around in front of the hologram, the viewer animates the holographic scene. A perception of motion then results from the viewer’s bodily awareness of physical motion and the visual reading of dynamics within the scene or movement of perspective through a virtual suggestion of space. By linking and transforming the physical motion of the viewer with the visual animation, the viewer’s bodily awareness – including proprioception, balance and orientation – play into the holographic composition. How multiplex holography can be a tool for exploring coupled, cross-referenced and transformed perceptions of movement is demonstrated with a number of holographic image installations. Through this process I expanded my creative composition practice to consider how dynamic and spatial scenes can be conveyed through the fragmented view of a multiplex hologram. This body of work was developed through an installation art practice and was the basis of my recently completed doctoral thesis: ‘The Emergent Holographic Scene — compositions of movement and affect using multiplex holographic images’.

1. Introduction
A culture of viewing holograms is not well developed. Viewing a hologram is a different activity from that of looking at sculptures, screen images and surface pictures. With a hologram what is seen depends on where the viewer looks, the hologram being a kind of virtual window through which a scene is recorded. As the viewer’s movement is coupled to the recorded visual perspective the viewer’s sense of space and motion extends into the perception of the holographic scene, giving the scene spatial and/or animate qualities.

With a multiplex hologram the virtual window through which the viewer can look around is fragmented, allowing for different perspectives to be mapped into a single scene. I began creating multiplex holograms by hand, using stencils to record stop-motion animations of physical scenes and objects. This work developed into a practice of using sequences of digital images to produce holographic scenes from 200 to 1800 related views. The multiplex holographic recordings were used to explore perceptual dynamics within urban experiences, by mapping the relationships that shaped my sense of place. Each hologram was a composition of re-arrangements and superimpositions of different related perspectives to create a spatially dynamic holographic scene.
With the installations of these holograms I experiment with how the imagery could be unfolded into physical spaces and how viewers tended to move through that space. The main design question revolved around how to establish and utilise relationships between the viewing experience and the spatially-dynamic visual perspective mapped into the scene. To produce an affective relationship or augmentation of motion the holograms would have ideally been larger than the viewer’s body – so that the viewer ‘looks around’ the scene by moving with their whole body. As the cost of producing large-scale holograms was outside my research budget, I explored ways to amplify the viewers’ bodily awareness with my installations. The techniques I developed induced a bodily awareness by limiting some aspects of movement while provoking others – a kind of choreography aimed at intensifying the virtual movement in the scene. These techniques involved:

- Confinement to guide the viewer into the viewing field of the hologram and amplify their sense of movement when exploring the scene.
- Heightening an awareness of gravity, to intensify a sense of balance and proprioception.
- Employing armatures to elicit a particular action.
- Playing on the inherent movement through architectural spaces.

These techniques also informed the type of places I chose to capture as well as the way I moved and directed the camera while making the recordings.

2. The holographic scene
The continuity of visual perception experienced when looking at a trompe l’oeil painting from its encoded perspective point or when looking around a classic holographic scene of a singular virtual volume allows a sense of space to extend through the image surface. The holographic image however has an additional sense of presence that is physically felt as the visual scene is intrinsically linked to the viewer’s movement. Artist Paula Dawson describes laser-viewable transmission holograms as ‘concrete’[1] holographic images because of the way they appear to have a physical presence. An example of this kind of holographic image is Dawson’s triptych installation of large-format holograms, ‘To Absent Friends’ (1989), which captures a bar at three times during a New Year’s Eve party. The holograms form a crystallized memory, three frozen moments of a scene that the viewer can peer around.

Such a visually realistic virtual volume can also be created with multiplex and digital holograms by capturing the scene with a matching camera perspective to that adopted by the viewer. Jacques Desbiens describes such holograms as synthetic holograms as they produce an “illusion of volumes and presence”[2]. As David Pizzanelli outlines in his PhD thesis ‘Aspects of Spatial and Temporal Parallax in Multiplex Holograms’[3] the multiplex hologram allows for the recording and perception of motion as well as volume. The holograms that accompanied Pizzanelli’s thesis follow the tradition of chronophotography, using the hologram to bring together a sequence of frames to represent continuous movement and space. By contrast I draw together different perspectives to produce non-linear structures and virtual movements that never existed physically.

I am interested in how virtual motions can be established by the holographic scene – how a dynamic perspective can be captured with a holographic image. To do this, my compositions often trace the perspective from a mobile body – such as the urban photographer; or are assembled from multiple different yet related perspectives – such as a collective view through multiple cameras.

3. Crossing into the holographic scene
The hologram allows a ‘peering into and around’ another space. This is like looking through a keyhole or from an aeroplane because the viewing window is much smaller than both the space in

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1 A number of installations were produced with multiple holograms or by tiling multiple pieces of film together. However for the most part the compositions were single 30 x 40 cm panels.

2 Such holograms are also know as ‘masters’ as their image can be reconstructed by laser-light and transferred into a ‘holographic print’.
which the body is situated and the space beyond the window. The extension of spatial perception through the holographic window is particularly apparent when looking into a laser-viewable transmission hologram as the holographic image can be very deep. As such, these images encourage a sense of an ‘over there’ that is distinct from ‘here’, where the viewer’s body is.

Holographer Dan Schweitzer, whose background was in theatre and film, made an analogy between the hologram and stage, describing both as spaces where there is a border – a ‘space barrier’ – between the observer and scene. This ‘space barrier’ delimits the accessible and the inaccessible, perceived ‘virtual’ space. Working in a small scale, Schweitzer and his studio partner Sam Moree incorporated miniature figurines into their compositions. In the catalogue of ‘Mehr Licht’ Achim Lipp describes Schweitzer’s figurines:

“At the same time they draw attention to themselves and prepare the observer for the appearance of the holographic image”[4].

The figures are a kind of visual protagonist, establishing the scene, and an avatar that suggests a perspective within the holographic scene. By adopting the suggested act of viewing within the scene the viewer imaginatively crosses the ‘space barrier’.

For the exhibition ‘Explorations of the holographic gaze’ at Gallery 175 in Seoul (2010), I brought together 16 holograms that visually depict the photographic act to emphasise the construction of the multiple-perspective scene. The photographer who appears in these holographic images is a protagonist and an avatar who simultaneously acts as the subject and director of the image. The shared activity of looking – between the construction and viewing – shapes and animates the scene.

In several of the holographic images, including Shadow-waves at Safety Beach, the photographer is implied by their shadow. The shadow’s movement and view is adopted by the viewer.

The sequence of views in Museum Reflection (2006/9)³ are also anchored to a shadow of the photographer, who in this case is looking into the Melbourne Museum through its glass façade. There are two references that establish the holographic scene Museum Reflection: the animated act of photographing as shown by the photographer’s silhouette on the reflective glass surface; and a spatial depth resulting from the parallax between the regularly spaced sequence of seated positions along a concrete block in front of the Museum. Each photographic view optically combines the silhouetted reflection of a building with the view through the glass into a courtyard and reflected again. With the second reflection the building’s spatial form shifts about because of the differences in orientation between the glass panels to produce a gentle cubism. Various readings of space and dynamics emerge as the viewer moves past the hologram. The photographer’s shadow is anchored to the image frame, which causes it to puncture the virtual image-volume established by the parallax – yet the figure is linked to the rhythm of this animate spatiality. The viewer’s movement then creates a connection into the animate scene.

³ The image sequence was photographed and compiled in 2006 but not printed into a hologram until 2009.
4. Movement as a material
The viewer’s agency of movement around my holograms is key to establishing an active engagement with perception. Artist David Hockney considers a sharing of time as crucial for linking the experiences of capturing and viewing:

“And the reason you can’t look at a photograph for a long time is because there’s virtually no time in it—the imbalance between the two experiences, the first and second lookings, is too extreme”[5].

While initially this lead Hockney to disregard photography, he then used the temporal quality of photography to explore an assembled perception through collages of photographs, which he called ‘joiners’. In making the ‘joiners’, Hockney had a rule to never crop the photographic prints, observing that “the evenness of time seems to be tied up with a regularity in the print size”[6]. The visual rhythm of the prints is used to establish a dimension that is temporally reconstituted by the viewer. In making compositions that both encoded movement and require movement to be seen I attempt to evoke a sensational reading of the scene, an experience constructed by cross-referencing the felt and the observed.

The concept that holograms encode a movement through space was compared to a projected diagram of dance steps by Bob de Marrais in 1981:

“A hologram properly viewed is an excuse for TaiChi, requiring you to bob up and down, weave left and right, each artwork having its own implicit set (or sets) of ‘Arthur Murray footprints’[7].

With my compositions and their installation the implicit choreography of the viewer’s movement was developed into a poetic aspect of experiencing the holographic scenes. However getting viewers to actively move when engaging with a hologram is not always easy.

The installation Jumping Jellyfish comprised five jellyfish holograms hung around a trampoline. When the viewer jumped on the trampoline they moved through the holograms’ vertical animation. Not only did one movement more-or-less correspond to the other, the jumping movement was an integral part of ‘playing’ the holographic animation. Participants felt their own ‘squishy’ parts as they watched a similar ‘blobbing’ in the jellyfish. The proprioception of elongating and squishing with each jump was projected onto the jellyfish by the viewer. While the spatial animation is recorded vertically, it is the animate horizontal expansion and contraction that creates a ‘shared’ sense of squishiness. The aim was for the visual to feed the physical (and vice versa) – to evoke an animated vitality that is ascribed to the jellyfish, whose action is mimetically associated to the viewer’s proprioception. Thus a physical-visual feedback loop is shaped by a sense of blobbing.

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4 The Arthur Murray School taught dance steps through mail-order diagrams of footprints.
5 Vitality affects are described by Susan Langer in ‘Feeling and Form’ [8] and Daniel Stern in ‘Forms of Vitality’ [9].
5. Disjunctions, amplifications and transformations

The holographic compositions and installations attempt to extend, dislocate and reveal the viewer’s perspective so that they can obtain a sense of both the overall structure of multiple viewpoints and a sense of the virtual dynamics and shaping of moving between them. The structural relations generated by using the photographer as a protagonist of looking allowed for scenes that mimetically referenced the viewer’s own looking at the holographic scene.

The viewer knows that they are looking into an image (as the photographer knows they are looking into a camera) yet this external perspective is incorporated into an expressive spatial experience. During my image capture for On the Roof the visual distortion of looking into the camera created a vertigo and sense of my feet stretching into a visual void in search of solid ground. I layered multiple copies of the video footage with a vanishing zoom to visually exaggerate these sensations.

The installation of these holograms on the ceiling was designed to evoke a similar vertiginous feeling in the viewing to that experienced during the image capture. When looking up and leaning around to animate a holographic image there is a heightened awareness of proprioception and balance. As one viewer described, “you lean backwards and realise there is gravity” an awareness that I am using to show how activity of looking can shape a sense of place.

6. A multiplex of movement

The multiplex process of producing the holograms is a hidden operation of recording, but one which I have used to reveal how the activity of photography shapes the perceived scene by structuring camera views into movement. By setting up a viewing structure tied to a recording of that view, there is both a looking at and looking with the holographic image. This situates the viewing act within separate but

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6 A Korean National University of Arts student visiting the exhibition ‘Explorations of the holographic gaze’ described her vertiginous sense of looking up at the holograms.

7 Prior to this work, my projects including ‘Hover…’ (2004) were aimed at revealing technical aspects of holographic recording.
linked processes – the act of recording is accessed through its relationships to the activity of reconstruction. While the differences between these processes highlights the activity of each.

While experimenting with the process of multiplexing I came to think of the pattern of captured perspectives as a kind of reference structure that enabled an encoding of spatial dynamics. As the scene is assembled through multiple related perspectives, the viewer becomes dislocated from a single position to inhabit a structure or action of looking.

For the series ‘we’re all looking’ the holographic view is composed from the combined photographic act of a group of photographers positioned in formations that related to the surrounding architecture. The group photographic capture through which the images are constructed is reinforced by the appearance of the photographers in the holograms.

In Figure8 on Drummond Street the act of photographing – a shared action – hinges the viewer to the scene. As the viewer of the hologram moves past the image their perspective seems to hop through each of the photographers, seeing them, seeing the next photographer through their camera and then seeing through this photographer’s camera. The jumps of visual perspective encode a change of position that fuses into a virtual movement. As the viewer moves from side to side the visual perspective moves through a figure ‘∞’ loop, while the effect of seeing through the sequence of perspectives is that of zooming into and out of the image.

At the centre of the image, the visual movement changes direction while the viewer continues to move. This flip is like a momentary feeling of ‘weightlessness’ or a micro sensation of realising you are lost – in that direction loses its vectorial structuring. The viewer feels forces shift within and around them as the expected result of action inverts. The sense of zooming in and out and the inversion of direction in this virtual perspective creates a complex experience of motion.

7. Resonating an experience of traversing stairs
My experiments to accentuate and amplify bodily awareness led me to realise that provoking vertical movement produces a more acute proprioception than horizontal motion due to a vectorial structuring of space by the experience of gravity. I made a number of installations in stairwells, utilising the vertical delimitation of physical space and the rhythm of viewing in moving between steps. The act of stepping is encoded in a staircase, an action that is drawn into the reading the holographic scene.
For a stairwell installation as part of ‘Sommerloch’ in Wuppertal (2010), I decided to record my traversing of different staircases and create a vertically animated series of holograms ‘Up the Stairs’. The initial recordings were made using a Bloggie HD video camera with 360-degree lens attachment that gave a ‘donut-panorama’ view. Each situation was different but all were captured as a single piece of video footage, which was then cut and layered. The layers of video fuse together through the shared rhythm of action – a stepping – activated by the viewer’s own stepping. In the first hologram the pace of the various layers was quite different, while in the later compositions each layer had the same pace.

When installed parallel to the stairs the animate action of the holographic scene unfolds into a suspended act of stepping. While the visual-protagonist climbs through a virtual staircase, the viewer is poised in the action of stepping. A potential act that becomes fulfilled through the image.

The recording for up and down the spiral stairs was made going down and then up an outdoor spiral staircase, my movement guided by both the physical staircase and my view through the lens. In one direction of movement, the footage was reversed for the hologram so the virtual movement always matches the perspective of a moving viewer. Using the Bloggie camera to record the action of traversing the spiral staircase there was both a physical circulation and optical circling due to the lens distortion. In the holographic scene the photographer’s shadow anchors the view so with each step the stairs seem to rotate underfoot. While only a few steps are captured, there is a distinct sense of spiral circulation from the combined moving perspectives, which one viewer described as an Escher-like infinity that seemed to fold in on itself.

8. Conclusion
My holographic scenes are inspired by the activity of moving through and the conceptualisation of urban spaces. The recorded movements along paths and through patterns become entangled with the physical sense of moving around the hologram. This extends embodied cognition to produce an awareness of virtual movement while the dynamics of the holographic scene fold back into the viewer’s sense of a located body.

The appearance of the photographer and camera links a point within the scene to the place from which the scene is viewed – hinging these locations into a structure of looking. As such, there is a simultaneous sense of being at the core of a dynamic scene and standing outside it, reading its diagram of structural shaping. The activities of exploring and recording multiple perspectives coalescence into a dynamic structure of viewing relationships allowing for a complex impression of place and action. The installations enhance the body’s role in this dynamic structuring of a visual impression – an experiential mapping of the scene occurs.

As the viewer moves around the animate scene, dynamics are coupled to their proprioception. This produces an awareness of different bodily sensations that shape the holographic scene. With the Jumping Jellyfish installation there is an internal sense of organs shifting, and the jellyness of what is under the skin. This is quite different from the sense of balance and vertigo that is an important part of
On the Roof and This morning of the balcony reminded me of a dream, different again is the ‘lost’ sensation within a directional inversion of the relationship between physical and virtual movement.

Various activities of looking, 'The Emergent Holographic Scene'. Photographs by Anna Baróthy

The physical negotiation of the installation space by amplifying, mirroring or contrasting the virtual movements and forces of the image becomes part of how the scene is experienced. The encoded movement between the visual perspectives amplifies and transforms the viewer's action, establishing virtual forces that are drawn from and affect a bodily sensibility. In using a visually-depicted protagonist who is at the core of spatial warping, I aim to assist the viewer of the hologram to navigate through the structure of folds and forces, to sense a different spatiality. The distortions of the image are virtual, yet are felt as an extension of movement – pulling, pushing, causing little jumps and folds in the perception of continuity. What emerges from the activity of viewing is a system of relationships, a kind of perceptual physics that is inscribed by the arrangement of relations.

In physically negotiating the virtual movement, an embodied sensibility is brought forward into conscious awareness and contributes to perceptual activity. I am interested in the way that a ‘shaping’ by perception can be carried through the image composition – from the act of capturing to the viewer’s experience of looking. My holographic image installations attempt to draw-out and amplify relationships and forces to express a perceptual construction of experience.

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Further documentation of the holographic image installations is at www.holographics.com.au