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Making a Magic Lantern, Horror Vacui Data Projector

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This paper describes the creative process behind an artwork that combines and projects data in sculptural ways. This projection comes in the form of a reimagined magic lantern device called the *Magic Lantern Horror Vacui Data Projector*. This device is the result of collaborative glass art and electronic art techniques. Central to the projection system are re-envisioned glass magic lantern slides. No longer flat, they are squat six-sided boxes made entirely of glass. These slide boxes are filled with data-representational glass forms through which light is projected. The projected images are emitted from a three dimensional aggregate of data represented by coloured pieces of transparent glass. The appearance of the projection is manipulated by positioning these slides along varying axes through servomotors. Code is being developed to read input from the projection, generate additional data, and control the positioning of the boxes.

1 Introduction

Horror Vacui: In visual arts, it is the fear of leaving empty spaces unadorned. (Ettinghausen, 1979) In science, horror vacui refers to the physics postulate of ‘nature abhors a vacuum’. (Grant, 1981)

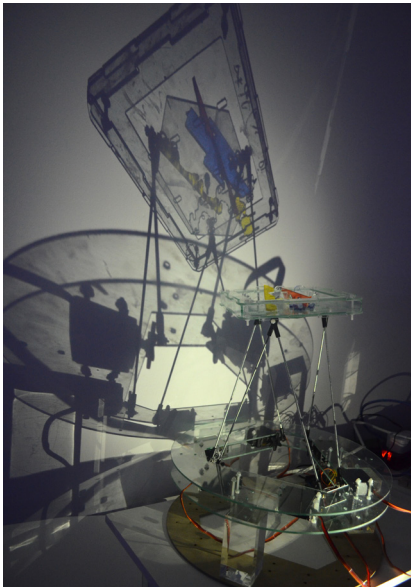


Fig. 1 *Magic Lantern Horror Vacui Data Projector*, 2015, Glass, servomotors, Arduino microcontroller.

The *Magic Lantern Horror Vacui Data Projector (MLHVDP)* uses analogue projection, creative glass and electronic art techniques that integrate and re-process data cyclically using sensors and servomotors. The term *horror vacui* relates to the function and appearance of the device as it is filled with data. The creative benefits of this project are that it combines illuminated kinetic glass sculpture and performative computational modes to counter the usually tacit, inadvertent, and invisible process that data undergoes as it is transferred through networks.

The projector uses clear and coloured glass segments to represent data. The transparent pieces, placed by a projectionist, connect and overlap in the visual arts sense of horror vacui; a fear of empty spaces. These palimpsestic shapes are seemingly indecipherable at first. While the data forms may seem arbitrary and practically unintelligible, they will be entered into a system that reads and re-interprets their shapes and imagery. The tension caused by this abstraction and organisation relates to Ettinghausen’s description of managing chaos through tessellated tiling techniques in Islamic art.

Each unit is then completely filled with a design, or at least as close as possible. Although the motifs are now repetitive, the horror vacui is again managed in an esthetically satisfactory manner. (Ettinghausen, 1979)



Fig. 2 *Glass Slide Box with data projection*, 2015, Waterjet cut fusing glass.

The ‘satisfaction’ Ettinghausen describes in relation to tiling motifs, here, relates to the mediation of data by a projectionist who collates and illuminates the information by arranging and constructing interlocking 3D glass shapes inside of the boxes. The way that glass represents data is through colour-coding; assigning each colour and shape a category and value. This data is being collected from weather and location tracking sensors through a collaboration with researchers at The Centre for Doctoral Training in Cloud Computing for Big Data at Newcastle Science Central.

The main objectives of this paper are to demonstrate an alternative to familiar modes of data display by screen-based computing devices and to extend creative collaboration between glass and electronic art. The aims supporting this objective are; to reinterpret artistic precedents as inspiration for developing an analogue, manually interactive and multidimensional system of

data representation and to develop code to govern the operation and interpretation of the device.

2 Influential Artworks



Fig. 3 *Raree Show*, 2009, Bradbury, Hornell, NY, USA.

The *MLHVDP* draws upon processes used previously in the authors' respective art practices. Victoria Bradbury has combined antique magic lantern technologies with digital/analogue projection and personal data with performativity. Mark Hursty has implemented pressed glass and waterjet cut glass techniques through creative and innovative applications. The *MLHVDP* is also influenced by Fabio Lattanzi Antinori's *The Obelisk*, 2012 and Semiconductor's *Data Projector*, 2013, both of which combine sculptural elements with data. Finally, Joseph Cornell's 1936 found footage film, *Rose Hobart*, is related to this project as an art historical reference.

In *Raree Show*, 2009, Bradbury live-projected 116 hand-drawn magic lantern slides using a 1940's opaque "Radiopticon" projector. The imagery appeared on a screen on the side of a sculptural circus wagon. The performance portrayed alternate outcomes of networked culture paired with financial collapse. The use of magic lantern techniques and slide performativity in *Raree Show*, 2009, influence the use of analogue slide projection in this new project.

In *Data Raft*, 2014, Bradbury created a forum for gallery visitors to retrieve and re-contextualise their personal data. Code and making processes were used to transform email metadata from intangible and private to tangible and public. A participant built a stick raft, attached a bespoke computer embroidered sail with their select data points, and set the vessel afloat on pools installed in the gallery.

This work underlines the performativity of the programmatic processing that data undergoes online. Data points are frozen in time as they are removed from the browser and embroidered on the sails. While engaged in a hand craft process, participants are temporarily unable to use their mobile devices to unconsciously generate additional data for the network. *Data Raft*, 2014, led to *MLHVDP*, which aims to abstract data through projection and sculptural means.

Central to the *MLHVDP* are the transparent glass slide boxes. These boxes, and the methodology behind their creation, emerged from Hursty's work with waterjet cut transparent pressed glass moulds in a series called **Puzzle Boxes**, 2014. In that on-going research, the one-time use boxes are filled with molten glass and then pressed with a central glass plunger, which fuses all of the elements as one object. The mould-pressing process itself illustrates horror vacui as the mould's voids are completely filled with glass. Using hot glass also resonates with Edward Grant's



Fig. 4 *Data Raft*, 2014, Bradbury, Sunderland, UK.

description of ancient horror vacui experiments, most notably with burning candles.

“Amongst the most striking illustrations that nature abhorred a vacuum were those employing fire and heat.” (Grant, 1981) The boxes were conceived to replace, in a didactic sense, opaque metal press moulds, so that practitioners can see how the molten glass behaves as it fills the mould crevices. The significance of this grew as fusing a mould into the finished object changes how that mould can be perceived; from a temporary apparatus to an essential component of the finished artwork. This methodological problematising of ancient craft precedents is also at work in the *MLHVPD* through reinterpreting projection devices and data display.

Fig. 5 *Puzzle Box Press Molds*, 2014, Hursty, waterjet cut fusing glass, Glass Art Society Demonstration, Chicago, IL, USA.

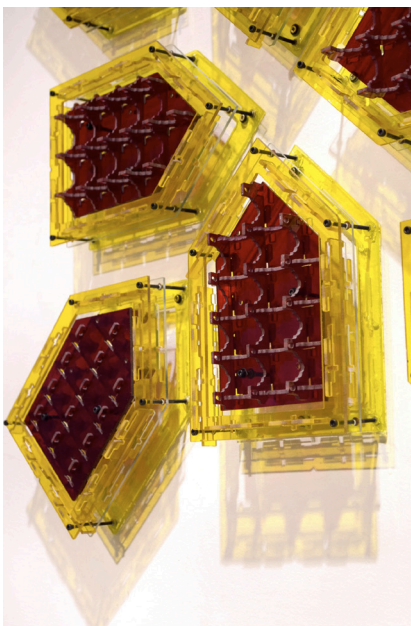
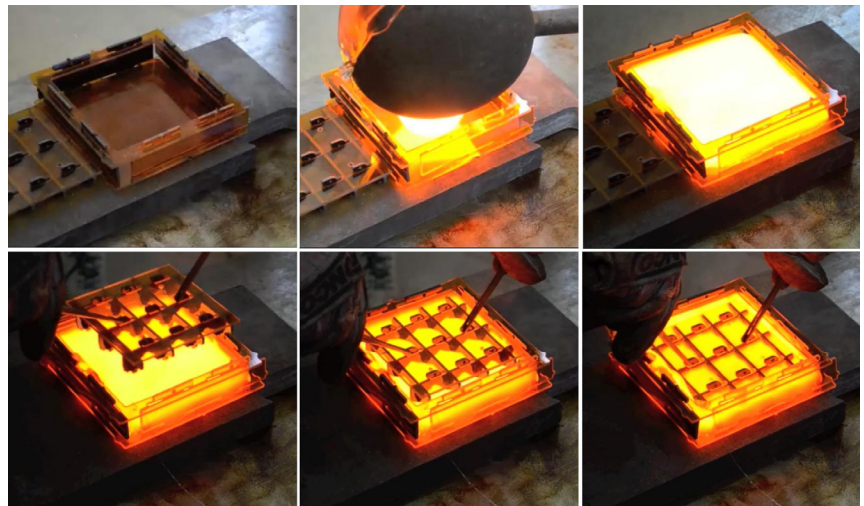


Fig. 6 *Puzzle Boxes*, 2014, Hursty, Shanghai Museum of Glass, China.

The process of making melting glass boxes requires complex glass-to-glass joinery with no metal fasteners. This is because the coefficient of expansion (COE) of glass is different than that of most metals. The negative result of differing COE are cracks where the different glasses or metal fasteners intersect and join. Where fasteners were needed for the *Puzzle Boxes*, they too were made out of glass so that they would also melt into the final box. Such complex joinery led to the title of *Puzzle Boxes*. Assembling them was like manipulating Chinese puzzle boxes, wood or ivory puzzles that were exported to the West in the nineteenth century.

While experimenting with molten glass and exhibiting the *Puzzle Boxes*, it became apparent that the boxes themselves acted as miniature projection devices. With only natural light as a source, they were like opaque projectors with light transmitting through their structural elements and projecting compelling detail on nearby surfaces. This discovery sparked the idea to use the boxes as the basis for a system of analogue projection. The *MLHVPD* for sculptural data projection is the first result of such a system.



Fig. 7 *The Obelisk*, 2012, Fabio Lattanzi Antinori.

Fabio Lattanzi Antinori's *The Obelisk*, 2012, serves as a precedent for pairing data with a sculptural glass object. Here, data, based upon a live feed of news stories about crimes against humanity, controls the levels of opacity of a box. The box is made of sheet glass (or Perspex) and electrochromic film, which changes from opaque to transparent depending upon whether electrical current runs through it. The streaming data causes each side of the box to independently alternate from opaque to transparent. This creates variable views of how the box and the sculpture behind it can be seen. Connections can be made between the clarity of the boxes' facets, war crimes, and levels of awareness raised by their reported descriptions in the media. Whereas *The Obelisk*, 2012, is static and is viewed in both transmitted and reflected light, the slide boxes in *The MLHVDP* are physically in motion and depend on transmitted light to be projected.¹ The formal difference between the two approaches is that Lattanzi's work is encountered by looking at the glass box directly, while Hursty/Bradbury's is meant as a type of lens that directs and focuses light elsewhere.

Fig. 8 *Data Projector*, 2013, Semiconductor.



The art duo Semiconductor, Ruth Jarman and Joe Gerhardt, created *Data Projector*, 2013. This piece offers a creative example of integrating digital projection, sculptural forms, and data processing. It uses data gathered from a forest, charting the tree canopy from the vantage point of an observation tower over the course of a year. According to the artists, "There's a sense of the hand made at work; the clunky tower and the hand-made carbon paper, suggesting the presence of man as observer trying to make sense of the world. Yet, there's also a precision which comes with the data, bringing structure and rhythm and creating a sense of complexity to what we see and hear. This conversation between analogue and digital plays with the divide between how science represents nature and how we experience it." (Jarman and Gerhardt, 2015)

¹ A concise distinction between the transmitted and reflected light follows in this example from microscopy. "A trans roscope mitted light michas a light source below the microscope stage and sends light upwards towards the sample and up to the viewing point. A reflected light microscope has a light source above the sample and what is seen though the view point are light waves that have reflected off the sample."

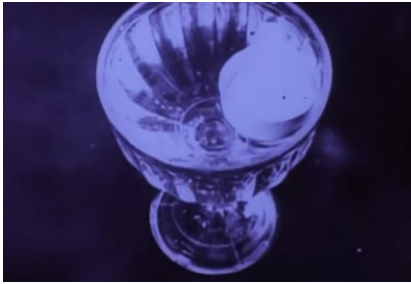


Fig. 9 *Rose Hobart*, 1936, Joseph Cornell, found footage film.

² In 1936, Cornell debuted *Rose Hobart* at the Julien Levy Gallery in New York City. His film, the footage for which he scavenged from destruction, drastically re-edits the feature film *East of Borneo*, 1931. This recontextualisation of *East of Borneo*'s subject matter was emphasised by Cornell's choice to project *Rose Hobart* through a tinted piece of blue glass. In the audience at the gallery were André Breton, Salvador Dalí and other contemporaries who were participating in the MOMA's first surrealist exhibition of 1936. Dalí's absurd, and apparently jealous, reaction to the film was to knock over Cornell's projector and call him a thief. Dalí claimed to Levy that, "My idea for a film is exactly that, and I was going to propose it to someone who would pay to have it made... I never wrote it or told anyone, but it is as if he had stolen it." (Solomon, 1997)

The structure, rhythm and complexity Jarman and Gerhardt mention is emphasized in the unusual, round-shaped projections that are a result of recording the forest canopy in 360°. The *MLHVDP* also uses attributes of analogue construction. Its structural apparatus, the slide boxes, serve as an architectural framework in the way that the wooden observation tower does in Semiconductor's piece. In the *MLHVDP*, however, the architectural components also function as a lens for the data and as the data itself. The result of this condensed form and function are projections that are asymmetrical rather than rectangular, as in familiar modes of data display.

Rose Hobart, 1936, is a pioneering found footage film by the American surrealist artist Joseph Cornell. The film was significant as a new way to gather, process and project film. This significance is reflected in the creation and use of data in the *MLHVDP*. Also influential to this new work was a notorious incident that occurred the first time *Rose Hobart* was shown.² During the film's debut Salvador Dalí knocked over the projector and accused Cornell of stealing the idea of found footage film from Salvador Dalí's subconscious.

Several aspects of the *MLHVDP* are summed up in this incident. First, Cornell's unorthodox use of collected and re-edited footage offered a new way of seeing and reading the content. Found footage filmmaking can be compared to physically salvaging data then reorganizing it, reinterpreting it, and re-projecting it; even down to reorganizing the mechanics of projection in order to obtain a new understanding of the material. Second, when Dalí knocks over Cornell's projector and claims that Cornell stole his subconscious idea, the projector becomes a proxy for Cornell himself. Dalí's violence is directed toward the mechanics of the projection. This mediates the ramifications of content on the projectionist, with violence directed through the projection device.

The essential dynamic of this relationship is re-performed by the *MLHVDP* in a loop of data collection and visualisation that has been abstracted, projected then reinterpreted through code. With respect to who collected the data and how (the researchers through sensors), and who abstracted the data and how (the authors through projection), this dynamic emphasizes a creatively constructive and malleable view of attribution.

The above artworks represent different approaches that are reflected across the iterations of the *MLHVDP*. Like the *MLHVDP*, their combined methods problematize the mechanics of projection, challenge orthodox screen-based modes of data display, and serve as a provocation for how data can be collected and processed.

3 Developing the Magic Lantern Horror Vacui Data Projector

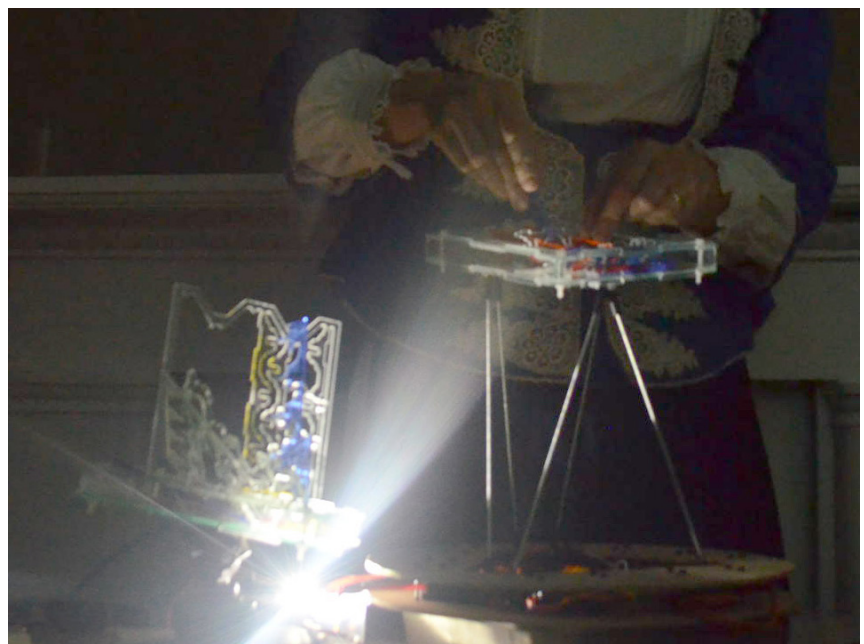
3.1 Making the Projector

The *MLHVDP* has been developed through a series of steps. The glass was designed, cut and constructed at the National Glass Centre at the University of Sunderland; the projector was performed at Gateshead Algorave #2; it was exhibited through Gateshead Arts and it is being further developed through the use of site-specific data.

The glass components of the projector base and slide boxes were constructed through waterjet cutting. The slide boxes were assembled atop a transparent Stewart platform to allow light to pass through. In this way, the light source could be placed either above or below the motors. If placed below, the mechanics of the base are projected in addition to the glass boxes (Figure 1). The platform has servomotors at the base, which are programmed through an Arduino microcontroller. At the Algorave, this kinetic work was performed live as Bradbury added and subtracted transparent coloured pieces within the glass box. A variety of light sources were tested to project through the glass onto the walls of the performance space.

Observations from the Algorave performance indicated that the projection is most complex and engaging when the glass boxes are filled with three-dimensional glass objects, which can be turned in space and evaluated from different vantage points. In comparison, a flat slide can only be viewed in one way. Tunnelling light through these transparent structures presents the edges,

Fig. 10 *Magic Lantern Horror Vacui Data Projector*, Performance, 2015, Gateshead Algorave #2.



three-dimensionally. The movements of the projected image are visually similar to toggling 3D computer rendered objects in virtual space.

Next, the authors are working with the cloud computing researchers who are providing weather and location tracking data sets that are specific to the city of Newcastle, UK and the building in which they work, The Core in Newcastle Science Central. As this collaboration develops, the researcher's data sets will serve as inspiration for how data can be encoded within the coloured glass structures, and, in turn how their projections can be decoded.

3.2 Properties of the Projector

The visual properties of glass that underpin the MLHVDP are clarity and uniformity of colour. If these qualities are used creatively, light can be transmitted through glass in stimulating ways that transcend its material reach. The physical properties of glass that underpin this device are that it is electrically inert, inflammable and archival. When the glass is projected, then read and re-interpreted by code, the enticing properties of glass, code, and data integrate and expand into new forms. These forms, unless broken, are permanent. Unlike digital archives, they will not degrade over time.

The glass data forms are encoded and decoded as they are projected. This coding process is twofold. The first stage is projected light in the form of a bespoke overhead projector. The slide box can be projected flat like a conventional slide, but it also has the range of motion to be rotated and tilted for 3D views. As it moves, variable perspectives of the sculpture illuminate the space. The goal of the second stage, which is still under development, is to create an algorithm that will read and interpret visual information from the projection, then re-position the slide box to frame certain vantage points.

While data is now predominantly considered and viewed in digital ways, Sara Diamond emphasizes its fundamental analogue nature when she states, "Data can be numbers, words or images. Data can be collected manually (as it has been for centuries), and then put into a computer." (Diamond, 2009) The *MLHVDP* returns data to an analogue, material state, contrasting this fragility and traditionally static nature of cold glass with the ephemeral, malleable nature of both data and projection.

The re-envisioning that this piece enacts allows us to apprehend multiple views of the 'data', a process that would normally be abstracted and highly obfuscated. These multiple perspectives could be helpful as a tool to visualize abstract data as concrete interconnected objects. What might be obvious in one view, may

present nuances in another. One example of this is seen in the edges of the boxes where the glass ‘data’ appears within dark contour lines. These lines maintain the projected illusion of turning an object in space. The advantage of this is that the data is made less abstract as it becomes a consciously sculpted, tangible object that is then re-abstracted for further interpretation through projection. This re-projection reflects a constructive distance from which the data can be evaluated.

4 Conclusions

This paper describes the artistic development of an analogue projection device for visualising data. The diverse influences include equating data collection with the horror vacui, or nature’s abhorrence of a vacuum; an altercation between Salvador Dalí and Joseph Cornell concerning attribution of the invention of found footage film making; the revival and reinterpretation of magic lantern projections and pressed molten glass; and the creative performativity of sculptural data. These coalesce in order to address contemporary questions of data attribution and generativity in a collaborative interdisciplinary artwork.

In further iterations of the *MLHVDP*, additional modes for interpretation of live-generated data may abrogate the horror vacui. This could mean that the device thereafter can be simply referred to as a “Magic Lantern Data Projector”. Anticipating that development will hinge on the effectiveness of the motorised slide platform and the light source in concert with the artist-written software.

The purpose of the *MLHVDP* is not only to present a new aesthetic to the portrayal of data, but also to offer potentially productive new techniques to the fields of new media and glass art. This new combination of modes arose by problematizing and performing a process of projection, obfuscation, and re-interpretation of data through a collaborative artwork. The resulting dynamic is intended to rethink staid representation, not only by what is projected, but also by the way each medium is perceived. In the case of new media art, these results could yield new ways to view data through analogue projection and sculptural means. This multidimensionality could also serve to expand and diversify the appeal of glass art and glass slide projection, not merely out of a sense of nostalgia for manual participation and material specificity, but as innovative and content-generative media in their own right.

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