And Travelling Often In The Cut We Make: Diffracting Art and Archaeology Practices

by

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And Travelling Often In The Cut We Make explores a performative and relational approach towards the use of digital imaging technologies such as Reflectance Transformation Imaging, Structure from Motion, and Fused Filament Deposition printing.

Through a series of iterative artworks, exhibitions and writings created over an eight-year period the research explores the entanglements of technical images and materiality. Drawing upon a diffractive methodology the work chronicles a continuous collaboration between artists and archaeologists which interlaces different theoretical, methodological, and disciplinary practices through one another; like overlapping ripples, to co-constitute productive situations where the effects of difference appear.

And Travelling Often In The Cut We Make takes its title from Ralph Waldo Emerson's poem Blight (1899) which bemoans the pervasiveness of new scientific methods in relation to innate experiences inside landscape itself. This seems to aptly raise the phenomena of Karen Barad's agential cut which rather than marking an absolute separation proposes a cutting together/apart. The iterative nature of the artistic practice which underpins this body of research sees Dawson re-turning to this cut to perform it differently so that the environments where people and digital imaging meet cannot be disjoined from the mediations that occur within them.

And Travelling Often In The Cut We Make: Diffracting Art and Archaeology practices

Ian Dawson

Commentary

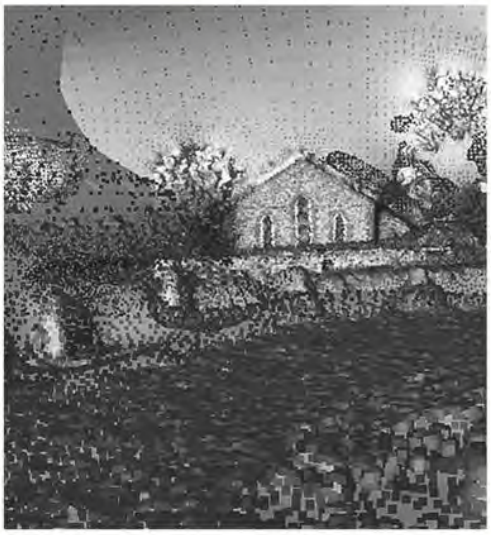
Ian Dawson RTI RTI 2017 (performative RTI, Annihilation Event, Lethaby Gallery, London)

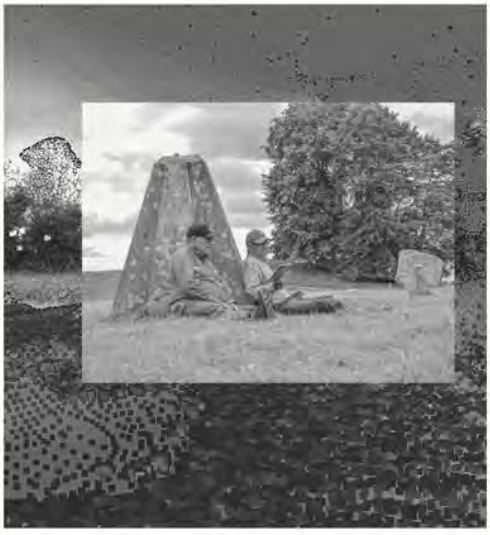
Introduction

This research represents a multi-stranded, collaborative, transdisciplinary body of work. This comprises both physical and digital items created through collaboration with archaeologists, artists, and curators. The body of work includes multiple iterations of artworks, exhibitions and texts. The research submitted spans an eight-year period from 2014 to 2022. Due to the interdisciplinary and emergent nature of the research 9 outputs have been attached in the appendix. All these works should be viewed as having an interlaced relationship between each other, however for the benefit of this commentary11 research outputs have been organised together which will act as a metonym for the larger body of work.

The submissions have also been separated into two strands, the first of these is called *Annihilation Events* and includes exhibitions and artworks variously staged as *Taplow House (2015), Pictures Not Homes (2017), Gestures of Resistance (2017)* as well as artworks presented in the exhibition *Annihilation Event (2017).* This strand also includes the book chapter *Dirty RTI* (2020). In this first strand synthetic imaging technologies such as Reflectance Transformation Imaging (RTI) are explored in various situations giving rise to questions about how one might re-conceive relationships between space and representation. Here the nature of a technospace is explored, taking this term from Frederica Timeto (2015) who describes the technospace as the dynamic environment where humans and machines intersect. A key part of the research resides in the performative methods applied whereby representation is not refused but instead rehearsed and re-enacted in reciprocity with the technospace itself. This puts into practice the theoretical position that Timeto raises when describing the structure of the technospace as ‘a dynamic and contingent formation whose emergence cannot be disjoined from the generativity of the mediations that traverse them’ (Timeto 2015, 1)

The second strand, titled *Phygital Assemblages* continues to explore archaeological and cultural heritage imaging practices. In this strand images and objects also participate in the unfolding of technospaces and continue to emerge from remediated and performed positions but the emphasis shifts towards following the movement of matter between physical and digital states. This is described as a phygital nexus, less of a 'site' and more of a 'state' where objects mutate, shift, disperse, colonise, and rematerialize in new complex and unforeseen relationships. This strand charts various iterations of predominantly 3D printed sculptures in various guises (*Old Minster (2018)* and the *Metalithic Sculpture Series (2019-21))* including the curated exhibition *The Wanderer's Nightsong II (2015).* These exhibitions are accompanied by two texts, *Messy Assemblages, Residuality and Recursion within a Phygital Nexus (2019) and Track and Trace, and Other Collaborative Art/Archaeology Bubbles in the Phygital Pandemic (2021)*. Both texts situate the work within the 'material turn' and a post-discursive stance influenced and guided by numerous scholars of new materialism (e.g., DeLanda, 1997; Barad, 2007; Bennett, 2010), who refer to a much broader *material* ontology of subjectivity.





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Dawson and Minkin, Avebury from Interstitial Images (2021)

Aim of the Research

And Travelling Often In The Cut We Make represents a complex, collaborative, and sustained undertaking. Its iterative process has tested and re-tested various notions relating to material practices. In *Annihilation Events,* field trips with archaeologists to study portable lithic artefacts across the UK are crucially hinged with an artistic residency on a South London Housing Estate which becomes a site to warp and bend those archaeological and cultural heritage methods. By drawing together the research in *Annihilation Events*, the following questions can be identified to have guided the project:

- By *diffracting* the formal techniques of archaeological digital imaging through a creative practice, what differences are exposed and how can these differing practices and approaches enrich and inform each other? Crucially, the aim is not simply to adapt techniques from archaeology to art practice, but to establish a new, shared discourse that allows for an interdisciplinary and critical interrogation of the methods, modes, and affordances of digital imaging.
- Under the artist's gaze, what happens to the supposed fidelity of the new digital imaging, and through dialogue with archaeologists, physicists, and other practitioners, what contribution can this make to our understanding of object making and new materialism?
- How can critical approaches and creative practices inform the future 'reading' of digital imaging across disciplines most notably within archaeology and cultural heritage?

In *Phygital Assemblages* the collaboration with archaeological practice creates an ever-growing bundle of physical and digital art/archaeological objects. At one point in this strand a recovered reconstruction of the Anglo-Saxon Old Minster Cathedral in Winchester is appropriated, remixed, and remediated through various processes to test the possibility of uncontrollable mutations, glitches and other accidents of context or reproduction. In this instance objects travel and oscillate along various axis, from containment to exposure, enchainment to dispersal and from colonization to dissipation. *Phygital Assemblages* explores a wide range of insights, findings, and emergent properties, which have been continually reflected upon and drawn back into the process of enquiry. Several high-level insights or findings can be highlighted from this strand.

- *Practice Research as Assemblage*: In exploring the notion of assemblage through deliberately practical, cross-disciplinary material means, the collaboration of artists and archaeologists itself is revealed through a form of assemblage. As worked through a range of (im)material entities, this has been shown to be an emerging, dynamic, and an intra-active conversation involving many actants. The focus and meaning of this conversation are contingent on the shifting relationships of all actants which unfolds over time. These include the developing intentions of the makers involved (both archaeologist and artist), diffracted through distinct and combined practices, the materials worked with, the application of modes of perception and expression, and various instruments of inquiry and presentation. Crucially all are agential participants and co-producers in this collaboration. In the use of digital imaging technologies, the signatures of all the main actants and their intra-actions have been auto-archived interstitially as aesthetic paradata within this assemblage.

- *Sociomateriality Research*: The field of sociomateriality (as informed by the debates of new materialism) is an enquiry into how we interact (and come into being) with the material world, sociomateriality is concerned with the affordances in and between material processes, technology, and objects. It necessarily seeks to break with discursive methods, but, to date, this area of research is still primarily accessed via textual, theoretical accounts. To change approaches to knowledge it is necessary to develop and apply new methods, otherwise we remain within a hermeneutic loop. *Phygital Assemblages* contributes specifically by applying a *practice research* approach towards working directly with materials, showing this as a *requirement* of sociomaterialist research.

- *Digital practices and cultural heritage*: the sustained testing and adapting of the underpinning digital imaging techniques has helped consolidate key knowledge and skills for future applications. Borrowing from the feminist scholar Barad (2007), this body of research refers to this as a *diffracting* of formal techniques across

different disciplinary lines. In this case, archaeological methodology and digital imaging have been applied across an artistic practice of 3D imaging and printing. The 'assemblage practice' has led to new projects: (1) a long-term collaborative project with Blackfoot Elders and a team of researchers at University of Lethbridge (Canada), which draws upon 'phygital' practices to skill share and provide virtual access to historical Blackfoot objects held in British museums (a project supported by Canada's federal 'New Frontiers in Research Fund' and also the *Concepts Have Teeth, And Teeth That Bite Through Time: digital imaging and Blackfoot material culture in UK museums*, the AHRC network funded project; and (2) an artist residency for a project led by Bath Spa University, 'Rethinking waste and the logics of disposability', which focuses on the heuristic knowledge politics of the informal waste management industry in India, in the 13th Compound in Dharavi, Mumbai's largest informal settlement.

Dawson and Reilly, 2020 Dirty RTI performance in a plastic studio

Diffraction

Taken Literally diffraction describes the scattering and breaking apart (*diffringere)* of light as it bends around obstacles. This is one of the overarching themes of the research as a whole and is returned to at successive points either in practice or methodologically. Diffraction describes the interference of light waves when they hit blockages and it is the images that are created by this interaction of light with these secondary sources that resonates throughout the project. Diffraction patterns were first observed in the seventeenth century as the effects of light passing through a medium were discovered and latterly studied in relation to quantum mechanics.

Physicists and philosophers have further explored the important implications of diffraction patterns since the quantum experiments by Heisenberg and Bohr in the early twentieth century. The Physicist Carlo Rovelli (2017 & 2020) describes his own experiences of witnessing a quantum superposition experiment, when two contradictory properties are present together, pointing out that one does not see a 'superposition', it is the *interference* of the consequences of the experiment that is only ever visible. In the 'which-path' experiment constituting a laser and two pathways of prism mirrors, Rovelli describes his confusion at trying to describe and understand how photons of light can be in two positions at once or completely absent, these different positions being entirely dependent upon how the experiment has been observed.

'What does a particle care if we are observing it or not?' Rovelli muses in his support of a 'relational' interpretation of quantum theory and the interference patterns that it creates. The scientist and their measuring equipment are *all* part of nature in a continuous interaction thus for Rovelli, diffraction patterns are a way to describe how one physical object manifests itself to any other physical entity. "Any interaction between two physical objects can be seen as an observation. We must be able to treat any object as an 'observer' when we consider the manifestation of objects to one another" (Rovelli 2020; 69)

This folding of the observer into a more entangled and complex relationship echoes that of Donna Haraway's (1997) application of diffraction as a way to break from methods of reflexivity. She argues that

the traditional reflexive loops of researcher and researched mirrors the geometrical optics of reflection and that it only serves to displace the same elsewhere (Haraway 1997: 273). She proposes that diffraction, through its tracing of dissimilar situations can make *difference* visible, thus counteracting the preferencing of sameness that occurs within any two-way reflective approach. "To make a difference" she says we should seek "to diffract the rays of technoscience so that we get more promising interference patterns on the recording films of our lives and bodies" (ibid.:16). These themes are enlarged upon by Barad who, as a physicist, seeks to account for diffraction as more than a metaphor, when arguing that diffraction patterns are patterns of difference that make a difference. "Diffraction not only brings the reality of entanglements to light, it is itself an entangled phenomenon" (Barad 2007 P73). Taking Rovelli's and Barad's relational interpretation of the which-path experiment and the images of difference that it creates *And Travelling Often In The Cut We Make* also seeks *to be* diffractive by drawing *through* techniques and concepts within the different fields of contemporary art practice, cultural heritage, and archaeology. Acting as an interwoven assemblage to highlight the importance of the performative, non-representational and relational not just in the formation of knowledge but of the making of the subjects of knowledge. (further details on diffraction can be found in the chapter "What is a Diffractive Image" (Dawson et al 2021))

Reflectance Transformation Imaging as Diffractive Practice

In *And Travelling Often In The Cut We Make*, one example of the use of diffraction can be found in the extended experimentation with the archaeological imaging technology of Reflectance Transformation Imaging (RTI). RTI is a synthetic two-and-a-half-dimensional image fabricated through the extraction of light information taken from hundreds of digital photographs. An orthodox RTI is created by using a Digital SLR camera, fixed in a static position upon a tripod and remotely tethered to a portable light source such as a flash. Sequences of photographs are taken whilst the lighting conditions between each shot are incrementally altered by tracing an arc or dome around the subject. Requiring a 'set', it is a technique that sits somewhere between *making* a photograph and

a silent movie whereby a sequence of actions is composed, framed and recorded. However, unlike moviemaking where the performative action mostly happens in front or behind the camera, the action here is situated in between the frames as the light source is moved after each successive *cut* of the shutter.

For archaeologists the compiled RTI images are commonly used to facilitate a chaine-operatioire analysis of objects. This adds to a processual understanding of the object in view (Jones et al 2015) The RTI image in itself is a processual artefact; the software output is a PTM file (a polynomial texture map) which remains interactive and enables subsequent viewers the opportunity to re-enter, review and re-manipulate the lighting conditions within the scene (see Dawson et al 2021c) Furthermore the shadows that surround any scene act like classic diffraction patterns and as such are the material trace which make visible the operational sequence of the gestures and actions of the practitioners producing the RTI images. Thus, RTI's can be de-constructed to reveal stimulating space-time diffraction patterns in which 'different times bleed through one another'. (Barad 2017 68). This ability for RTI to be 'volatile' (Beale 2018) enables the images to be thought of as 'images in the making' (Back Danielsson and Jones 2021, 5). This term is used to comprehend RTI images as ongoing events, RTI as an 'image in the making' has a condition of possibility inherent within it. RTI can be thought of as a gestural mark, 'where futurity and presentness coincide, to invoke the memory not of what was, but of what will be' (Manning 2016, 47)

In *And Travelling Often In The Cut We Make* RTI was first adopted as an experimental process inside Taplow House, a derelict south London estate in 2014. In response to the evocative architectural spaces of the housing estate, RTI, was stretched to document more than flat textured surfaces and instead these "Dirty RTI" image files began to capture the conditions of their own making within them. Thereafter RTI was performed in various settings including workshops and events so that all aspects of the process could become visible from the construction of the RTI images to the subsequent mediation and remediation of these images which become a representation of a different kind. This performative and productive status of RTI imaging invokes Karen Barad's (2007:3) term:

'mattering' in which the material world and its meaning are co-constituted by reiterative practices.

Dawson and Reilly; experiment with RTI as auto archiving paradata (2019)

Marta Diaz Guardamino making a presentation in front of a reconstruction of the Partially Buried Woodshed WSA October 2015

The Core Collaborators

And Travelling Often In The Cut We Make is a result of a set of parallel long-term collaborations. Firstly, as an artistic collaboration with Louisa Minkin which was initially fostered through a series of student-centred projects to remake and restage historical works of art. These projects revisited the methodology of reconstruction as a learning tool and the projects often worked towards a single collective outcome. In tracing precedents, the practice of transcription that used to be a staple both of apprenticeship training and art schools were revisited. Emphasizing an understanding by doing the goal was not to produce an exact facsimile or replica; rather to work out, refigure, to focus attention, to discover complex intentionalities, folding in failures and discontinuities. What Bernard Stiegler [2012] would call "working against the loss of knowledge, against passivity, for responsibility, a return of agency, against consumerism." The initial aim was simple, to foster connections across siloed departmental structures and reconnect academic and technical conversations that had been separated through studio and workshop workflow and line-management reorganisations. Reconstruction is also familiar as a speculative tool within archaeological practice. Replicas of structures and objects are often fabricated using historically specific techniques and materials, and a dialogue between the University of Southampton Archaeology department and WSA began with the acquisition of its first 3D printer in 2013. Archaeologists Simon Keay, Greame Earl and Gareth Beale were working on the archaeological site of the Roman Port of Portus and were experimenting with archaeological computing as a method for recording and presentation (Earl et al 2011). A carving known as the Portus Head had been digitized which became the conduit for a set of conversations between the art and archaeology departments. Following the same methods as used in the student-centered projects, shared workshops between archaeology and art practitioners were devised which initially included etching workshops with archaeological tools and digital imaging open days. The project developed characteristics akin to Brecht's Lehrstück or learning play: "We tried a type of… performance that could influence the thinking of all the people engaged in it. It was, so to speak, art for the producer, not art for the consumer … in this way collaboration

develops between participant and apparatus, in which expression is more important than accuracy." (Brecht 1958)

In 2014 a 'bottom up' re-exploration of Neolithic portable art was embarked upon by Andrew Meireon Jones and Marta Diaz Gaurdamino which integrated RTI and SfM techniques into field trips across the UK. Bringing to light Neolithic carvings that might have been overlooked (Jones et al 2019; 11) this project embraced collaborative visits to Orkney, Avebury, and major museum collections as well as experimental workshops which folded field trips into studio practice.

Reconstruction of Willeme's Photosculpture Apparatus WSA 2012

Strand 1: Annihilation Event

The developmental work in the strand *Annihilation Event* can be traced initially to a series of large-scale collaborations undertaken at Winchester School of Art (WSA). In 2012, a student-centred project rebuilt and restaged François Willème's Photosculpture, dating back to 1863 this was an apparatus for turning photographs into sculpture. The device (the size of a room) produced 3D models of sitters using 24 cameras triggered simultaneously around their entire periphery. The images were projected sequentially to allow a craftsman to pantographically produce a 3D rendering in a block of clay. As outlined in the chapter 'Grave Goods' (Dawson, Minkin 2017), the project was inspired by (and helps verify) the thesis that the apparatus is an antecedent for parallel processing; it *spatializes* synchronous images, using a model of simultaneity, rather than

deploying the serial frames of chrono-photography, which historically leads to the dominant *cinematic* model of the image (Galloway, 2012; Sobieszek, 1980). This project sets in train a series of enquiries into the procedures and affordances of imaging techniques and technologies with a particular interest in the *spatial* dimensions of imaging.

This interest in various imaging technologies and new forms of reproducibility, is also placed within a reading (and re-fashioning) of art history. In 2013, the WSA group reconstructed Eduardo Paolozzi and Alison and Peter Smithson's installation 'Terminal Hut', from *This is Tomorrow*, the show staged by the Independent Group at the Whitechapel Gallery in 1956. As is well documented, this exhibition mobilised teams of artists, architects, and designers to work in collaboration. 'Terminal Hut', as a collaboration between a sculptor and architects, raised questions about the ruins always at the centre of our habitation (informed at the time by post-war London, still scarred from the war-time bombing). This historical context fed into the broader considerations of the research, which is concerned with the topologies and 'landscapes' in which work is made, as much as individual pieces of work. In 2014, the group's attention turned to a full-scale rendering of the raft from Gericault's *Raft of the Medusa*. In this case, a key point of interest was the fact Gericault reconstructed a raft to scale from survivor testimony (and famously locked himself in the studio with body parts from the hospital morgue). Here again are procedures and politics of reproduction, scaling, and re-recording. What these three projects have in common is *collaborative* problem-solving and knowledge sharing, but also a 'creative testing' of imaging technologies, and as a result the thinking through of materials, scale, and fidelity to 'original' objects.

Raft of the Medusa Re:make WSA 2014.

Carved stone balls workshop WSA 2013.

The importance of these projects was articulated firstly in Grave Goods (Dawson and Minkin 2017) and then more extensively in Terminal Hut (Dawson and Minkin 2019). Terminal Hut was written as a sequence of postcards which mixed timelines and events, a precursor to the *diffractively* written works of 2021 and 2022 (see appendix). Terminal Hut situated the media archaeological methods of reconstruction alongside an unfolding dialogue with the Archaeologists Andrew Jones and Marta Diaz Guardamino as they embarked on The Making a Mark project. This was a five-year study of portable lithic artefacts which enabled the artists to travel alongside Jones and Guardamino as they sought to make a new record of these objects across Britain and Ireland. During the project a carved stone ball making workshop was convened in the WSA Sculpture studio to test the possible making sequence for these objects. Performing a reconstruction of these objects enabled a reconsideration of the *chaine operatoire* of the carved stone balls and to reassess their function as a 'pedagogical hinge' (Jones 2019 112- 121) These workshops performed as

a *pivot place*, a space for knowing differently as the knowledge, thoughts and concepts of the learner are put into relation with other events, histories, and social ideas.

During the Making a Mark project enquiries into different materialities of objects, including chalk, stone, bone, antler, and wood from three key regions: southern England and East Anglia; the Irish Sea region; and Northeast Scotland and Orkney were deeply observed. Working through this project, over an extended period, in a controlled, yet also exploratory manner, a technical understanding and application of Reflectance Transformation Imaging (RTI) was developed. This then allowed the technology to be repurposed in new ways within the boundaries of a creative artistic practice. This began when RTI was applied to the closed-off spaces of a South London housing estate undergoing a process of 'regeneration'. This allowed for a form of 'archaeology of our times' and became the basis for several iterations of an exhibition and workshops. The *situating* of RTI within the present-day politics of regeneration is an important dimension of the work, helping to reveal and augment socio-political narratives. Indeed for Haraway diffractive images have a strong link to the locations that they inhabit, they are material discursive meeting points or 'commonplaces' that are both *topoi* and *tropoi* (Harraway 1997 & 2008a) They not only map the world as it appears but also highlight the changes in what they map and at the same time that they change what they map, they also change while mapping (Haraway 1997:12) 'No Layer of the practice is outside the reach of technologies and critical enquiries about positioning and location' (Haraway 1991:37)

Taplow House is a housing block within the Aylesbury Estate in South London. Built between 1963 and 1977, the estate was one of the most imposing in Europe with its dramatically extended and raised walkways which created forms akin to huge ocean liners: Concrete Cunard's as Owen Hatherley would describe them (Hatherley 2009). The Aylesbury Estate had been constructed to rehouse Londoners from earlier slum clearances which in turn had been built on common land, the Walworth Common. The architecture of the Aylesbury almost immediately became synonymous with decline. The community didn't arrive as planned, failing to cohere along the elevated gangways and the communal levels of

Taplow House had been boarded up for thirty years. These spaces became informally accessible for the briefest of moments (10 days in 2014) during their transformation into artist studios. The construction company Lendlease had purchased the land from Southwark Council to demolish and redevelop the Aylesbury and the neighbouring Heygate estate into the Elephant Park development. The Lendlease contract stipulated that these derelict spaces in Taplow House were to be rented at a peppercorn rate to not-for-profit arts organisation. As a registered charity ASC (Artist Studio Company) took on a lease to convert the spaces into a complex of artist studios, galleries, and artist workshops, populating the area during the phases of demolition and transition. The area is expected to be repopulated in 2032.

Thinking through Hatherley's ocean liner metaphor it was productive to think of Taplow House as having been *scuttled;* of intentionally made irretrievable. However, at sea alongside the jetsam and flotsam there is also the *ligan*, which is the marking of any site to ensure that any abandonment can later be recovered.

How is a modernist architectural site whose importance is determined by its own hostility to heritage to be mapped and remembered? Can RTI be an acting participant in performing the *ligan* and ask how values for the lost, the forgotten and the discarded are to be endured.

Dawson 2017 RTI workshops during Taplow2

The experiments in Taplow House enabled the technology to be pushed, which raised new questions and dialogues with archaeological technique and a sense of the underlying *physics* of imaging. This exchange was articulated (and accelerated) in the hybrid exhibition/workshop programme, *Annihilation Event* (Lethaby Gallery, London, 2017), which, in the context of participatory testing of 3D imaging, brought together a diverse range of artists, archivists, archaeologists, historians, technical experts and theorists from all over Europe including Michael Doser, a physicist from CERN.

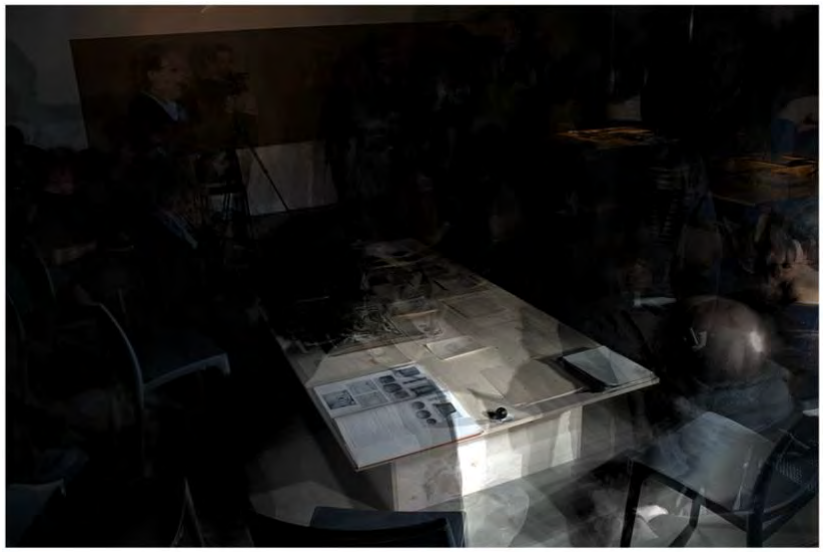
Annihilation Event folded the testing of imaging technologies into an exhibition, at its centre was a neolithic chalk object which had featured in the Making a Mark project, during the exhibition RTI and SfM workshops created fluid evental data sets and images of the unfolding assemblages of object and audience. Guest speaker, object-oriented discussions, and imaging workshops would intersect creating an expanded co-constitution of the kinds of practices that had been rehearsed during the Making a Mark project.

The term 'annihilation event' – drawn from particle physics – operates as a key critical concept; underlining a problematic shared across the disciplines of art, archaeology, and physics, regarding how we choose to 'cut' into the matter and materials around us as the means to formulate and understand our surrounding conditions. Technically, annihilation occurs when a subatomic particle collides with its respective antiparticle to produce other particles. Importantly, the total energy and momentum of the initial pair are conserved and distributed among a set of new particles in the final state. The idea of something forming out of what is already present can be considered in a material sense within archaeological digs, whereby objects are both recovered and created from the surrounding soil. Here 'annihilation' is a process of extraction, the forming of objects through *removal* of what else surrounds. Low-energy annihilation events typically produce photons, as these particles have no mass. We can understand light not only as a medium (in the way that McLuhan (1997) reminds us that the electric light is like the message of electric power), but as part of a more radical interconnection of materialities. This leads to a reappraisal of the state and status of our material conditions, with light arguably a form of waste product. We might think of the 'green' of

nature as the colour of life, for example, but in physical reality it is the colour that life *throws away*, the waste photons from the photosynthesis process reflecting back into our eyes. How we 'cut' into this reality is dependent upon the means of recording (whether the naked eye, camera, or electron microscope etc.). As developed in the chapter, 'Dirty RTI' (Dawson 2020), what transpires is that our use and study of imaging is a study into the devices that create our visualizations. As Carlo Rubbia, the particle physicist, puts it: 'Detectors are really (just) a way to express yourself' (cited in Cubitt 2014); or, put another way: 'The world does not exist as data: it must be produced as data' (Cubitt 2014). Additionally, consideration of high-energy annihilations, which produce a wide variety of heavier particles (a phenomenon that helps us to understand the big-bang model of the early universe), takes us into further philosophical quandaries as to what we even refer to as 'original' materials.

An important development in imaging technology, and key to the contextualising of this strand, is a shift from visual to 'avisual' technologies (Lippit, 2005; Cubitt, 2014). Of the former, there is a long history of the development of lens-based techniques and apparatus that function within the electromagnetic spectrum as experienced in any given moment. However, avisual technologies such as deep field imaging in astronomy and the scanning probe microscope allow us to 'image' states we are unable to experience for ourselves in any way. These are technologies of data, not images, but which can be rendered visually with stunning results. While Reflectance Transformation Imaging uses light as its means of recording, it is in fact aligned with these new avisual technologies. It is the means of a *composite* spatial recording of objects. By looking at RTI images, which help reveal elements invisible to the naked eye, we can adopt Derrida's (1995) term of 'in-visibility', being 'an invisible order of the visible'. Yet, equally, these 'images' are actually datasets of light recordings, and as such equate to Derrida's notion of 'absolute invisibility', as that which 'falls outside the register of sight'. If we imagine a typical RTI 'image' providing a composite and *dynamic* dataset of all light reflectance within a determined 'dome' of light we can begin to understand that the 'visuality' of RTI is always a recording of all light and locations (within a specified dimension of space). Instead of the simple image plane of a picture, RTI provides access to a complex,

three-dimensional set of relations. It 'extracts' materiality from a given space in a sequential way, akin to how an MRI scanner will 'slice' through our bodies and then combine all layers to offer a rich three-dimensional rendering. The creative mis-practice of RTI adds a further dynamic element, whereby the *movement through* the dome of light is also recorded. This, along with other creative manipulations comes to be described by the members of the archaeological team as 'Dirty RTI' and opens a critical dialogue about the prospects and affordances of the technology. Dirty RTI and Remote RTI (creating RTI images by utilising remote meeting software) are then further expanded upon in *Temporal ripples in art/archaeology images (Dawson et al 2021)* and *Track and Trace, and Other Collaborative Art/Archaeology Bubbles in the Phygital Pandemic (Dawson et al 2021).*

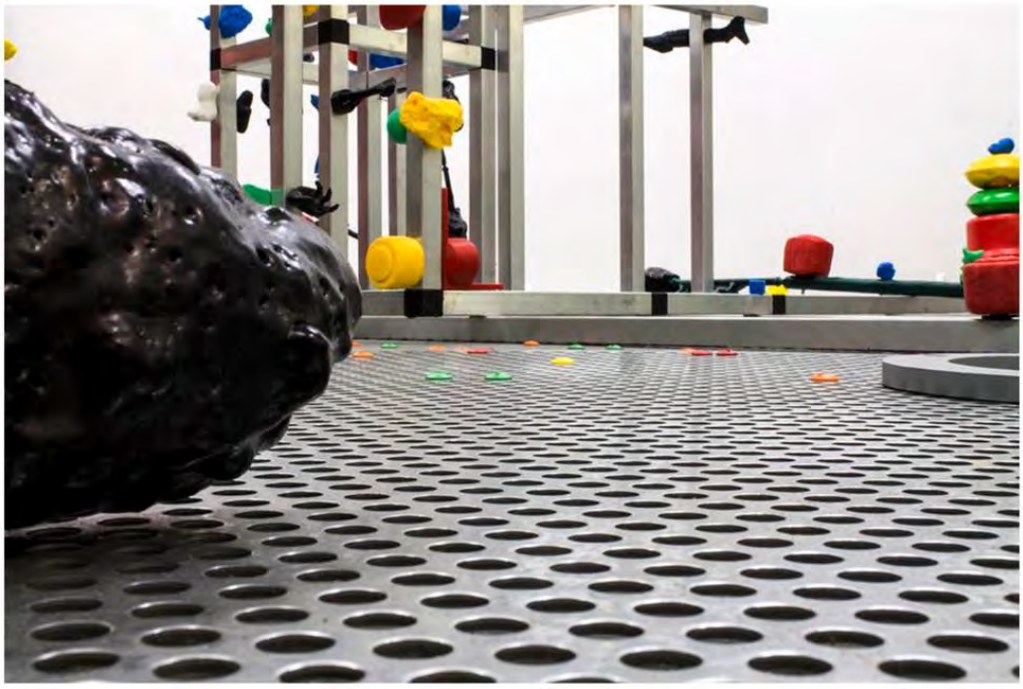


Dawson 2017 Annihilation Event Dirty RTI performance (still screenshot)

In reference to critical questions within new materialism (foregrounded, for example with *Annihilation Event* at the Lethaby Gallery, which included direct dialogue with particle physicists), ontological and agential questions emerge as the boundaries are blurred between one body and the next (when all is held through continual annihilation particle events). In the 'dome of light' captured through RTI imaging, there is a way in which, at least computationally, all points are interconnected, the visible and invisible, the material and the immaterial are no longer clearly defined, which in turn disrupts our everyday sense of time and space (in the sense that

matter is more of a continuum than a series of discrete events). It is in this vein, for example, that the feminist scholar, Karen Barad (2007), draws upon a reading of quantum physics to outline an empirical approach to agential 'intra-actions' of matter. For Barad: 'Matter and meaning are not separate elements. It is a position that differs from the Cartesian cut in that she does not seek to 'disentangle' phenomena. Instead, what the agential cut provides 'is a contingent resolution of the ontological inseparability within the phenomenon hence the conditions for... description: that is, it enables an... account of marks on bodies, but only within the particular phenomenon.' In this way, and again thinking about the dome of light as a set of interconnections in an expanded sense, bodies are forces or gatherings, which are always already gathering and connecting with multiplicities. They are nodes in spacetime, congealing together through forces intra-acting. It is this sense of intra-action – the entanglement of matter and meaning – that underpins the work brought together within this strand.

The written components associated with this project first developed from a technical article on the analysis of the Folkton Drums (Jones, et al., 2015), but the text *Dirty RTI (Dawson 2019)* is much more discursive and art/archaeological in nature. Here the text is not mere documentation of the visual practice, but rather a part of the iterative process overall, and 'performs' a certain reading of image- and object-making. Weaving together various accounts in an essayistic style, it provides a further 'lens' upon this project, a form of 'cultural imaging' as a corollary to the physical imaging of RTI, which demonstrates an intra-action or gathering of images, objects, and their making (or associations). This method culminated in the editing of the volume Diffracting Digital Images (Dawson et al 2021) which combined co-written chapters by all the collaborators as well as contributors from a larger group of specialists within the fields of art, archaeology, and cultural heritage. The research methods for this book are further explored in the chapter What is a Diffractive Digital Image (Dawson et al 2021)

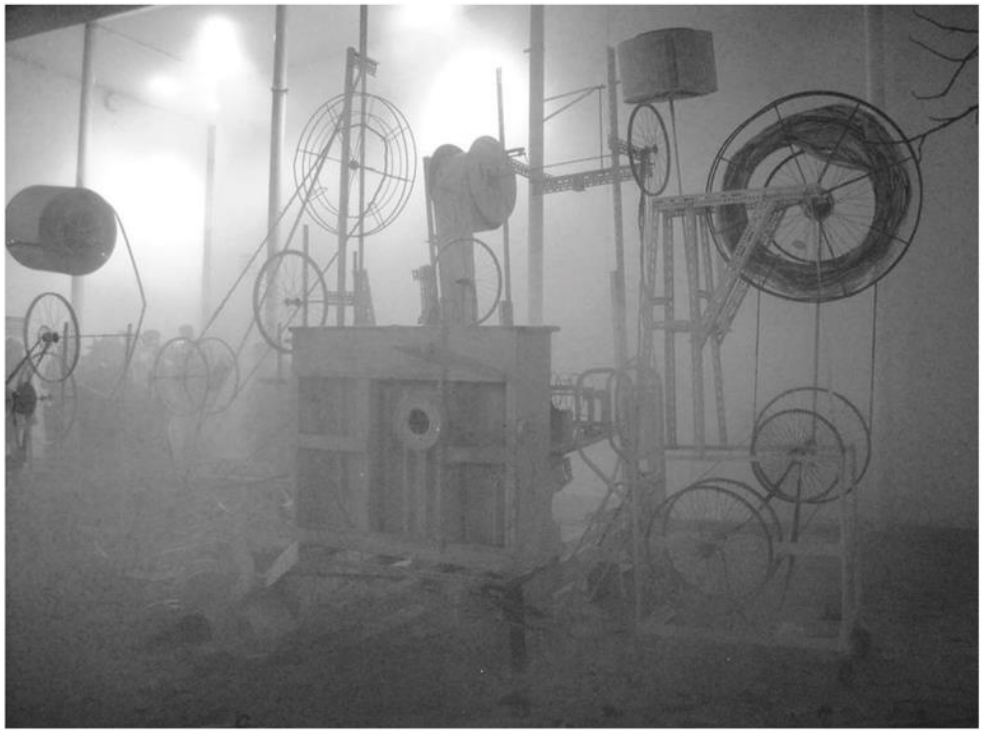


Dawson, ID 2.7.1816, (Detail) 2016, as exhibited in Artist Boss, New Art Centre, Roche Court

Strand 2: Phygital Assemblages

Phygital Assemblages has several antecedents. The first of which is historical and biographical, as evidenced in the Group exhibition, *Artist Boss* (2016-17), which marked the influence of the British sculptor Anthony Caro upon contemporary sculptors who he had developed a close relationship with during their time as assistants to him. Readings of Caro in Artist Boss refer to the Triangle Workshops of the 1980s when Caro had led, along with Robert Loder, workshops over extended periods within a shared studio setting, allowing for the making of new work through an exchange of ideas and the sharing of knowledge and skills. A similar combination of collaborative methods whilst focusing on materials and material processes underpins the research for *Phygital Assemblages*, which expands into the use of new material processes in the form of digital 3D print technologies whilst also making a consideration of the virtual 'materiality' of digital objects and objecthood.

Dawson and WSA students- Remake of Early One Morning 2010



Dawson and WSA students- remake of Homage to New York 2011

Dawson and WSA students remake of This is Tomorrow 2013

Dawson and WSA students remake of Partially Buried Woodshed 2015

Dawson and WSA students reperforming JG Ballard's Assassination Weapon 2017

Dawson and WSA students constructing Francoise Willeme's Pantograph Apparatus 2012

Akin to *Annihilation Event, Phygital Assemblages* can be seen to develop from the same series of copy projects undertaken within the teaching context of WSA (2010-2017). Firstly, written up as a journal article, 'Object Lessons' (Dawson and Minkin, 2014), these projects involved working collaboratively with student groups to remake historic art objects. These projects produced remakes of works such as Anthony Caro's Early One Morning, Jean Tinguely's Homage to New York and Robert Smithson's Partially Buried Woodshed. As described in Strand 1 it included, for example, a complex reconstruction of François Willème's Photosculpture technique, which was a nineteenth century apparatus for making 3D copies from multiple, carefully calibrated photographs. This was explored as a paradigm for nineteenth-century modernity, offering a genealogy for 3D prototyping (Galloway, 2014). As part of developing a material historiography, as well as seeking to understand current culture, a third key influence and underpinning collaboration for *Phygital Assemblages* is a partnership with archaeologists at the University of Southampton. This relationship began with a specific project to examine Neolithic artefacts (Meirion et al., 2015) which involved sharing various practice and knowledge around both contemporary visualization technologies and ancient processes.

In bringing these contextual strands together, *Phygital Assemblages* can be understood to be situated within the 'material turn', which breaks with discursive, linguistic-based frameworks. It draws influences from numerous scholars of new materialism (e.g., DeLanda, 1997; Barad, 2007; Bennett, 2010), who, while not discounting social constructions, nonetheless refer to a much broader *material* ontology of subjectivity. More specifically, *Phygital Assemblages* relates to considerations of 'sociomateriality', which refers to social and material aspects of technology and organization (Orlikowski, 2007). Key connections can be made to practice and learning. Fenwick (2015), for example, notes how everyday practices are 'constituted through entangled social and material forces that continually assemble and reassemble'. She argues that objects, events, identities, and knowledge are all performed through these social and material relations. As such, she writes: 'Effects such as capacity and 'skill' are understood to be distributed, not located as agency within human beings. One task for analysts is to trace just how these relations work: how human and more-than-human forces act upon one another in ways that mutually transform

their characteristics and activity, how they produce assemblages that become stabilized, and sometimes become extended and powerful.' (Fenwick, 2015; 83)

In contributing to the debates *and practices* of the material turn, the research investigation within this strand centres upon two interacting terms: the 'phygital' and 'assemblage'. The latter term has various connotations. In art it typically refers to the compositional combination of found and collected objects associated, for example, with collage as method (Craig 2008). In archaeology, assemblage has two overlapping meanings. As Gavin Lucas (2012) explains, it refers to 'a collection of objects associated on the basis of their depositional or spatial find-context', in this sense it is termed 'midden assemblage'. It also refers to 'a collection of one type of object found within a site or area', termed 'pottery assemblage'. In the archaeological sense assemblage is a more technical term, concerned with various 'object itineraries', relating to positionality, formations, timelines, and context etc. (Joyce and Gillespie, 2015). These specific considerations have been applied back into art practice as a way of opening a more extensive understanding of what happens when we work with objects, object processes, and, crucially, how we come to relate to the 'positionalities' and materialities that lie *between* the various defined states of objects and their fabrications (and degradations). In connection to which, reference can be made to Manuel DeLanda's (2006) assemblage theory, who in turn draws residually on the philosophy of Giles Deleuze and Felix Guattari (1987). Here we find the concept of archaeological assemblages rearticulated to foreground external relationships, in effect greatly *expanding* the very concept of the 'object'. Objecthood is opened out to a wider set of relational, environmental aspects, as opposed to the internal configurations of component parts. The work situates itself at this level which enables different ways of relating to an object's 'autonomy'; allowing for movement between assemblages, which continually recombine elsewhere in other spatiotemporal contexts. Here, specifically, the term 'phygital' is put forward as a way of understanding objects that are digitally defined but that can be invoked, instantiated, and brought into constellation with other entities both physically and virtually – giving shape to a new terrain of *digital* relationships of 'midden' and 'pottery' assemblages.

A ‘phygital nexus’ (Dawson and Reilly, 2019) can be thought of as a no-place and an every-place where digital and physical worlds intersect; a space where novel, ‘messy assemblages can emerge. Underling this consideration is the influence of new media theorist Friedrich Kittler (1999), who, contrary to the position taken by Marshall McLuhan, whereby media is viewed as ‘extensions’ of the human, Kittler argues for an *autonomy in technology.* In reference to digital, internet-based culture, whereby information constantly circulates, he makes the case that humans become a reflection of their technologies, not the other way round. A key claim, for example, is that the last ‘historic act of writing’ occurs in the late 1970s when Intel engineers produced the architecture of the first integrated microprocessor (Kittler, 2013). Now that we are placed ‘within’ its circuits, we are in effect inhabiting *perpetual phygital assemblages*. It is this understanding of our ‘mediation’ (and of its materialities) that forms the *site of investigation* for the project. As such, through art-archaeological practices of building and re-building, a key critical question regards the (de-)ontology of the object. E.g., Where does the object begin and end? How does information pass through assemblage, and what are the longer trajectories and itineraries of information? Pursuit of these questions – as explored through these collaborative engagements challenge the notion of origins, heritage, authenticity, and surrogates. Along with questioning what happens to future versions of objects, we are continually drawn back to critical debates about physical, digital, and ‘phygital’ states and their interstitial spaces.

Spanning from 2014-2022, *Phygital Assemblages* involved working with numerous artists and curators for a series of exhibitions and was underpinned by a sustained collaboration with a team of archaeologists. There is an iterative process, whereby the same key ideas and research problematics are explored, tested, and reflected upon in multiple and accruing ways. Broadly, however, there are three main phases. Firstly, a series of ‘copy projects’ were written up as a journal article and an exhibition was curated and dedicated to questions of the technical evolution and translation of 3D objects. Secondly, artworks were made and re-made for a series of exhibitions and projects, which furthered the material practices of 3D scanning and printing, and which perform a series of physical and virtual assemblages and object itineraries. Finally, in collaboration with the archaeologist Paul Reilly the project’s key critical

considerations have been explored though a sequence of Art/Archaeology projects and articles on the 'phygital nexus' (Dawson and Reilly, 2019, 2021).

(1) *Objects Lessons*: The research investigation begins with the writing up of the article, 'Object Lessons' (Dawson and Minkin, 2014), which, as noted, reflects on a series of copy projects conducted at WSA over a four-year period, including the remaking of historic art objects such as Anthony Caro's *Early One Morning* (1962) and Jean Tinguely's *Homage to New York* (1960); as well as the aforementioned Willème photosculpture apparatus. These projects are characterised in the article as a form of material historiography and help initiate a working relationship with members of the Archaeology Computing Research Group at the University of Southampton, which goes onto underpin the development of *Phygital Assemblages*. A critical consideration of 'Object Lessons' regards how information travels, translates, and transforms through material processes, and how we can approach the idea of the 'generations' of objects – referring both to the creating and fabrication of objects, and process of copying and remaking.

The chapter argues that image culture in art schools has shifted from observation and transcription through modes of measurement, trace, and projection, to the swift transfer of data, active on multiple platforms and with many potential outputs. New tools of production and reproduction have been introduced into the set of tools and processes available to artists. Rapid prototyping and 3D scanning present us with questions of technique. They give us a direct imperative to understand the potential of new fabrication methods, new ways of materializing and constructing, copying, and reconstructing. In this vein, these copy projects are a reminder that the subject matter of a work of art is limitless, that it remains incomplete and that 'the language of art is with an unfinished event' (Gadamer, 1975). Echoing the contemporary arguments of new materialism (as breaking with the linguistic turn), Gadamer is critical of the established role of modern theory where 'theoretical knowledge is conceived in terms of the will to dominate what exists'. Instead, reopening the unfinished event contributes to the re-articulation of theory as contemplation (*theoria*) and participation (*theoros*). Here 'the aim is not to recover the forgotten per se but use the difference between past and

present usage to create a space in which new meanings might arise' (Davey, 2006).

Explorations with the object, copying and new imaging technologies are taken further in the curation of the exhibition *The Wanderer's Nightsong II* (2015). Showing the work of Gavin Turk, Neil Gall, Kate Atkin, Cathy De Monchaux, and Chris Hawtin, the exhibition raises questions about technical evolution and translation of objects through the *ambiguous* role as 'curator'. The curator role is extended further to that of technician and collaborator by 'translating' the artists' work via 3D scanning and printing, creating copies of their work as a means to ask questions of mediation, re-mediation, authorship, and originality. The title of the exhibition is taken from Goethe's classic eight-line poem which was scratched into the walls of a mountain lodge and describes a progression from mineral through animal to human, of a natural process becoming language. As Kittler (1992) has argued, the poem's power lies in three simple factual statements followed by an assertion for the future, which, without the use of simile, metaphor, or symbol, is *untranslatable*. Kittler's interest in the poem is its status as 'object'; that the mechanisms of the development of language are wholly bound within the essence of the poem. The medium itself is very much the message, but – as in the terms of sociomateriality – it is an *extended* medium through which we pass (rather than apply). It is this reading of object processes and translations that persists through the later stages of this project.

The Wanderer's Nightsong II (installation view) 2015 C&C gallery London

(2) *Phygital Assemblages*: A central component to the research process for Phygital Assemblages are studio-based sculptural works. These are constituted from multiple 3D printed objects made from a corn-starch derivative bioplastic (PLA) using a Fused Filament Deposition process. Works vary from being conglomerates of hundreds of prints dispersed in various ways or fused together as a single unified object in the instance of the Metalithic object series as exhibited in Autumn Attic (2021) and Patternicity (2022).

The first iterations of *The Phygital Assemblage* comprised of 3d prints affixed to an architectural scaled aluminium-framework which developed through four main iterations. Additionally time-based digital works are constantly constructed and created and reedited. Of the former, following a commission to produce a work for the exhibition, *Artist Boss* (2017) a large-scale 'assemblage' combined several hundred individually 3D-printed objects along an aluminium frame. The brightly coloured corn-starch derived prints were an assortment of miniature models, derived from signature artworks and archaeological artefacts (including Neolithic objects from Orkney and the British Museum, and prints from modern and contemporary art objects held in the collection of Tate Modern). Other objects include elements from Cody Wilson's infamous 3D-printed gun (distributed as part of a 'Wiki Weapon Project'), and Nasa satellite data

of asteroids. The objects are all scaled to the same handheld miniature size and printed with the same material, acting as souvenirs or trinkets. The title of the work, 'I.D.2.7.1816', as shown for *Artist Boss* (and later for 'Itinerant Objects' at Tate Exchange, Tate Modern, April 2019), is in reference to the date the French frigate 'The Medusa' ran to ground on the Senegalese coast, an event remediated through Gericault's shipwreck scene. (Gericault's work was the inspiration for one of the WSA copy projects), and which, for Gericault, involved constructing a life-sized raft from which to paint. Through a persistent process of working and re-working material and digital objects, Dawson's assemblage work evocates a massive archive of objects and of their copying, transmission, and translation. The aluminium framework acts as a holding form, as an apparatus, as if at once a flatbed 3D printer and the *raft* as a site to remediate new forms of cannibalism.

Dawson, ID 2.7.1816, (Detail) 2019, as exhibited in Itinerant Objects, Tate Exchange

When shown at Tate Modern, in April 2019, as part of a programme of events around the theme of 'itinerant objects', the artwork was displayed within the context of open workshops using 3D scanning and printing, and Reflectance Transformation Imaging, techniques of imaging increasingly adopted in archaeology, using varying lighting conditions to reveal surface phenomena. Extending the artwork directly into these participatory events

furthered a sociomaterialist agenda *through practice*. In effect, this was to activate the material archive of the artwork, to foreground how we engage in objects that surround us and to provide a means of re-articulating these forms through process of digital reproduction (which then can re-emerge as material objects through 3D printing).

A version of 'I.D.2.7.1816' was shown as 'Gnomon One' at *Backyard Sculpture*, an exhibition curated by Neil Gall and David Gates, at Domo Baal Gallery (2019). It was an artist-curated survey of sculptural objects created with an ethos for utilizing an independent eccentric fabrication as a means of production (a 'backyard aesthetic'). The exhibition charted experimental approaches, particularly within British Sculpture (though it also referenced an East Coast American strand, including upstate New York traditions evidenced through the early Triangle Workshops). The exhibition asked the viewer to consider a suburban method of making work rather than an urban aesthetic – of assemblages involving repurposed equipment, materials, and processes that while informed by contemporary art, might well sit outside the usual frames of reference. In this context, the cubic aluminium frame again supported the display of 3D prints, providing a variety of x, y, and z planes. The artwork's title is a reference to the Greek 'Gnomon' (the one that knows everything) and is the technical term for the part of the sundial that casts the shadow. Like the echo of the flatbed printer, the reference here is to technologies of marking and measuring. From the humble yardstick to other more extended forms of mapping and projection, gnomonic maps are used to chart seismic waves, for example. The gnomon in geometry is the piece that needs to be added to create a larger piece yet is created through fragmentation.

Further renderings of these assemblages involved a direct collaboration with archaeologist Paul Reilly. In this case the aluminium structure was again the holding form for the work and continued to support the eclectic mix of 3D printed objects (including Goethe's death-mask, a starfish, and Neolithic carved balls), the framework was also configured to support a digital screen. This was used to show images of a recovered digital file from the 1980s, specifically IBM's commissioned digital reconstruction of an Anglo-Saxon building, the Winchester Minster. This file represents an early form of digital archaeology which itself had to be recovered (Reilly, et al.,

2016). On top of the screen was shown a 3D print, a further reconstruction of the reconstructed IBM digital file. The work was shown at Annihilation Event (2017) and *Along the Riverrun* (2017), an exhibition curated by Alex Goulden and George Watson, at ArtSway. The title of the show was taken from the opening line of *Finnegans Wake*, Joyce's final novel which eschews conventional narratives and blends portmanteau words with lexical items and neologisms in a cyclical work whose last line recirculates as the opening line. As in *The Wanderers Nightsong II*, the naming of the exhibition alludes to ideas about both objects and language.

The aluminium framework disappears completely in a final important collaboration with Reilly in the Metalithic sculpture series of phygital objects (2019-2022) with a set of assemblages that become pluritemporal, that is having multiple overlapping pasts, ongoing presents, and imminent futures (Olivier 2011). During the Covid 19 lockdown Reilly had discovered a hoard of Mesalithic flint hand tools close to his home in Mottisfont, England. Reilly began to share sequences of these digital photographs as data sets for these mesolithic flint tools to be remodelled using SfM software hundreds of miles away in Dawson's London studio. A complex dialogue began between the discovered mesolithic flint artefacts, the data transfer processes, and the corn-starch printed models ensued. Invoking the cognitive assemblage as described by Katheryn Hayles (Hayles 2017), the compiled SfM data were cleaned in MeshLab and Meshmixer and then sliced and sent as gcode to be 3D printed. The silica flint tools found initially in a cornfield, then turned into images in a home office in Hampshire, were now (re)instanted in colourful polylactic acid (cornstarch) using a FFD printer. More than any other process, 3D printing exemplifies the idea of object-as-trace, as a continuous plastic line is drawn across a three-dimensional field. This 3D printing performance recalls the assembly section of Willème's photosculpture process where the silhouettes of his daguerreotypes were translated by pantograph into a block of clay. In a similar manner the 3D print software slices a model into a sequence of silhouetted profiles which are printed one ontop of another. Both processes reveal the uneasy interface, or rather complex intraface, between artisan and the machinic array. In the Metalithic series the print process is actively acknowledged as the machine is spontaneously turned on and off

to introduce different colours of filament thereby creating stochastic interruptions within the merging patterns that develop on the surface of the print. The stop-starting was arbitrary and often conducted between video conferencing meetings, marking both the day and the duration of the printing process. Each metalithic surface that emerged was a colourful, indeed dazzling, plastic amalgam of prehistoric flint tooling and post historic 3D fabrication.

At one point printed versions of the metalithics were posted back to the location of the find to implicate an extended assemblage (Deleuze and Guattari 1987; DeLanda 2006). This process thus involved a much messier, ontologically itinerant, phygital assemblage (see Reilly and Dawson 2019) which included a post box, the Post Office, a Royal Mail distribution depot, the cardboard box and tape, a barcode, a barcode reader, postcodes, gcodes, 3D printer, office and studio environments, digital cameras and jpeg images, a step ladder, in addition to the human actants (i.e., the delivery driver, depot workers, postman, the artist and the archaeologist). Following Bennett's vibrancy of matter (2010, p. 36) the consideration is toward the agency of this extended human and nonhuman assemblage as distributed over a 'confederacy' of intersecting and resonating actants ex-isting separately and together, bringing order and disorder, assembly and disassembly, to the material world.

Dawson and Reilly, Track and Trace - Ontological itineraries (Wrapper detail and contents) 2021

(3) *Phygital Nexus*: As a final stage in the research process the collaboration with Reilly is formalised in the publication of a series of Journal articles (see appendix). In 'Messy Assemblages, Residuality and Recursion within a Phygital Nexus' (Dawson and Reilly 2019), the term 'assemblage' with its different applications to both art and archaeology practices (and drawing substantially on new materialist discourse) is considered along with the concept of the 'phygital nexus'. The approach is to reflect on the movement of objects and images within the *phygital* (i.e., across the physical and the virtual) to consider how different components of assemblages meet, mingle, and sometimes experience ontological shifts, when an artist and an archaeologist, and those differing practices and apparatus intra-act (cf. Barad 2007). The essay identifies the phygital nexus as a 'state', which can be in various states of flux. These articles draw out a shared methodology as underpinning of their exploration of the phygital (whereby the nexus is subverted to enable the remixing of multifaceted, multi-(im)material, and multi-temporal phygital artefacts that recall themselves). And in *Track and Trace, and Other Collaborative Art/Archaeology Bubbles in the Phygital Pandemic* (Dawson and Reilly 2021) they chart their art/archaeology collaborations during the Covid19

pandemic using the idea of 'bubbles' to explore Hayles' (2017) "cognitive assemblages" in which human and nonhuman decision, or choice-making functions are distributed across, and link together. Hayles' cognition is a broad capacity that extends beyond consciousness into other processes, life forms and complex technical systems including scanning devices. Hayles refers to these broader and more widespread cognitive capacities as operating below the level of consciousness as unthought or nonconscious cognition. What is perhaps most noteworthy in *Track and Trace, and Other Collaborative Art/Archaeology Bubbles in the Phygital Pandemic* is how the art/archaeology artefacts are produced through an intraacting cognitive assemblage in which the cognitive components do not simply interact in parallel or in tandem. Rather they are part of a conscious diffraction of different modes of cognition through one another, human with nonhuman, conscious with nonconscious, artistic with archaeological practice and techniques, with the hopeful intention of producing surprising and unexpected results.

Importantly both articles are placed in open access, online journals that (in the case of Messy Assemblages) allows them to present a written text with actual existing components of the phygital, so including various digital (animated) files as part of the article's layout and argumentation

Objects as Curriculum workshop at University of Lethbridge with the Indigenous Art Programme


Artist Residency, Compound 13 Lab, Mumbai, India 2019

CONCLUSION

In writing this final section it is important to emphasize that concluding is a task which the project has actively sought to refuse. At Ing-Marie Back Danielsson and Andrew Jones's 'Making images, making worlds: Art-Process-Archaeology' session at the Art, Materiality and Representation Conference hosted by the Royal Anthropological Institute at the British Museum in 2018 the practice and ethics that surround closure were discussed. How could archaeologists and artists explore the difficulties which occur with foreclosure when messy forms of practice are inevitably excluded. Jones had just presented a new critique on the 387 carved stone balls which have been found in various locations across mostly Scotland but now reside in museum collections across the UK. He reflected on the numerous 'unfinished' versions which are hidden from view in archive spaces and posited the idea that through a processual unfolding of these carved stone balls they could be seen as didactic objects which teaches technique (Garrow and Wilkin 2022). This narrative suggests that despite the current marginal status of these *unfinished* stone balls, when considered together they are better able to aid future possibilities by being open to reinterpretation through subsequent remaking.

Unlike the finished smoothed and perfected versions as presented in isolation, the whole body of stone balls can offer a greater potential for constructive dialogue that includes what is outside and beyond the object itself.

Like the carved stone balls, the work presented within this thesis evidence various stages of making and unmaking to maintain its own open-ended reiterative qualities so that it too can usefully engage with the intrinsic role of exclusion. The performative production of matter is used as a complimentary process, it is understood that when objects manifest through assemblages they do so at the expense of other possibilities and as such are reminders that things could be otherwise if the assemblage was composed in another way. The work not only seeks to remember other possibilities it makes those accessible for future reuse, Here the work can be thought of as a 'capacity-building' practice (Stephansen and Trere 2019) where the dual aspect of capacity is explored. The work expands people's capacity to actively participate as well as broadening the possibility for the assemblage to continue to grow.

In Tiquun's text How is it to be done? (Tiquun 2010) they call for new cartographies, 'We need maps. Not maps of what is off the map [...] Tools for orientation. That don't try to say or represent what is within different archipelagos of desertion but show us *how* to meet up with them.' Taking the polemic of Tiquun's text which advocates the importance of the *how,* the adoption of diffractive methods has enabled the decision making of boundary forming practices and the excluded other possibilities to be messily connected. The integral role of exclusion as both a component and consequence of how images are brought into being is both evidenced and traced and left responsibly for future generations to pick up.

As Giroud notes in What Comes After Entanglement? (Giroud 2019) when she raises the necessity to heed the tools that are entangled within the production of knowledge it is the constant act of warping RTI and mutating 3D prints which shifts the focus from what is being expressed to how these expressions are crafted. Throughout this roaming body of work from Taplow House to Messy Assemblages the pursuit has been to

consider the non-neutral aspect to image making (Dawson et al 2021) asserting through practice the principle that any apparatus that generates knowledge about the world is inextricably intertwined with its object of study. As Barad articulates this has a profound influence on the ethics and ontology of the practice of image making. RTI images change at each viewing and photogrammetric models develop distinct occlusions when recompiled at different times, whilst 3d prints have substantially varied qualities depending upon the shifting environmental conditions of each workshop and studio.

By setting each work in relation to other works, each piece of work has become a layer within a set of layers which considers the exclusions that have come to emerge. By disrupting the illusionary nature of a clean framework and to contest the notion of smooth transitions between forms and formats the work productively engages with how exclusions could be made to matter. Crucially the work (as practiced) can make the hierarchies of decision making visible which proffers from Harraway's writings that figure the *relation* as the fundamental 'unit of analysis' (Harraway 2003 20) As illuminated earlier by the example of the carved stone balls the presentation of artefacts within empty spaces in Galleries, libraries, archives, and museums is often misleading and divisive. The framing of artefacts in a disembodied featureless vacuum ensures that exhibits and accessions can obscure and hide many things including the gestures from people who have applied their considerable skill sets, knowledge, and experience into the making of the work. The diffraction patterns which have evolved and continue to evolve out of the processual nature of the work can be seen to embody layers of paradata which would otherwise be inaccessible. These admittedly complex images take considerable effort to unpick but what becomes clear is that the apparently inert, empty, space surrounding the object under study is an intersubjective space full of energy, light, movements, gestures, equipment, and people. These interactive intersubjective spaces are laden with meaning-mattering decisions and become a form of 'autographic' image (Offenhuber 2020) which contains "a trace of the process itself: it retains some interpretive authority, and it is taken as a product of the phenomenon at its face value" (Likavčan and Heinicker 2021, p.212).

By finding creative ways to render the apparatus of image making visible, to challenge them *and* by engaging in a practice which spreads expertise the work has built productively towards an ethics of image making which accounts for the complexity of working in an entangled position where agency is often fraught with difficulty. The development of these diffractive methods has led to a large-scale collaborative project with the Blackfoot Confederacy and The Digital Blackfoot Library. In this project the methods developed have been applied to ask if indigenous digital objects can be crafted and handled responsibly, and if so how. Museum archive visits with Blackfoot Elders were combined with RTI and SfM imaging sessions, these viewings were complex as they involved multiple discussions from various voices and the handling of objects occurred during the creation of their digital relatives. The aim was to create digital objects that were not 'oblivious to the indeterminacies of encounter' (Tsing 2015, 40) Narrating across and through the physical and digital objects was a way to develop an *'ethics of storytelling'* for digital imaging as a productive way to articulate the situated entanglements within the contested space of the archive room. During these sessions particular details of beadwork and quillwork were illuminated through RTI allowing for a knotting-together of narratives, the customs and practices of a bead worker were described alongside the instructional unfolding of the process of RTI. Paying attention to the *process* of weaving together these stories thus allowed for an assemblage to form which created the space for different knowledges to be heard collectively.

What has been discovered is that it is not enough to acknowledge the noninnocence in image making, this recognition alone only serves to naturalize exclusionary aspects to the practice. Instead, the diffractive messy image-making in this project has worked towards a productive relationship with the inevitability of the agential cut. This requires an openness that is only afforded through constant work *and* constant re-working as the artefacts and images of In Travelling Often in The Cut We Make constantly fold into their own omissions so that the work can respond to the politics and ethics of image making.

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STRAND 1: ANNIHILATION EVENT

1.2 Residency Documentation

1.3 Exhibition and workshop documentation

Dawson, Ian and Minkin, Louisa (2015)
Taplow House and **Taplow 2** 29.06.2015-21.08.2015
ASC Gallery, London

1.4 Iterations

Dawson, Ian and Minkin, Louisa (2017)
Pictures Not Homes 12.01.17- 27.01.17,
Winchester School of Art Gallery, UK

Dawson, Ian and Minkin, Louisa (2017)
Gestures of Resistance, 20.04.2017-30.04.2017
Centre Romantso, Athens, Greece

Dawson, Ian and Minkin, Louisa (2017)
Annihilation Event, 22.03.17- 29.03.17
Lethaby Gallery, CSM London

1.5. Dawson, Ian (2019) '**Dirty RTI**', in I-M. B. Danielsson and A. M. Jones (eds.) *Images in the Making: Art, Process, Archaeology*. Manchester: Manchester University Press, pp 51-64

TAPLOW HOUSE RESIDENCY DOCUMENTATION

TAPLOW HOUSE RESIDENCY DOCUMENTATION

RESIDENCY PERIOD: 9 days between 9th May and 2nd June 2014. Each day was spent inside various spaces at Taplow House, London SE17 2UH. Access was gained to 3 units on the raised walkway, these units had been boarded up more than 13 years. The units are named

1. Cab office
2. Cuevas
3. Derelict Unknown Unit

This is an itemised document of the areas that were recorded during this residency

In total 75 Reflectance Transformation Imaging Data sets were made. 13 areas were Laser scanned and 1 photogrammetric/structure from motion model was compiled.

Visits were made by Dr Paul Reilly, Gareth Beale and Nicole Smith.

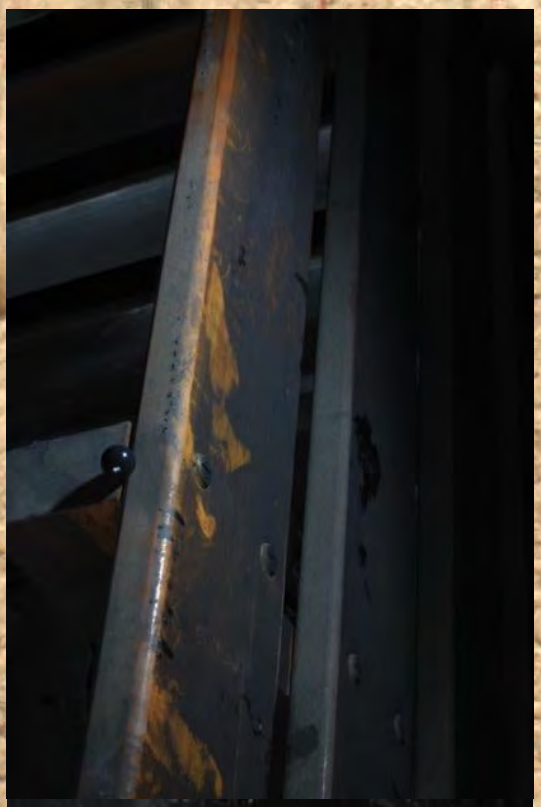
DAY 1

Friday 9th May 2014

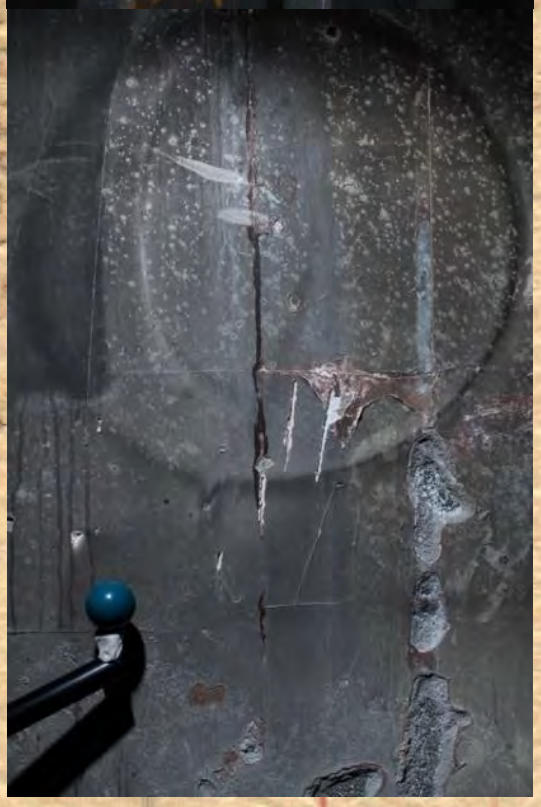
Day 1 was spent in Cuevas. The Unit was given the name due to the layer of fine soot that had covered all the surfaces. The soot was a consequence of an electrical fire within this space.

A Total of 10 RTI data sets were recorded. The focus of these recordings were the first thin layers of deposition in the space and the marks that had been left in them.

1. Bannister
2. Ceiling
3. Circle on wall
4. Floor
5. Plug and wall
6. Tap
7. Wall and scratches
8. Wall (DJ stickers)
9. Wall and Porn



Bannister

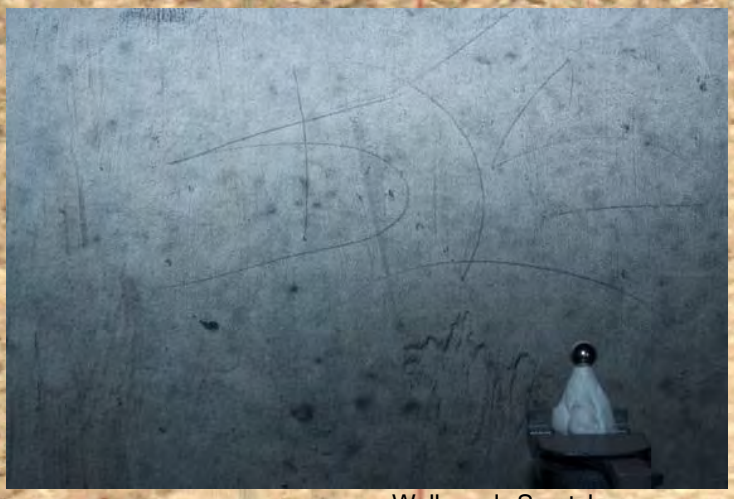


Circle on wall

Ceiling

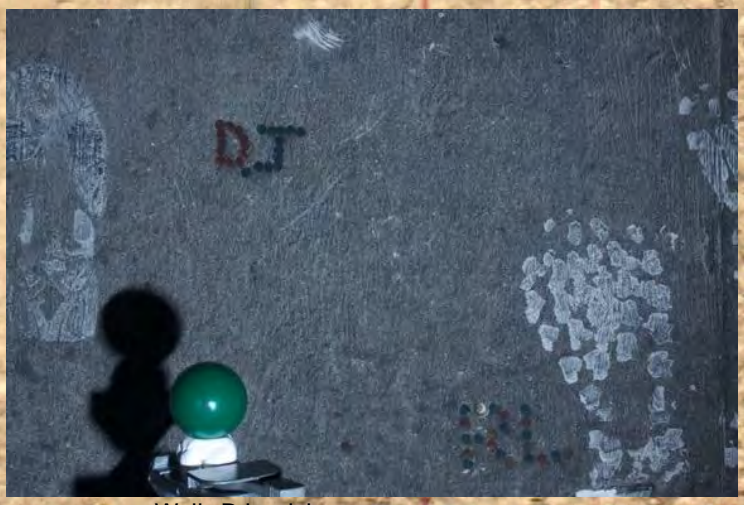
Floor

Plug on wall



Wall and Scratches

Tap



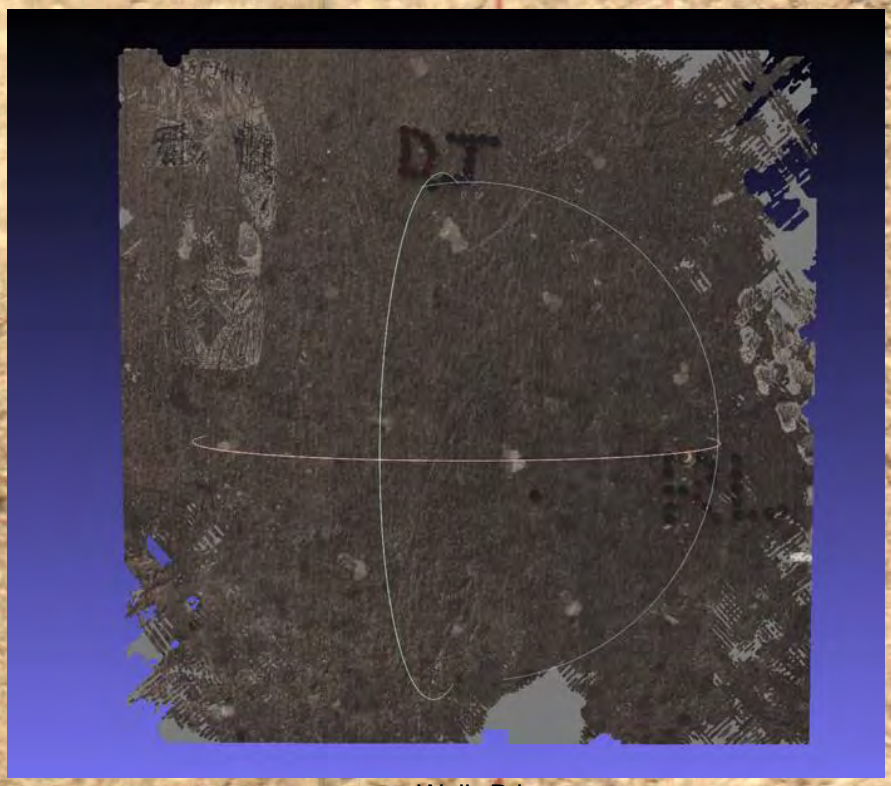
Wall DJ stickers

Wall Porn

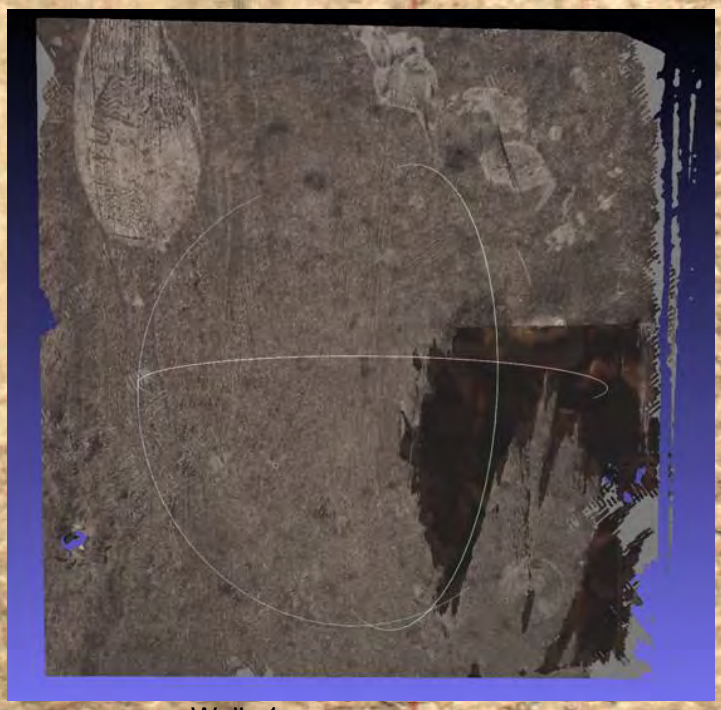
DAY 2

Wednesday 14th May 2014

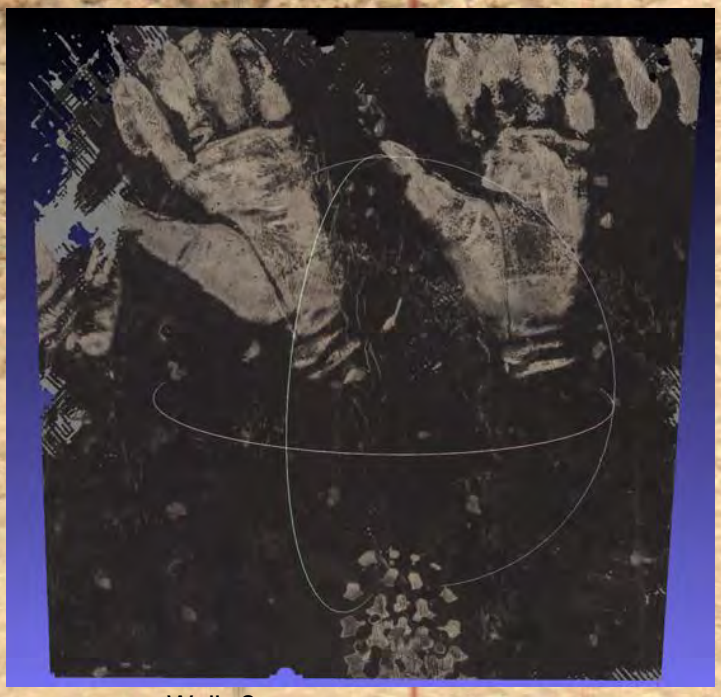
Day 2 was spent inside Cuevas using the Laser scanning equipment 3 scans were made of the walls where the soot had been disturbed by human contact. .OBJ. MTL and .BMP filetypes were saved for each scan



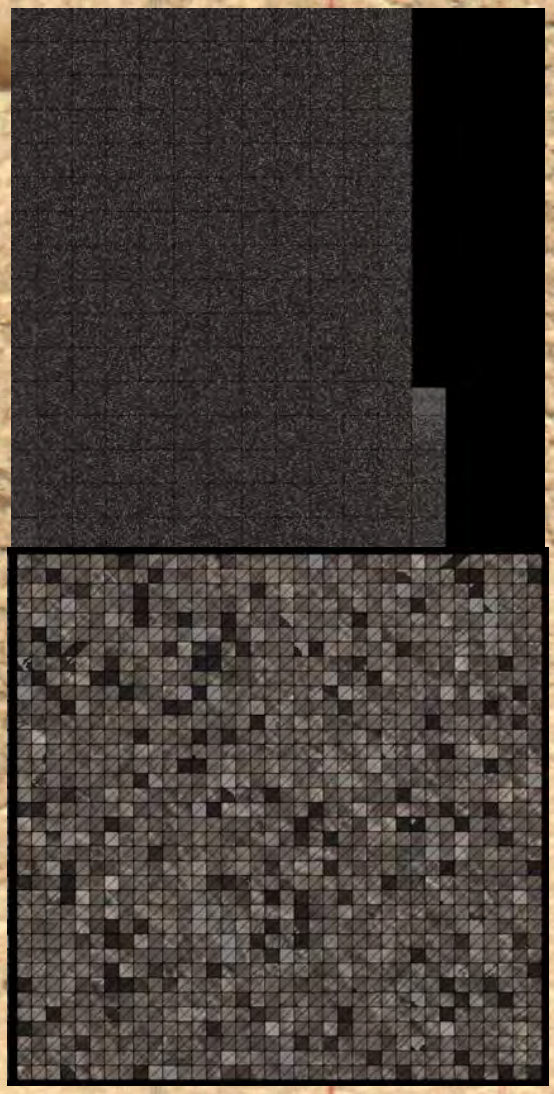
Wall DJ



Wall 1



Wall 2



Example a bmp map.

Detail of BMP map

DAY 3

Friday 16th May 2014

Day 3 was spent inside the cab office, which had been closed boarded up between 2001 and 2014. A combination of RTI and Laser scanning was conducted.

RTI of The Cab Office. 9 RTI data sets were collected.

1. Broken window
2. Yellow room
3. Corridor
4. Stairs
5. Floor5
6. Floor4
7. Floor3
8. Floor2

9. Floor1

Laser scan of 5 areas in the cab office

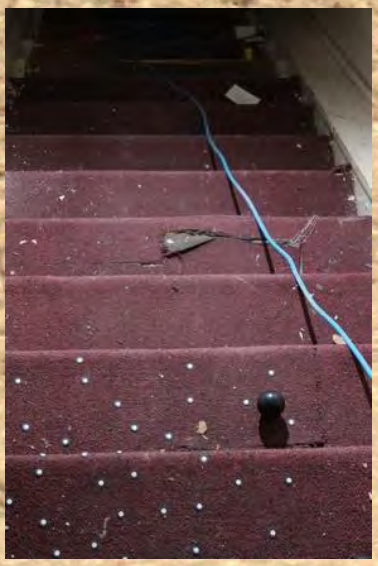
1. calendar
2. door
3. floor1
4. floor2
5. stair

RTI data sets:

Broken window

Yellow room

Corridor



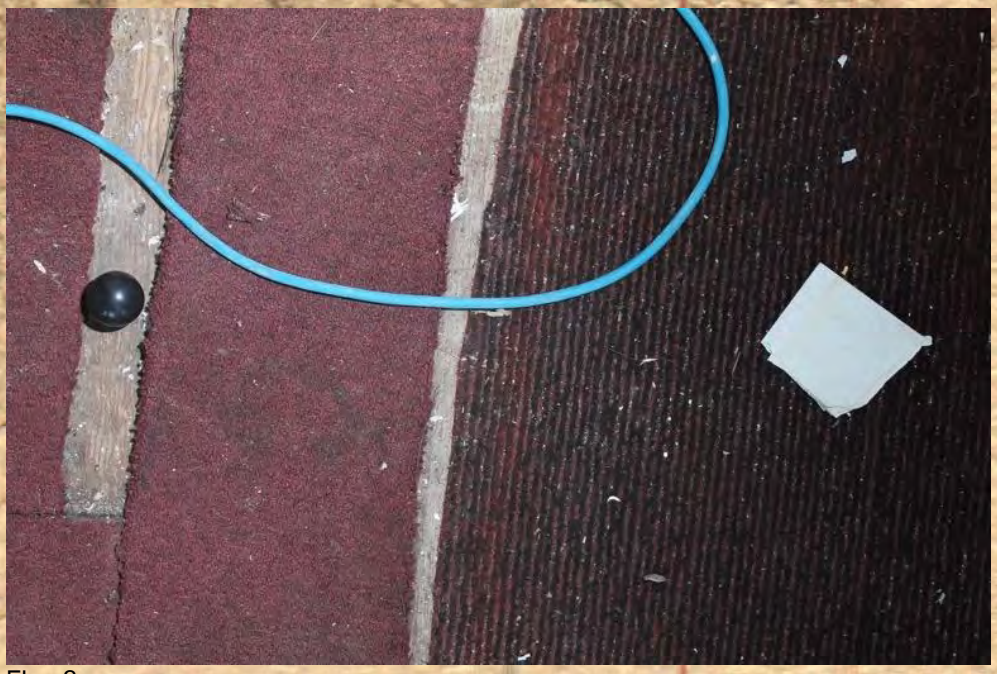
stairs

Floor5

Floor4

floor1

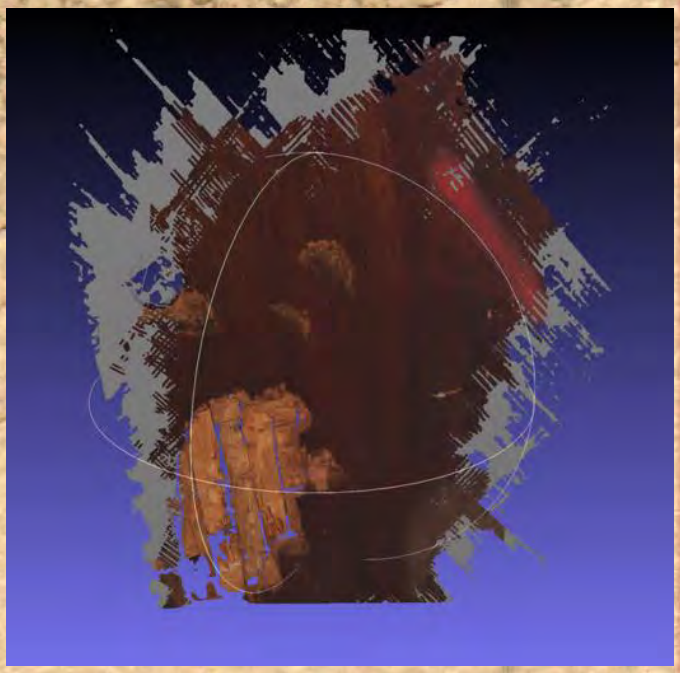
Floor3



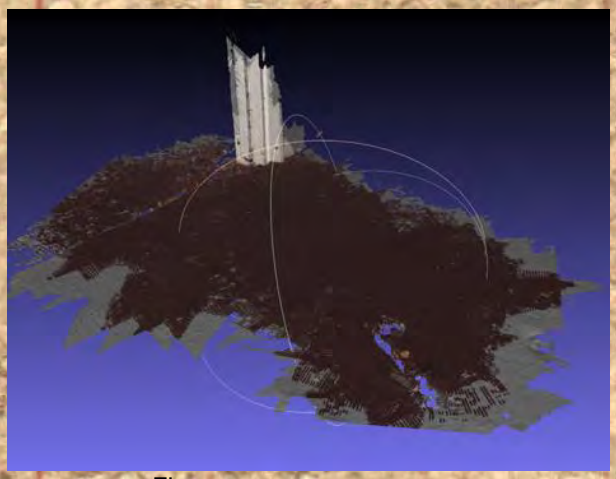
Floor2

laser scan data sets:

calendar

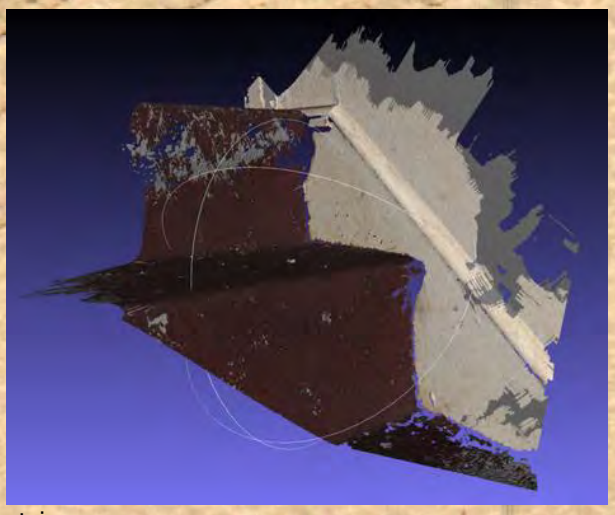


Door



Floor

Floor2



stairs

Day 4
Monday 19th May 2014

Day 4 was spent inside the 'derelict unknown unit'. 5 scans were made of various surfaces inside the unit.

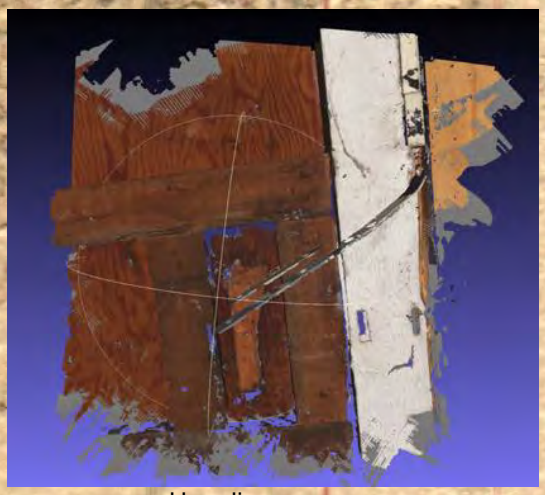
Image: Scan targets

Laser scans in 'derelict unknown unit'.

1. Hoarding
2. Doorframe
3. Wallpaper
4. Wallpaper 2

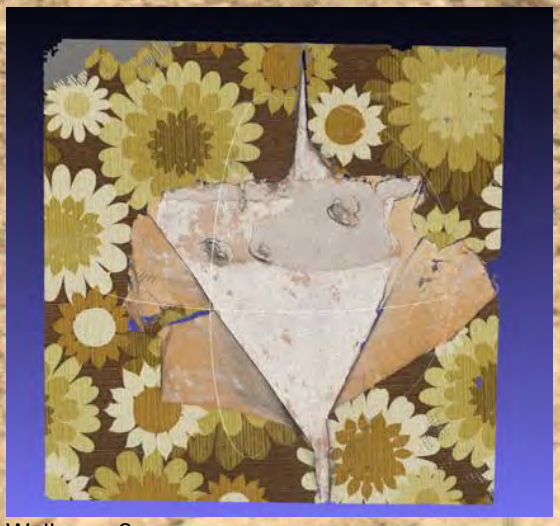
5. Wallpaper 3

Doorframe



Hoarding

Wallpaper1



Wallpaper2

Wallpaper3

BMP filetype

Day 5

Wednesday 21st May 2014

Day 5 was spent in the 'unknown derelict room' recording with RTI. In this space there was significant evidence of human and animal activity that had occurred in the decades that the space had been boarded up. Initially the RTI focused on these areas within the space. The dirt on the

glass and windows however provided the impetuous to allow the shadows and reflections into the RTI process. Re

RTI data sets:

1. Corner arrangements 1
2. Corner arrangements 2
3. Corner arrangements 3
4. Corner arrangements 4
5. Floor 1
6. Floor 2
7. Poo
8. Poo 2
9. Floor
10. Ceiling tiles
11. Ceiling circle
12. Window
13. Chair
14. Hoarding
15. Door
16. Door 2

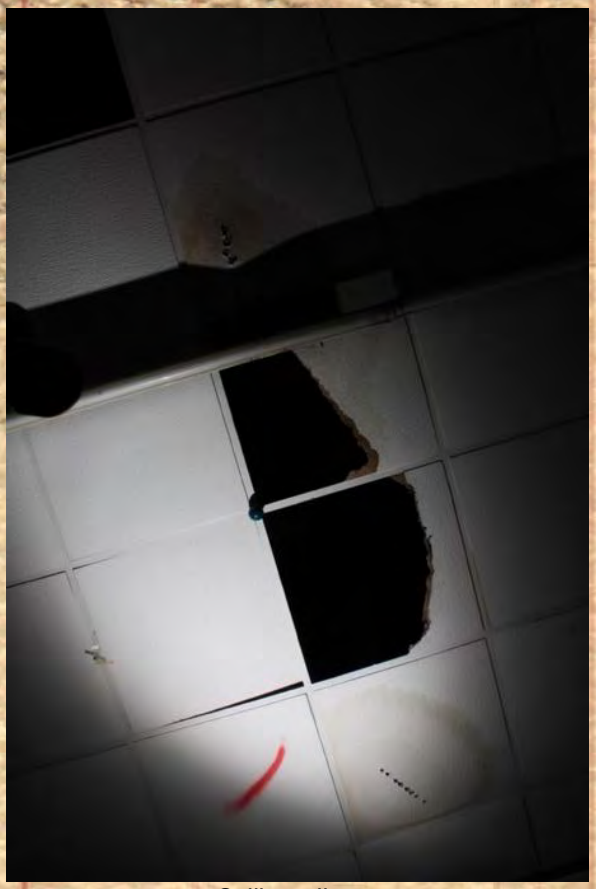
Corner arrangement 1

Corner arrangement 2

Corner arrangement 3

Corner arrangement 4

Ceiling circle

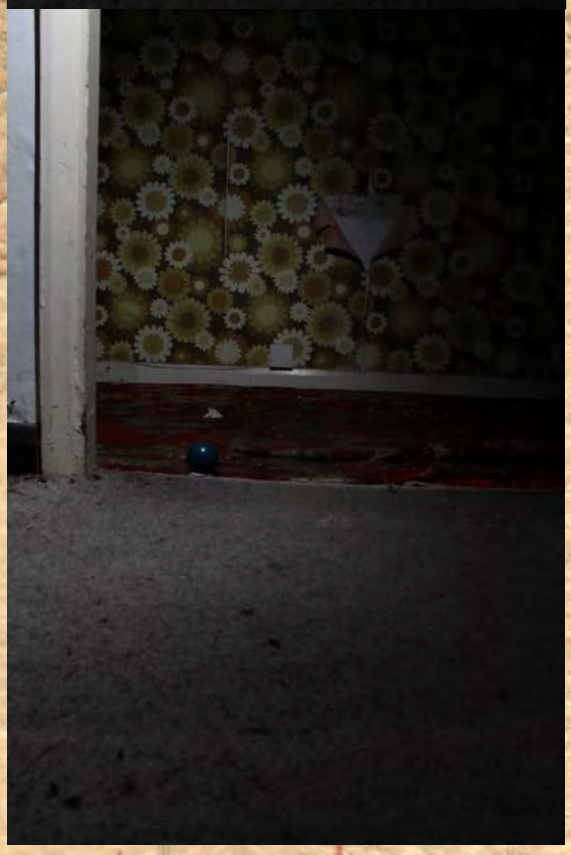


Ceiling tiles

Chair

Door1

Door2



Floor1

floor2

Hoarding

Poo1

Poo2

Window

Day 6

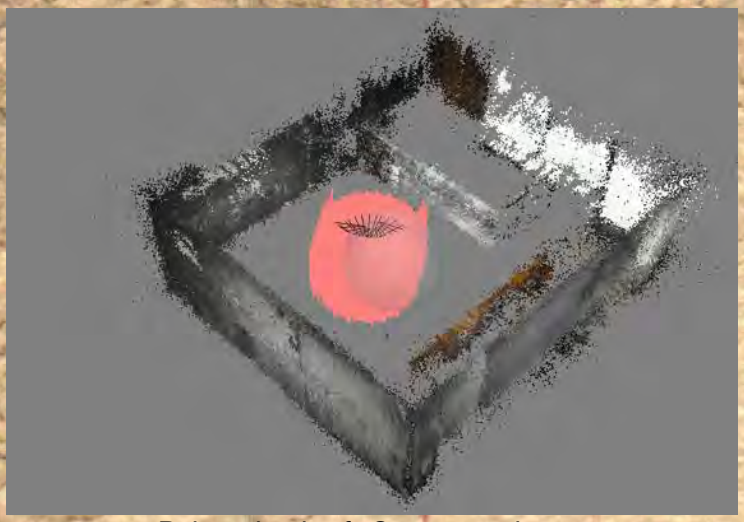
Friday 23rd May 2014

Day 6 was spent inside Cuevas; a photogrammetric data set was created. 4 further RTI data sets were made focusing upon the fire damage. And 3 RTI data sets were created of tiles on the external facing side of the unit.

1. photogrammetric data set of cuevas

RTI data sets

1. yellow room
2. no smoking sign 1
3. no smoking sign 2
4. fire damage
5. external tiles 1
6. external tiles 2
7. external tiles 3



Point cloud of Cuevas unit

Texture Map Filetype

Fire damage

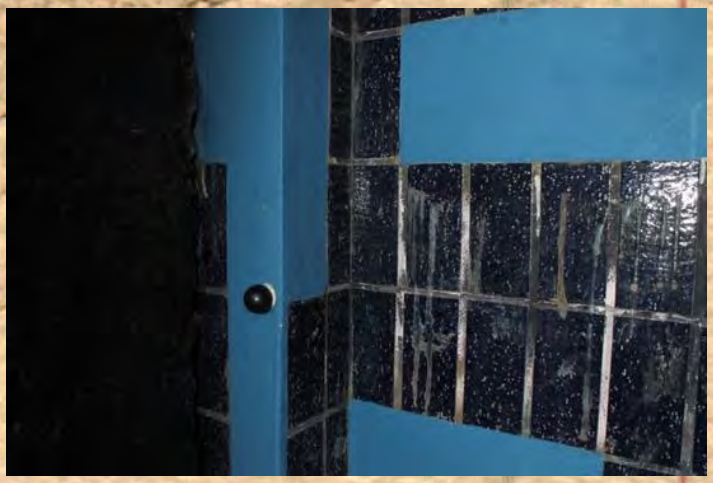
Yellow room

No smoking sign1

No smoking sign 2

External tiles 1

External tiles 2



External tiles 3

Day 7

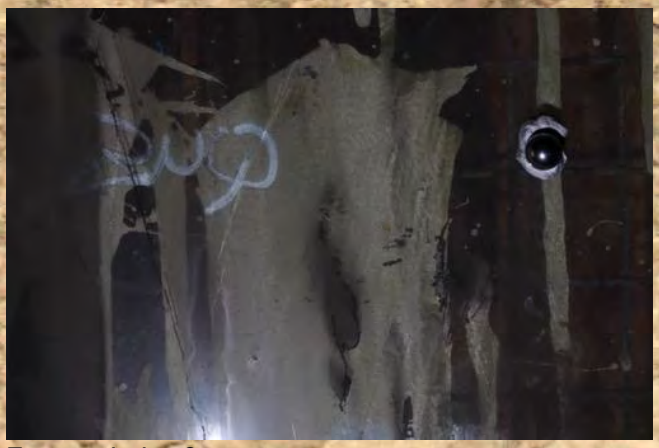
Wednesday 28th May 2014

Day 7 focused in the downstairs area of Cuevas. 13 RTI data sets were collected of various areas including more fire damaged parts of the space, and the different layers of security grill and hoardings. RTI Date sets:

1. Front window1
2. Front window2
3. Front window3
4. Grill 1
5. Grill 2
6. Grill 3
7. Grill 4
8. Grill 5
9. Grill 6
10. Grill 7
11. Melted cable 1
12. Melted cable 2
13. Shattered window

Front window

Front window2

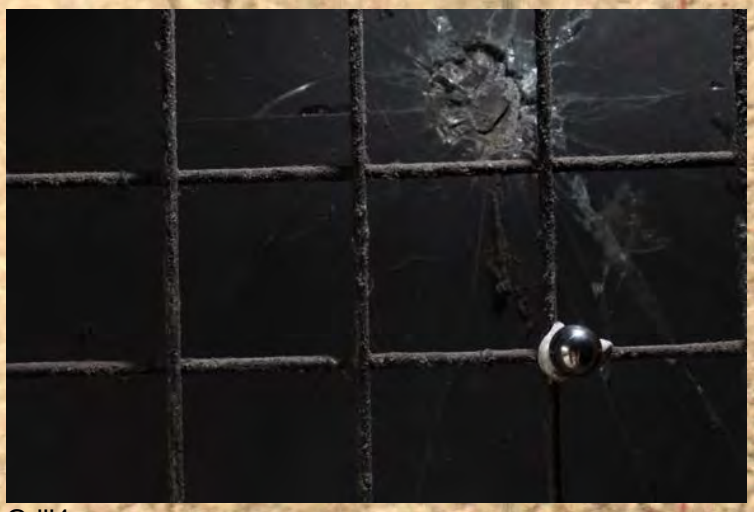


Front window3

Grill1

Grill2

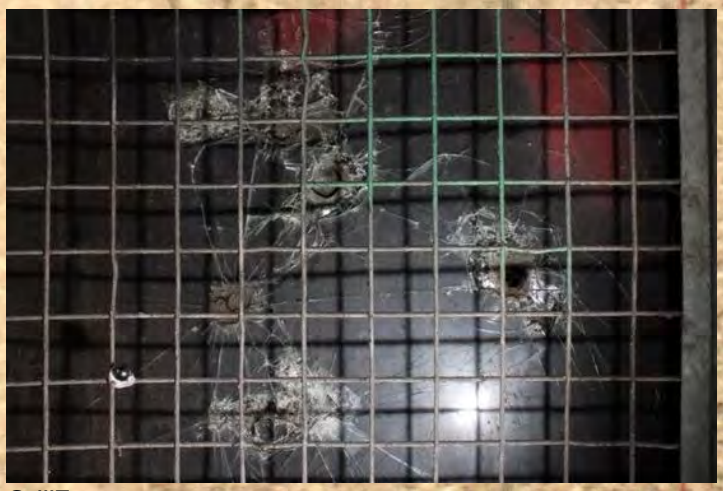
Grill3



Grill4

Grill5

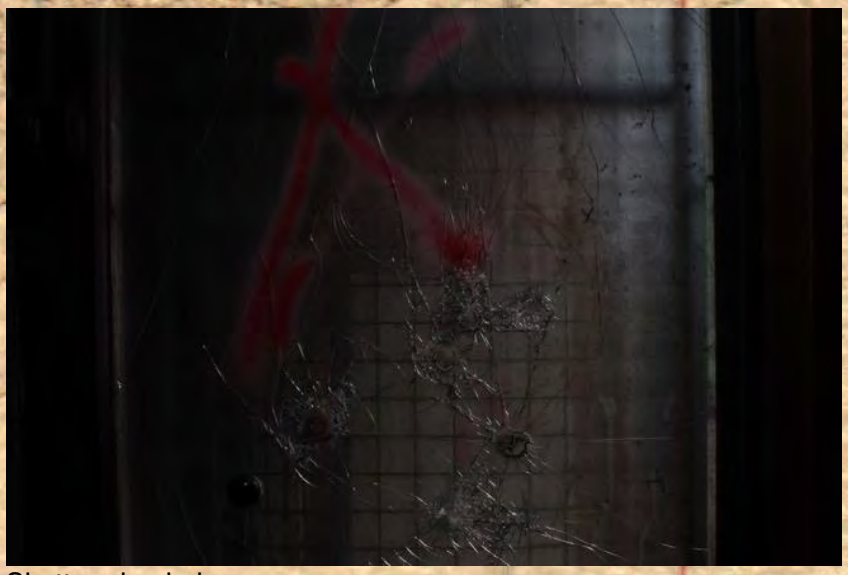
Grill6



Grill7

Melted cable1

Melted cable 2



Shattered window

Front window

Day 8

Friday 30th May 2014

Day 9 was spent in the Cab Office, 9 further RTI data sets were recorded.

Significantly the geometry of the architecture was used to affect the RTI capture conditions.

RTI data sets:

1. Stairs1
2. Stairs 2
3. Service box

4. Cab office
5. Broken window
6. Broken window 2
7. Loft
8. Wall
9. corridor

Service box

Cab office

Broken window 2

Broken window

Loft

Wall

Stairs

Stairs2

Corridor

Day 9

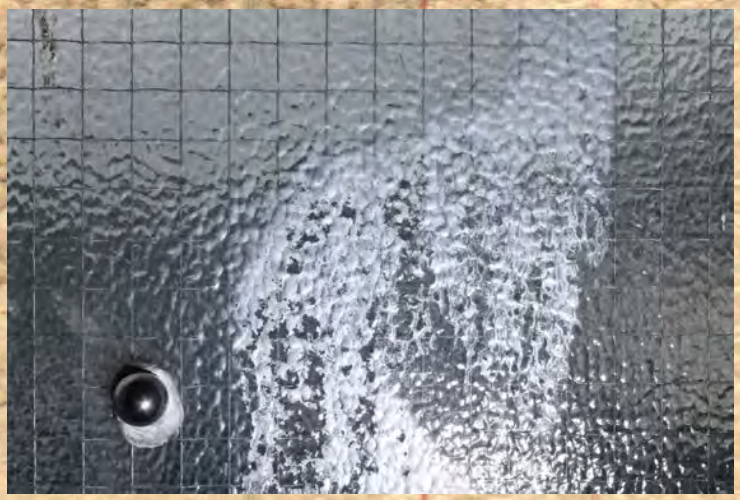
Monday 2nd June 2014

Day 9 was spent on the mezzanine level of the cab office. A total of 12 RTI data sets were collected. These RTI's focused upon the accumulation of dust in areas of the unit. A small ball bearing was used as the key ball. An additional set of RTI's were created of the outside surfaces of the unit.

RTI data sets:

1. window 1
2. window 2
3. window 3
4. window ledge 1
5. window ledge 2
6. window ledge 3
7. window ledge 4
8. corner 1
9. corner 2
10. corner 3
11. tarmac
12. external tiles

Windows3



Windows2

Windows1

Windowledge4

Windowledge3

Windowledge2

Windowledge1

Corner3

Corner2

Corner1

Tarmac

External tiles

TAPLOW HOUSE

EXHIBITION DOCUMENT

EXHIBITION PART 1:

TAPLOW HOUSE, ASC GALLERY, TAPLOW HOUSE, SE17 2UL
19th June 2015- 21st August 2015

INSTALLATION PHOTOS


JVC


SONY

RTI documentation:
https://www.youtube.com/channel/UCUPMsWUApJTskPDrRtGeo3A/videos

Corridor https://www.youtube.com/watch?v=R4TgREg6tyU
Broken Window https://www.youtube.com/watch?v=LciksFrd8CQ
Chair https://www.youtube.com/watch?v=qH58KfzSSIY
Ceiling https://www.youtube.com/watch?v=dbeLok3OdN4
Wall Porn. https://www.youtube.com/watch?v=rTDB1Pstk2U
Ceiling Circle https://www.youtube.com/watch?v=rTDB1Pstk2U
Front Window https://www.youtube.com/watch?v=ISFNgHMMJWc
Corner https://www.youtube.com/watch?v=yOOPJbrQxA0
Grill 6 https://www.youtube.com/watch?v=9jB00HC_OFY
Floor https://www.youtube.com/watch?v=4pG7xctbIJ0
Corner Arrangement https://www.youtube.com/watch?v=7EX0-02fEhI
Cab Office https://www.youtube.com/watch?v=AX2DyMzWHIo

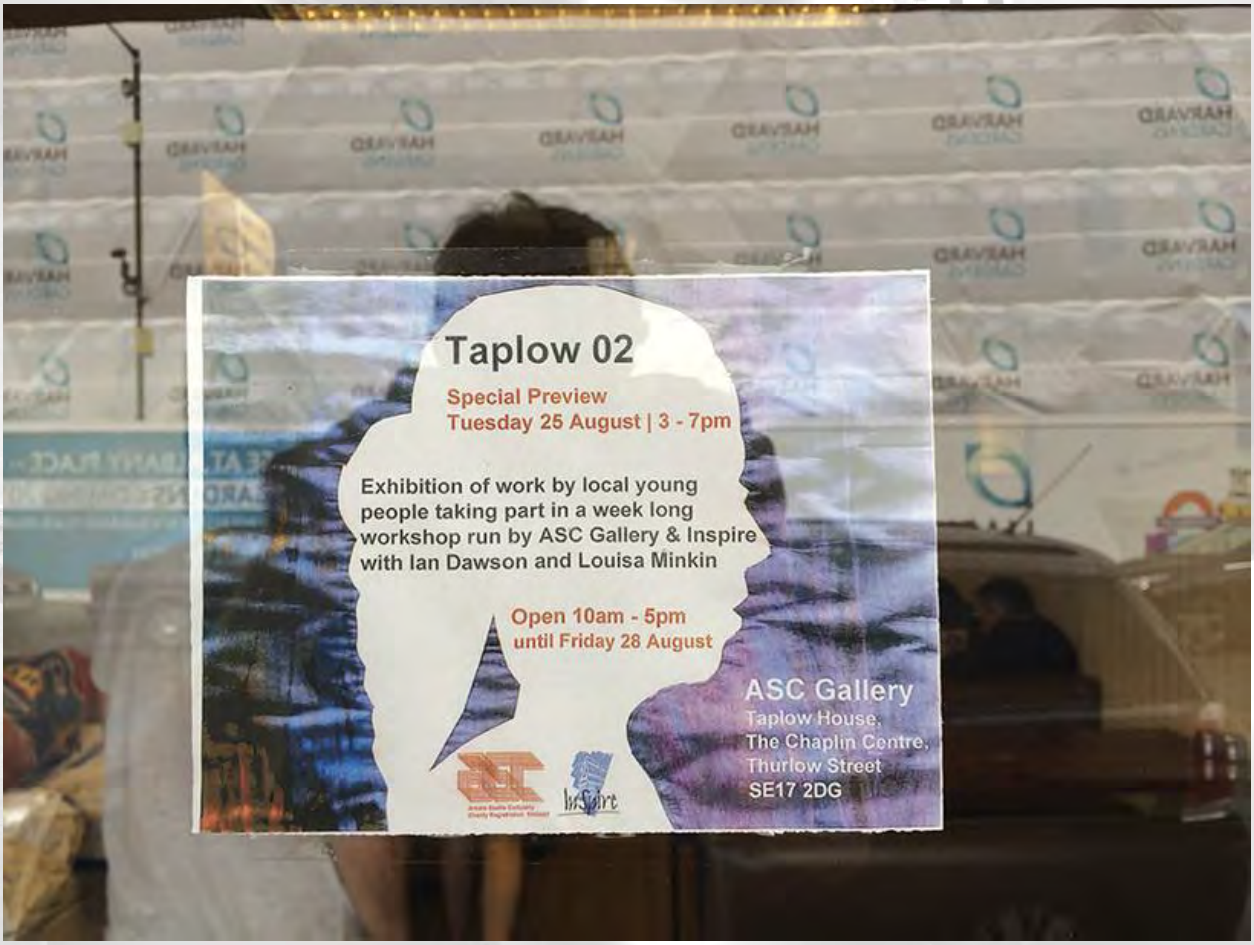
Photogrammetry Film of Cuevas
https://www.youtube.com/watch?v=eONUzunS6O0

3D Printed objects


DJ

TAPLOW 02

WORKSHOP and EXHIBITION TRANSFORMATION



EXHIBITION PART 2: Taplow 02: ASC Gallery Taplow House SE17 2DG

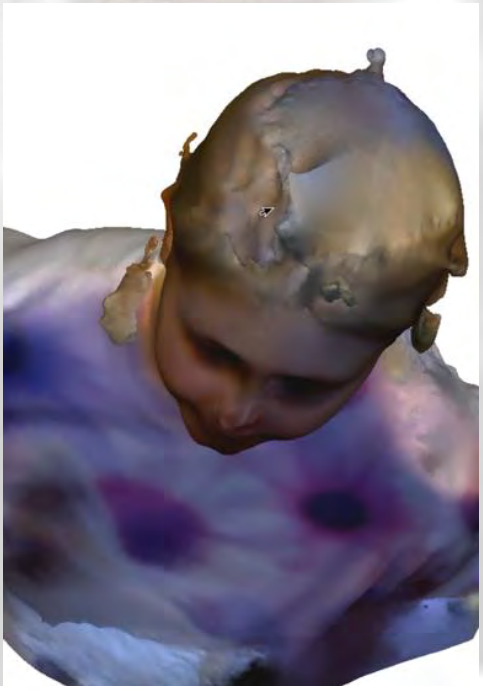
Workshops and Gallery Takeover 17th August 2015- 28th August 2015

WORKSHOP RESIDENCY LOG
DAY1
Monday 17th August

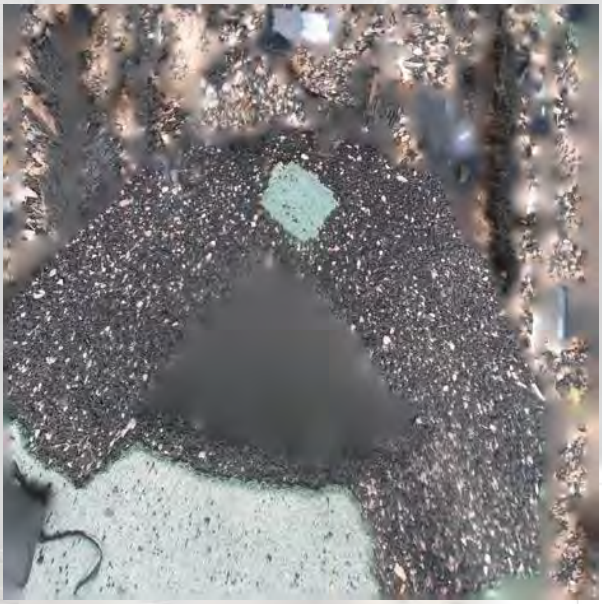
Day 1 activities: scanning and documentation of Wendover House, the neighbouring estate to Taplow House.
Scanning of the Play area and External surroundings of Wendover. 3 digital cameras, 1 digital SLR, 1 digital camcorder and 1 Sense laser scanner used to collect data. Visit to the neighbouring Taplow House.

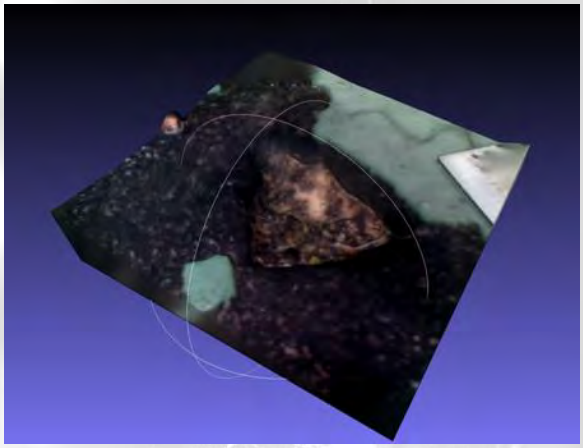
Screenshot of the photogrammetric model made from the play area

Recording in the play area



Laser scan portraits





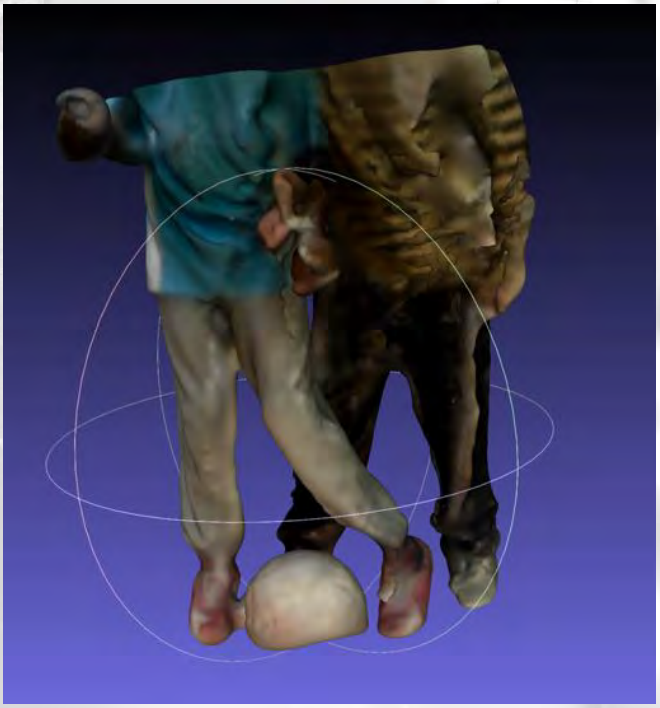
Documentation of the Play area scans

Photogrammetric scan of Wendover made in the play area

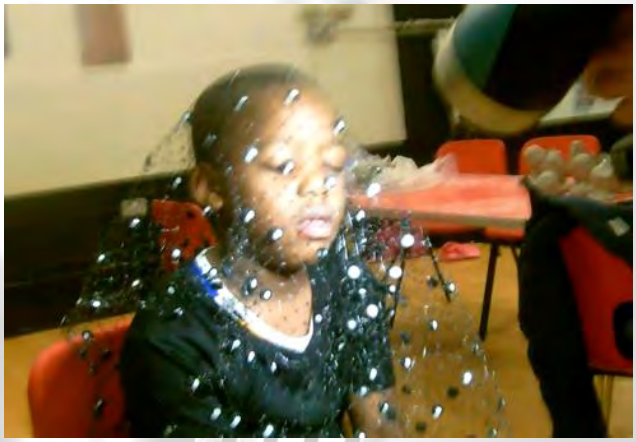
DAY 2

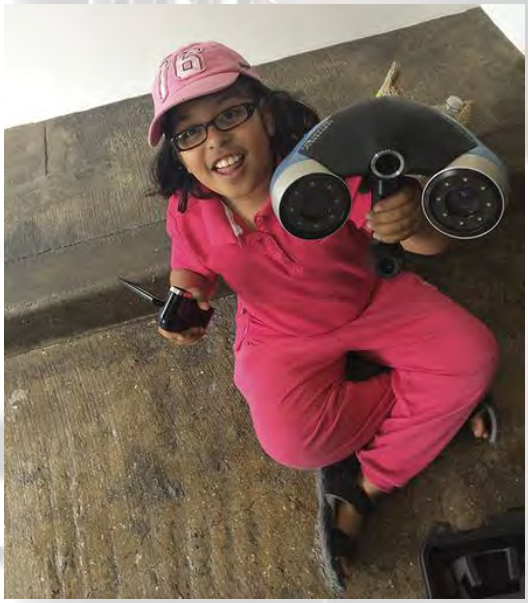
Tuesday 18th August

Day 2 activities inside Wendover Youth centre included photogrammetry workshops, laser scanning portraits in conjunction with clay modelling portraits. The clay model portraits were also laser scanned.

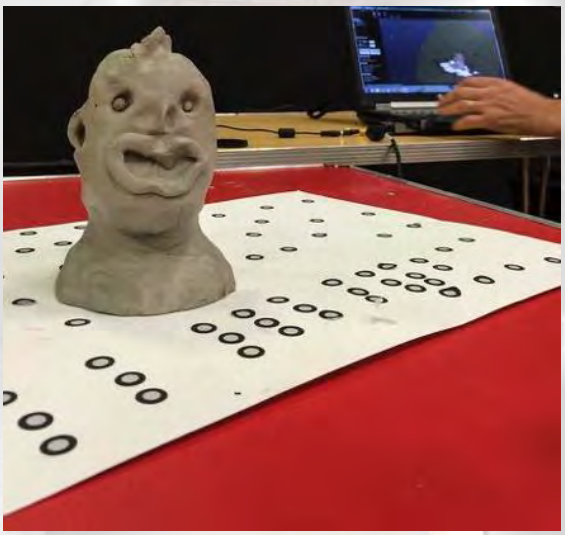


Documentation of day 2





Documentation of day 2

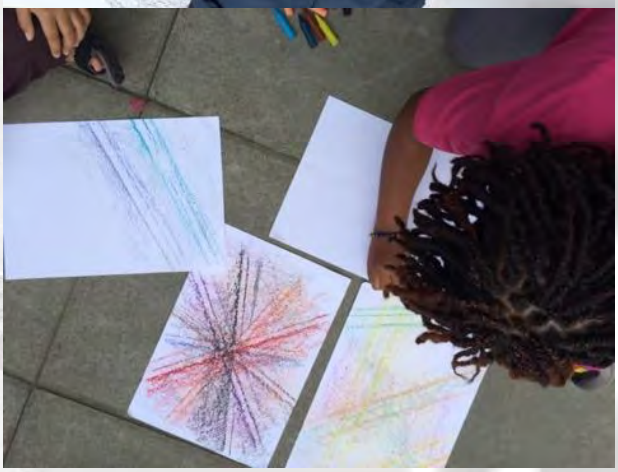


DAY 3

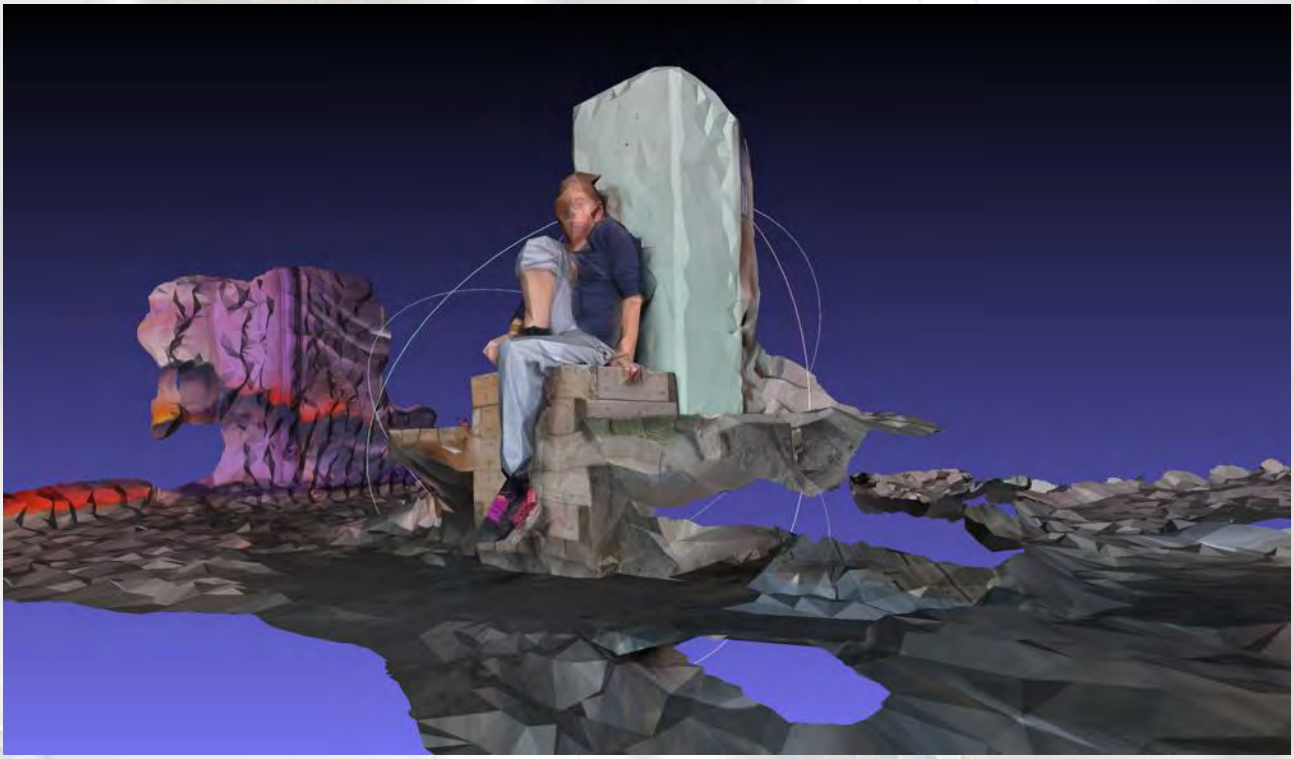
Wednesday 20th August 2015

Day 3 Activities. Created floor rubbings of the walkway at Taplow House. Photogrammetry of the walkway. Silk screen demonstration.

Making rubbings at Taplow House



Making rubbings at Taplow House



Photogrammetric scans on Taplow House walkway

Photogrammetric scans on Taplow House walkway

DAY 4

Thursday 21st August 2015

Day 4 activities: Photogrammetry portraits, Silk screen profiles RTI workshop with 2 data sets recorded of the external walls of Wendover Youth Centre

RTI outside Wendover House

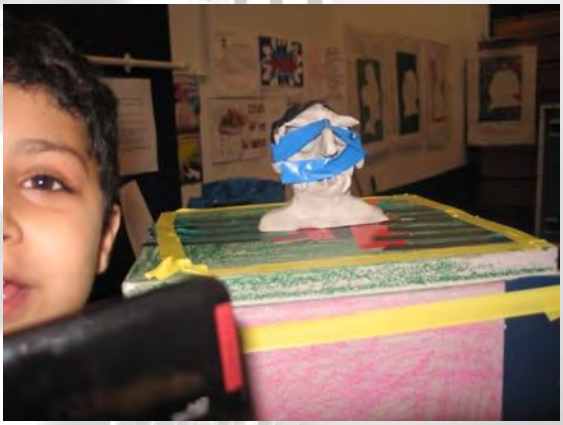
RTI Data sets of Wendover House

Silkscreen project

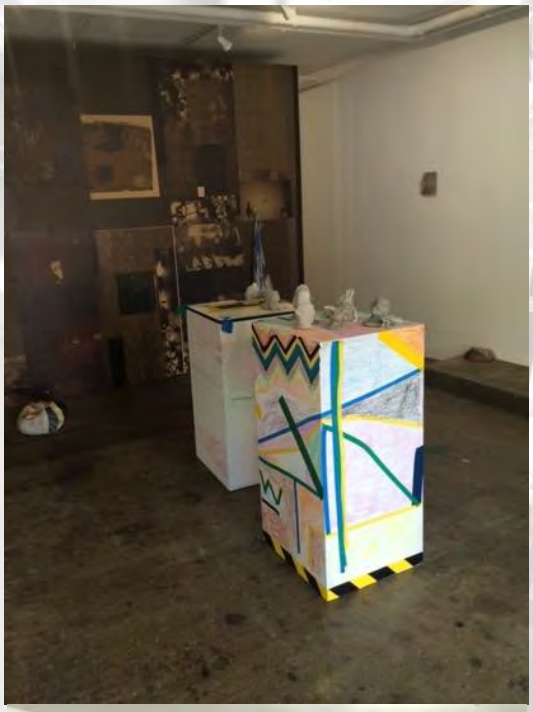
DAY 5

Friday 22nd August 2015

Day 5 Activities: Exhibition architecture preparation, scanning and screen recording, Taplow gallery transformation.



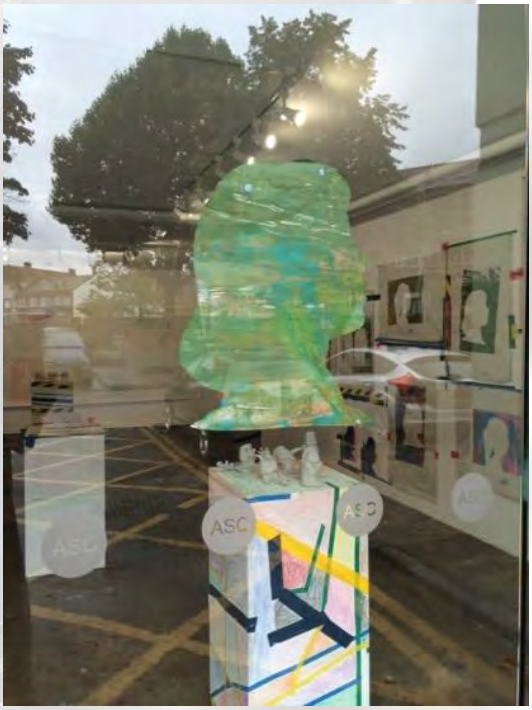
Exhibition preparation



Taplow Exhibition Takeover

Taplow Exhibition Takeover

Taplow Exhibition Takeover



Taplow Exhibition Takeover

TAPLOW HOUSE
ITERATIONS

Pictures Not Homes
Winchester School of Art Gallery
12th Jaunuary - 28th January 2017

Gestures of Resistance
Centre Romantso, Athens, Greece
20th April - 30th April 2017

Annihilation Event
Lethaby Gallery, Central Saint Martins, London
22nd March - 29th March 2017

PICTURES NOT HOMES

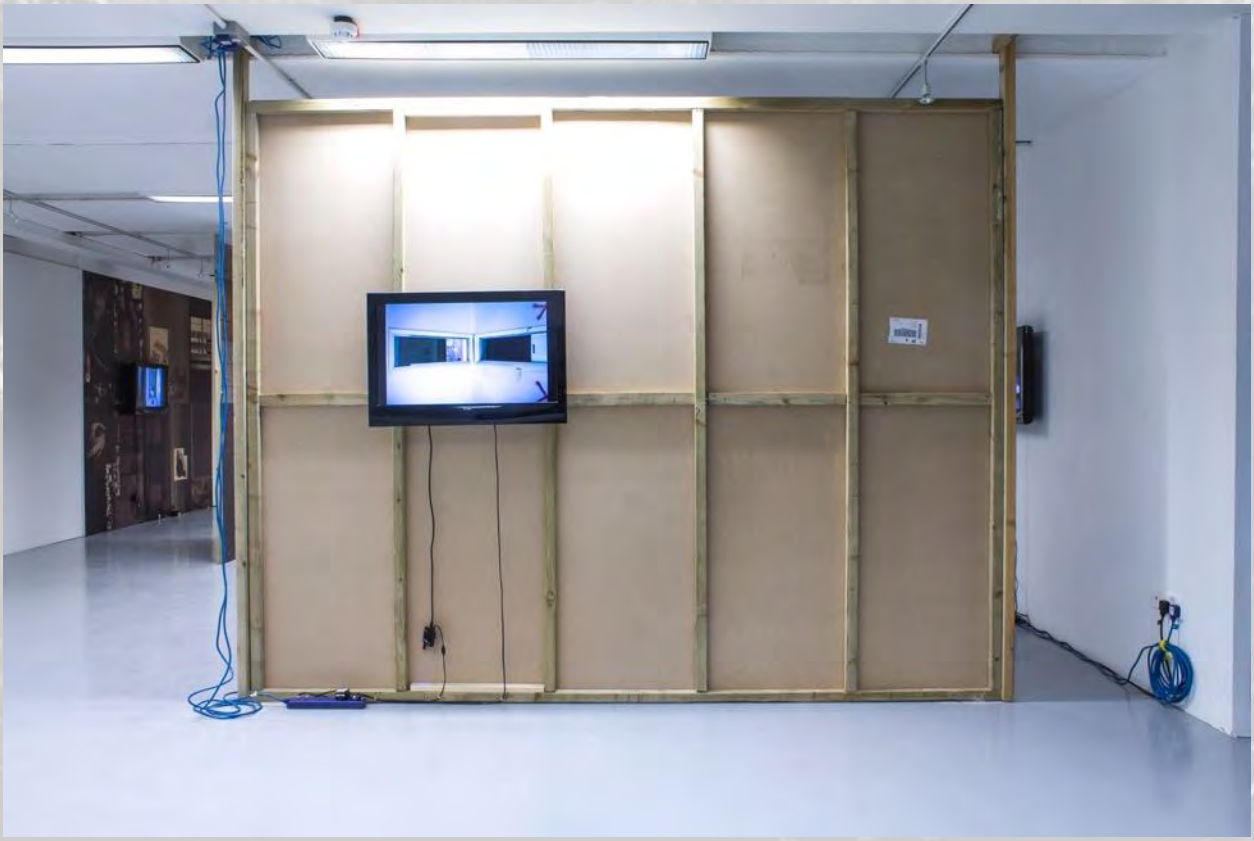
Winchester School of Art Gallery

12th Jaunuary - 28th January 2017

Exhibition of artworks generated from the Taplow House Project.
Exhibition consisted of:
Hoarding structures, printed panels on timber frames.
10 monitors playing RTI animated sequences.
1 digital projection of Cuevas Photogrammetric model
3D printed objects

6 Printed fabric sandbags
1 black RTI capture ball

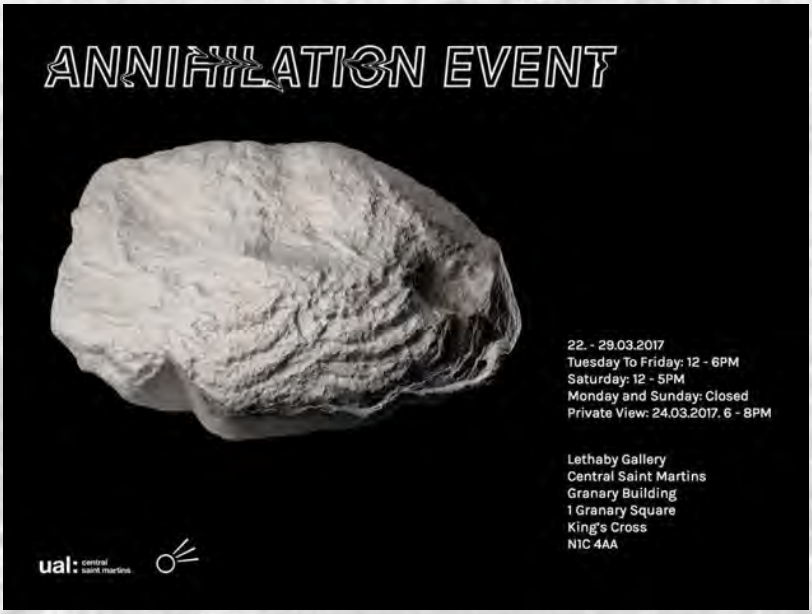

Aylesbury Health Centre



Annihilation Event

Lethaby Gallery, Central Saint Martins London

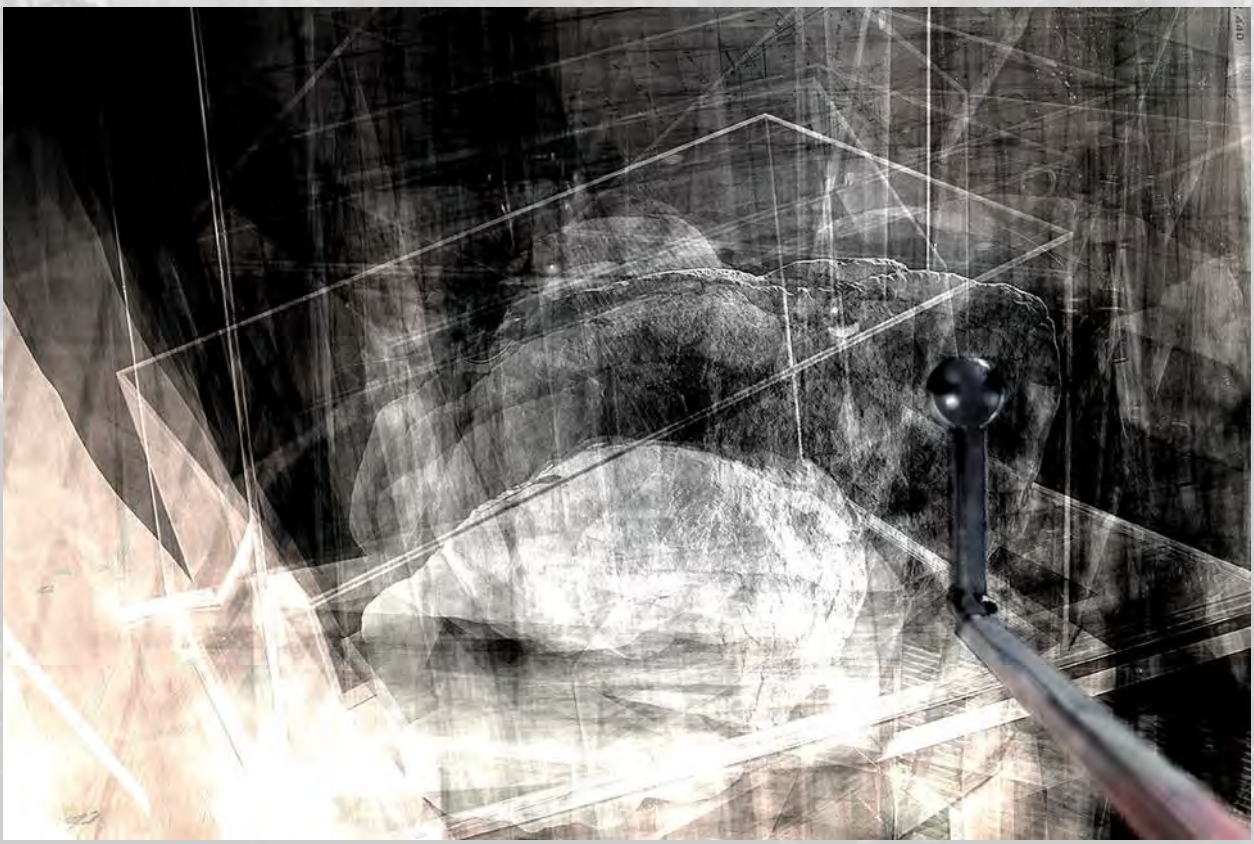
22nd March - 29th March 2017



Group Exhibition and workshop event curated by Minkin, Dawson and Jones.

Contributors: Thomas Allison - Harry Badrick - SE Barnet - Bernd Behr - Belgian Litho Stone - Bilderfahrzeuge - British Museum - Victor Buchli - the Campari Fountain - Sarah Campbell - CCW Digital Derive Group - Central Saint Martins - Steven Claydon - Ami Clarke - Georgia Clemson - Stephen Cornford - Nelson Crespo - Anthony Davies - Ian Dawson - Naomi Dines - Michael Doser (CERN) - English/ British Art and the Mediterranean - ENSAV La Cambre Brussels - Mick Finch - Sion Fletcher - Marta Dìaz Guardamino - Marc Hulson - Pierre Huyghebaert - Kate Jarvis and Claudia Zehrt - Jet Jet - Andy Jones - Eric King - Alex Landrum - Nicola Lorini - Anna McSweeney - Louisa Minkin - Monkton Up Wimborne chalk block - Sally Morfill and Ana Cavic - Jean-Pierre Muller - Digital Old Minster - Greg Nijs - Portolan Chart - Paul Reilly - Paul Simon Richards - Daniel Rubinstein - Shadow without Object - Alex Schady - Sounds and Spaces - The Department of Subjective Archaeology - Pete Smithson - John Stezaker - Mia Taylor - Jim Thrower - Susan Trangmar - U+2604 - UAL Archives and Special Collections - David Usborne's Collection - Athanasios Velios - Christelle Viviers - Johannes Von Müller - Waend - Alexandra Warwick - Jo Wheeler - Winchester School of Art - John Wollaston - Elizabeth Wright

Exhibited works consisted of:
2 monitors playing RTI animated sequences
3D printed objects of Taplow House
Performance day with RTI, creating RTI live within the exhibition space



Links to film documentation:

Underpass RTI https://www.youtube.com/watch?v=DHCmOLt5TEo
Candle RTI https://www.youtube.com/watch?v=1w6WnUWSo1E
Static Flash RTI (Kylie) https://www.youtube.com/watch?v=zxlaqNMoghI
Static Flash RTI (Jackson) https://www.youtube.com/watch?v=KwJcR_W5RTw
RTI (documentation of the black ball position)
https://www.youtube.com/watch?v=FM9PcF4wfgE&t=11s
RTI (Theta 360) https://www.youtube.com/watch?v=2tPNDJcXjqI&t=46s
RTI camera https://www.youtube.com/watch?v=0HadnpYkzOk

Gesture of Resistance

Centre Romantso, Athens, Greece

20th April - 30th April 2017

Group Exhibition curated by curated by Jean Wainwright.

Exhibition contribution consisted of:
Hoarding structures, printed panels on timber frame.
2 monitors playing RTI animated sequences.
1 monitor playing Cuevas Photogrammetric model
1 3D printed object of Cuevas
6 Printed fabric sandbags

Other exhibiting Artists: Bill Balaskas, Pavel Büchler, Broomberg and Chanarin, Edward Chell, Ian Dawson, Craig Fisher, Alfredo Jaar, Peter Kennard and Cat Phillipps, Steffi Klenz, Małgorzata Markiewicz, Louisa Minkin, Francis Summers, Terry Perk, Julian Rowe, Yorgos Sapountzis, Bob and Roberta Smith, Socratis Socratous, Wolfgang Tillmans, Jessica Voorsanger, Stuart Whipps

Images in the making

Art, process, archaeology

Ing-Marie Back Danielsson
and Andrew Meirion Jones (eds)

Images in the making

Art, process, archaeology

Edited by

Ing-Marie Back Danielsson and Andrew Meirion Jones

Contents

4

Dirty RTI

Ian Dawson

> One night I was, as usual observing the sky with my telescope. I noticed that a sign was hanging from a galaxy a hundred million light-years away. On it was written: I SAW YOU.
>
> Italo Calvino, 'The Light-Years', *Cosmicomics*

Introduction

Light is our window on the universe and the condition for all life on earth. Light deposits energy into matter and fills the universe with radio-waves and X-rays as thousands of watts per square metre of filtered solar radiation are absorbed upon the surface of the world. The catalyst for molecular vibration that scatters wavelengths of visible light across the landscape as plants across the planet harness light using chlorophyll to harvest the photons in a complex process that delivers sugar for growth, whilst painting tranches of the natural landscape green. We might think of green as the colour of life but in physical reality it is the colour that life throws away, the waste photons from the photosynthesis process reflecting back into our eyes.

The spectrum of colours that illuminate our environment; from the cold blue emanating from water molecules to the pink projecting from hydrogen gases in the Milky Way is all a result of the complex interactions between electrically charged particles within all matter and the light-emitting photons that are created as energy – which bathes the world and the whole cosmos in colour.

Light thus becomes the 'condition of all vision' (Cubitt 2014), as the arc of the sun crosses rock art formations, the flicker of flame illuminates

the painted inscriptions of Chauvet, and outlines are tracked and traced around human shadow. There are long histories of the desire to control light culminating in Newton's law of optics which becomes the root of modernity setting a dialectic that Goethe would grapple with when saying 'we can never directly see what is true, … we look at it only in reflection' (Cubitt 2014: 127).

Light, which for millennia has been a celestial medium, has properties which are now converted by 'reason and experiment'. Fragmented through a prism, its meaning is relocated into the laws of physics. The contradictions between those positions were best illustrated by the Impressionist painters of the late nineteenth and early twentieth century in whose work the tensions between the impact of natural light and colour on the eye – an aesthetic based on truth to nature – is in opposition to an equally absolute assertion of the individual eye of the artist at the moment of perception (Cubitt 2014: 128). The tussle for meaning continues, and synthetic images, including Reflectance Transformation Imaging (RTI), are a new generation of image making. Producing a cam-puter image that glows brightly on a liquid crystal display in which subject and object are intra-acted; the RTI apparatus acts as a boundary forming practice that is 'formative of matter and meaning' (Barad 2007: 146).

4.1 Ian Dawson, RTI RTI, 2017 (performative RTI, Annihilation Event, Lethaby Gallery, London)

Reflectance Transformation Imaging

In 2015, fellow artist Louisa Minkin and I accompanied the archaeologists Andrew Jones, Marta Díaz Guardamino, Eleni Kotoula and Andrew Cochrane to the British Museum. We were there to study the Folkton Drums, three remarkable decorated objects from Neolithic Britain (Jones *et al*. 2015). The Folkton Drums; three solid cylinders of chalk decorated with sequences of crosshatched chevrons and sets of eye-like indentations below eyebrows denoting rather melancholic-looking faces. One wonders if these objects, excavated from a child's grave in North Yorkshire between 1866 and 1868, were ever intended to be viewed by the living at all. We were there to scrutinise these artefacts with a new form of imaging technology to probe an object that predates script by technologies that succeed script (Dawson and Minkin 2017). RTI, developed by Hewlett Packard Laboratories, is one of the technologies adopted by the cultural heritage industries to record historical artefacts and objects of archaeological interest. Concealed pockmarks on carvings can be reanimated (Jones and Smith 2017) as the technology accentuates the perception of surface deformations. The realism of the image enhanced through a process of interreflection (Malzbender *et al*. 2001) as jpg and pixel information is converted to a synthetic polynomial texture map.

The customary RTI process involves taking multiple photographs from a static digital camera installed upon a tripod, upwards of seventy shots from a single point of view while repositioning a photographic flash for each shot. This dataset, each photograph with its own unique light condition, is inputted into the RTI software to create an interactive image which can be traversed on a computer screen. The RTI of the Folkton Drums revealed evidence of erasure and reworking, of motifs being rubbed out, removed and replaced, suggesting that the form of the Folkton Drums was arrived at through experimentation and revision, akin to a drawing and artistic process (see Dawson 2012).

In addition to the images-revealing process, the act of performing RTI is processual in itself. Both the data capture stage and the image viewing phase involve complex intra-actions between environment, camera, object, image, computer and operator (Jones and Smith 2017). In this instance the Folkton Drums were thrust into the limelight, caught in the glare, their faces startled by the media spotlight, continuing the arc of their exhumation: 'An artificial "exhibition of firelight" where the living commemorate the annual return of the departed from the land of the shades' (Stafford and Terpak 2001).

Limelight, the combustion of a lump of calcium oxide, originally known as koniaphostic lighting; was used on the Herne Bay Pier in 1836 (During 2004), to illuminate the magic acts of Ching Lao Lauro, possibly

a Cornish man, and the first European to practise sitting in the air upon nothing, also known as the ethereal suspension illusion. The whole pier was 'overwhelmed by a flood of beautiful white light' illuminating and capturing the act of magic. Limelight 'transformed night to day as a special effect' sharpening images and enriching colour; used to raise and set the sun across theatrical panoramas (Klein 2004).

Dirty RTI

Limelight – the term endures even after the obsolescence of koniaphostic lighting – describes the focus of attention on a mediated object and I too was caught in the RTI spell, watching the Folkton Drums absorb and reflect the glare of the camera flash asking the question; what can RTI bring to light again, what can it revive and restore? This question was posed when Louisa Minkin and I took the RTI process into some derelict spaces within a South London housing estate, Taplow House.

Many of the rooms in Taplow House had been closed since the 1970s, a cab office, a butcher's and a launderette. The dust and grime had settled on places and spaces unused for forty years. In the darkness Louisa and I traversed these rooms, still lives revealed through the stroboscopic activity of the photographic flash. There were arrangements of midden accumulation, flotsam, jetsam and lagan architecture, spaces waiting to be salvaged, the first layers and stratigraphy of the onset of the archaeological process.

The relationship between these RTI images and the reflections, refractions and spatialisation in Edouard Manet's *Bar at the Folies-Bergère* (1882) became apparent (the balcony at Taplow House points northwards towards the Courtauld Institute and the painting's current home). The painting, and Foucault's 1971 lecture, describe its well-known features: the entanglement of three components, the space, the lighting and the viewer which occurs through a mirror (the lens) situated parallel to the picture plane and encompassing the whole canvas, so that everything in front of the mirror and within the painting is also found within the reflection. Yet, owing to the impossibility of the position of all the components, the painting becomes an image that 'the viewer can move around'.

The distortions that arise between the reflection and the represented point of view of the painting are 'simultaneously two incompatible places' (Foucault 2009).

The RTI images at Taplow House appeared to raise similar questions; here is an illusory image file that is navigable, that resembles something else – an amalgamated time-lapse image – yet with inherent temporal

4.2 Ian Dawson and Louisa Minkin, RTI Taplow House, 2015

disparity as if the traditional logic of the visual is being superseded by a new logic, that of data-smart image processing.

Shadow

somewhere in the waste. The Shadow sits and waits for me
Alfred Lord Tennyson

The RTI experimentation at Taplow House caught shadows cast through discarded bottles and broken windows. Outlines of deflected shade aggregated into cloudy smears, catching glimpses of phantom images: a hand holding the flashgun appearing out of the haze. The Shadow is a vast penumbra in Western art, used to conjure what's not there and to prophesy with ghost stories of demons and hobgoblins. The Shadow was adopted as early as the second century to pictorially explain structure: Roman and Hellenistic floor mosaics would depict litter, discarded fishbones and fruit, titbits on the floor, the shadow becoming the foremost way to describe form, and it has continued ever since. This mosaic image plane is a precursor to the fragmentary subjectivity of the encoded pixelated image that occurs nearly two millennia later (Lazaratto 2014). The shadow, and its alignment with ideas of a geometric space, is typified by *trompe*

l'oeil where shadows are part of a history of animation that converts the image into deceptive figments of the real world, 'devoted to the replication of appearance and to the power of technique to produce illusion' (Cubitt 2014: 170)

In these second-century mosaics, as well as Man Ray's silver gelatin photograph *Dust Breeding* (1920), which pictures Marcel Duchamp's *Large Glass* with a year's worth of grime settled on its surface, we see the shadow and the detritus itself functioning as a physical index for the passage of time. The accumulation of dirt and dust is both an index and a projection; the shadow and spatial measurement inextricably linked as the pre-eminent technique for creating relations between objects and their environment.

Metric photography

> 'We can only see what we are looking for,' wrote Alphonse Bertillon in the late nineteenth century, 'and we look for what is already in our minds.'
> (Dufour 2015: 19)

Nineteenth-century Paris, the city of light, 56,000 gas lamps illuminating its streets, home to the Folies-Bergère, a city which was absorbed with *ombremanie* (Gombrich 1995). At *Le Chat Noir*, shadow plays such as *L'Epopée* would use four thousand silhouettes performing thirty scenes. The silhouette, the image of austerity, made epic. Bertillon was a Parisian police clerk, who had started to assort and arrange with photography, dividing facial features into discrete units of information, thus introducing biometrics and anthropometry. At this time psychology was further questioning the reliability of human memory and scepticism was placed on eyewitness accounts. Bertillon continued to pioneer forensic science by merging metric measurements, plans and calculations with the camera to create a systematised procedure for photography.

Bertillon, from a family of statisticians, developed a formal structure of photography allowing for re-investigation of the crime scene with the aim to 'produce directly with no instrument other than the lens, photographs which could be utilized as actual geometric plans in cross-section, elevation and horizontal projection, and which, with the aid of simple rules and calculations would be capable of providing the shapes and exact dimensions of the objects shown' (Dufour 2015: 19). By using an overhead camera fitted with a wide-angle lens, recordings were made by Bertillon under strict standardised conditions from atop a two-metre-tall tripod. These images take on a supra-human point of view: looking down on to murder scenes, the victims are framed within the converging lines created by the apparatus. These photographs are then fused with

4.3 Ian Dawson Louisa Minkin, RTI Taplow House (Cab Office), 2015

a *perspectometric* measurement grid to enable a transformation of the image into *planimetric* drawings. This elaborate representation system was even applied to the morgue, where the floor was divided with a sequence of cross-hatched, isometric lines in order that all photography could be used as a metric analytic tool.

Back at Taplow House, in the cab office, a room set out in quadrants, a letterbox aperture divides the rooms, once used to communicate one's desired destination to the controller.

RTI is designed to record a flat narrow depth of field but was used to describe a whole space, the RTI software ordering the shadows into a synthetic sundial, the architecture of the space acting as the gnomon. Gnomon: Greek for the 'one that examines', the emblem for French notaries (Schwartz 1996) and the orientation tool on three-dimensional visualisation software.

Optical tricks

Any studying of imaging is a study into the devices that have created them; visualisations, whether digital or analogue, are always constructions, as Carlo Rubbia the particle physicist said: 'Detectors are really (just) a way to express yourself … The detector is the image of the guy who designed it' (Cubitt 2014: 245). There is a fundamental uncertainty to

images when produced by contraptions; apparatuses create experimental impressions: they are not unmediated truths. From torch light to optical boxes, lenticular images and holography, mediation affects the event itself – visual media are also interventions into the physical processes of the world. 'The world does not exist as data: it must be produced as data' (Cubitt 2014: 246).

Optical tricks were often byproducts of scientific endeavour; the solar microscope of the eighteenth century was used by both scientists and swindlers, with quasi-scientific shows, involving necromantic cats and influenza lice, being presented before dubious remedies were peddled. The noble pursuit to understand nature brought fashion to lenses. London's famous diarist Samuel Pepys chronicles the shop of Richard Reeve's, which he frequented, where microscopes, telescopes, magic lanterns were avidly sought. Spectacles, invented in Pisa in the thirteenth century, and eyeglasses to fix faulty vision were in general use by the seventeenth century (by the wealthy) and these were offered alongside sextants, telescopes and compasses. One could also find fantastical eyeglasses with faceted lenses, cut from crystal and mounted in gilded metal frames, devices that multiply an object's view as the saying went at the time: 'These are pleasurable spectacles for avaricious persons that love Gold and Silver, for one piece will seem many, or one heap of money will seem a treasury' (Stafford and Terpak, 2001: 185).

These particular lenses influenced a type of optical painting that could be viewed through a special perspective glass; here the image didn't just proliferate but instead the broken elements of the scene would realign into a coherent new image. The busts of twelve Ottoman rulers combine to form a portrait of King Louis XIII, for example, as a tuft of hair from one, a nose from another, are drawn together. The influence of this form of imaging can be seen on Hobbes's title-page for *Leviathan* (1651) as the body of the towering figure of Leviathan is composed of innumerable smaller figures. 'There is no power on earth to be compared to him', it states, as Hobbes's frontispiece illustrates the translation of new optical technology into political and religious spheres (Stafford and Terpak 2001: 186).

One might say Taplow House is twinned with Taeppas Low, the seventh-century Anglo-Saxon burial mound located sixty miles upstream on the river Thames. This mound dominates the local environment and must have been the focus of legend and curiosity. In 1883 a group of antiquarians excavated the mound 'with a zeal only outmatched by their incompetence' (Webster 2001), producing contradictory plans of the burial chamber and failing to keep any systematic records of their observations. The extraordinary array of grave goods from the Kentish east lay around the body indicating the dead man's power and hinting at the politics and power struggles of the early Anglo-Saxon period.

Eastwards and firmly in Kentish territory, Taplow House has its own political dimensions. Built between 1963 and 1977, the estate was one of the most imposing in Europe, one of the last to be built using the now defunct LPS (large panel system) of prefabricated concrete slabs. This style, along with its raised walkways, almost immediately became synonymous with its decline. And it is here that Tony Blair gave his first public speech as Prime Minister, with his 'Will to win' speech, standing high on a balcony, saluting out towards the country.

Like the antiquarians', our own archaeology of the forgotten rooms on this estate was similarly problematic; the estate is under regeneration, artists' projects are the first wave of gentrification – as new blocks of incremental housing and dispersal architecture are constructed. As Taplow waits for its own demolition, how does one remember buildings whose importance lies in their very own hostility to heritage (Hatherley 2009)? The very same imaging techniques used to explore the site from within are those used to advertise renewal, and revival from outside with the pixel-bright hoardings and panels featuring cleansed regeneration sunsets. Perhaps our images of the interior of Taplow House can be classed as beautiful images that counter the an-esthetic subordinating images of mass media so that they can be used to communicate and ascribe a common value and used to discuss relationships to the machinery of production?

4.4 Ian Dawson, RTI Underpass, 2016

The self-swallowing camera

In 1971 with the aid of a couple of mirrors John Hilliard photographed a camera using seven different apertures and ten different shutter speeds. The resultant work – a grid of seventy photographs that disperses the dark black underexposed images in the bottom right-hand corner to the overexposed bleached images in the top left part of the grid – is a shimmer of cameras. This is a recording of the phase space of the 35 mm camera as apparatus. Titled 'A camera recording its own condition', these photographs impart a teleology (Hofstader 2007): a system endowed with desire to describe its own status and illustrating the dialectical position that 'with every photograph, the photographic program becomes poorer by one possibility, while the photographic universe becomes richer by one realization' (Fuller 2005). What would happen if the RTI process were to be turned in on itself, to create a recursive feedback loop? How would RTI evidence its own phase space? The RTI software doesn't like reflective surfaces, so what would be generated by the flashlight reflecting through the lens and on to the film? Or more accurately, what do multiple electronic discharges of xenon (the flash) do when captured on the metal oxide semiconductor of the DSLR image sensor? The process commences with an electronic charge of flash-emitting photons which rebounds from a mirror before entering the lens and reaching the image sensor at the rear of the camera; these photons then react with the photosensitive capacitors of the chip to release electrons thus to produce a charge. What starts with an electronic charge returns to an electronic charge.

The charge couple device (CCD), a relative of the solar panel, stores these incoming photons. There is a further dialogue around the existence of photons in the first place; photons are emitted when electrons jump, and electrons exist only when they are being interacted with (Rovelli 2014: 14). These photons are organised at the back of the camera in a grid-and-column structure, holding the heat charge until a system of gates and barriers enables an orderly discharge and conversion via voltage to information. At this point the CCD performs its function as if like a clock (Cubitt 2014: 100). After the output as lines of numeric code, the RTI software calculates the directionality of the light source of each pixel and extracts the reflectance information translating these data into a polynomial texture map. Here the directionality of the light source for each single pixel is converted, producing a surface normal for those pixels whilst discarding all other pixel and jpeg information. The RTI Viewer acts as the interface that allows for a visual representation of this information. At this point the world of visible surfaces have transitioned from geometrical and grammatical structures to mathematical organisation.

Polynomial, a conjunction of the Greek for 'many' and Latin for 'term', is an algebraic function: wherever there is proliferation a polynomial will be used to relate the data from one to another; it encodes information about objects into curves. Polynomials process variables that are easily smoothed; and because they are 'many termed' they obey all the rules. Polynomials are used to design rollercoasters or to plot the trajectory of projectiles, and in the stock market to strategise demand against pricing. In the polynomial imaging of RTI we can see that, once converted into numbers, light can be subjected to the kind of manipulation that we observe in the financial sector, where the abstraction rather than the actuality is massaged and manipulated: a system in which any light, any charge, any voltage can be exchanged for any other, creating an externality out of the very substance of image making. The image is not only fashioned mathematically, it can also be refashioned mathematically.

Unstable RTI

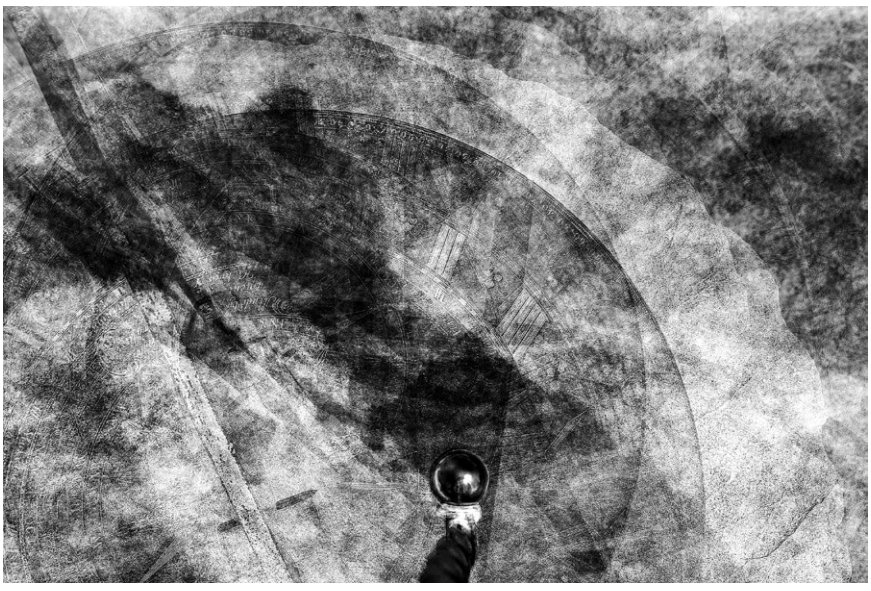
The standard spherical cue ball is a constant in RTI: it contains the high-light information used to extract the directional light information, the crystal ball for the software. In conventional RTI this black sphere is eventually cropped out of the image, redundant and superfluous. The black ball became an ever more central part in our experimentation, expanding in scale, to the size of a beachball when capturing oversized environments, the situation for the cue ball ever more significant as thresholds between architectural spaces were used to explore the limits and tolerances in the software itself.

Firstly, the sphere was supplanted by the reflective domes of the security mirror, the eye of the underpass, before the camera was pointed (Peeping Tom style) at the fish-eye lens of a 360-degree camera, itself becoming the tool for reordering the temporal and spatial configurations of the process, allowing for multiple processing of the latency of each camera. The 360-degree camera footage bears witness to the omni-point of view of the sphere, the ensuing film inducing the latency of the digital image: the disappearance and reappearance of the technical image and the transformation of time into space, the spherical coding of the camera creating images organised for a post-optical point of view. In a final untethering, a jig was constructed to conjoin the camera to the ball in order to release the camera from the tripod. The apparatus was now able to align photographic data derived from different viewpoints; the subsequent polynomial texture maps present dematerialised images, merged compound images of dissipated data.

An experiment with this unstable RTI was also conducted in the grounds of Lacock Abbey, Wiltshire, a movie location for Hogwarts, the

school of wizardry and magic in the *Harry Potter* film franchise. Lacock Abbey is also the erstwhile home to William Fox Talbot, one of the inventors of photography. Lacock Abbey was where the earliest photographic experiments were performed. By the latticed oriel window, an image of which is the earliest surviving photographic negative, a sundial is captured by RTI. The jig allows the camera to become the re-locatable and re-quantifiable component in the system in order for sunlight to be utilised as the light source.

The first experiments at Taplow House were dubbed as 'Dirty RTI' (Eleni Kotoula coined the term during a field trip to record Neolithic chalk carvings at Monkton Up Wimborne), describing the bending, stretching and unfolding of the spatial capacities of the RTI process. These latest experiment with unstable RTI continue the dialogue about image making where the apparatus continually enslaves and ensnares us and asks us to challenge its boundaries. The complex temporalities of these unstable RTI processes produce images that are like tree rings. They are not evenly spaced moments, where matter is tracked regularly; rather the properties 'that come to matter' in the image are 're(con)figured in the very making/marking of time'. To follow the metaphor of the RTI image as tree ring is to consider these images as 'enfolded participants in matters iterative becoming' (Barad 2007: 181). These are images that celebrate and revel in having no such exterior observational point of view.



4.5 Ian Dawson, Unstable RTI, Lacock Sundial, 2017

Light years

The quotation which began this chapter is taken from a short story by Italo Calvino, which is a tale of a galaxy. This galaxy spots a sign from another galaxy 100 million light years away which references an embarrassing moment 100 million light years previously. The story then unfolds, of the comic and ever more frantic escapades of the universe to reconcile the moment when it had been spotted and how to resolve that moment when light had sent a message into space and time. No matter what it did, the universe couldn't satisfactorily alter its message; and its only respite was the knowledge of a ten-billion-light-year horizon where no object can be seen again. The galaxy said, 'I suddenly felt a kind of relief, as if peace could come to me only after the moment when there would be nothing to add and nothing to remove in that arbitrary ledger of misunderstandings' (Calvino 1968).

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STRAND 2: PHYGITAL ASSEMBLAGES

2.2 Dawson, Ian and Minkin, Louisa (2014) **'Object Lessons: Copying and Reconstruction as a Teaching Strategy',** Art, Design & Communication in Higher Education, Vol. 13, No. 1, pp.197-29.

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2.5 Dawson, Ian 2020-22 **Metalithic Sculpture Series** (Artworks) exhibited in
Autumn Attic, Flowers Gallery, Shoreditch London, 12th August -18th September 2021
Patternicity, ASC Gallery London 26th March - 23rd April and Exeter Phoenix Galleries 30th April - 26th June 2022
Crucible Thameside Studio's Gallery, London 8th- 23rd April 2022

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Object lessons: Copying and reconstruction as a teaching strategy

ABSTRACT

As tutors at Winchester School of Art we have worked through a series of copy projects over the past four years. We began remaking historic art objects including Anthony Caro's Early One Morning *(1962) and Jean Tinguely's* Homage to New York *(1960). Works were fabricated collectively with undergraduate fine art students and staged at an end of term event. The project developed to reconstruct apparatus to make copies, including François Willème's Photosculpture apparatus: a paradigm for nineteenth-century modernity that provides a genealogy for three-dimensional (3D) prototyping and is arguably an antecedent of cybernetic culture. Obsolete technological positions were restaged in order to better understand current cultures. Over this process, which we characterize as a material historiography, we have worked collaboratively with archaeologists at the University of Southampton to share practice and knowledge around both contemporary visualization technologies and ancient processes, most recently working speculatively through the production process of carved Neolithic artefacts. Both projects draw together technical and contextual teaching and define new uses of space and collective research structures.*

KEYWORDS

trans-disciplinarity
3D prototyping
copy
archaeology
technics
reconstruction

> We tried a type of … performance that could influence the thinking of all the people engaged in it. It was, so to speak, art for the producer, not art for the consumer.
>
> (Brecht 1964: 80)

INTRODUCTION

An object lesson is a practical or concrete illustration of a principle. As a teaching method its associations are with Victorian religious instruction, a rigid proof of doctrine that operates to reinforce orthodoxies and to separate instruction from pleasure. The objects we are concerned with here serve rather to trace a process of learning through its operational framework. They are copies, mediators, technical objects and have different and multiple materialities, existing as data or script as well as granite or resin.

Image culture in art schools has shifted from observation and transcription through modes of measurement, trace and projection, to the swift transfer of data, active on multiple platforms and with many potential outputs. Broken master-plaster casts prop open computer room doors and the practice of painstaking transcription has been substituted by the pleasures of appropriation, 'copypasta' culture, dragging and dropping source to sauce. At the same time re-enactment and reconstruction have become familiar tropes in mainstream contemporary art practice, operating as rhetorical forms, as public education, as super-intense commodity production. New tools of production and reproduction have been introduced into the set of tools and processes available to artists. Rapid prototyping and three-dimensional (3D) scanning present us with questions of technique. They give us a direct imperative to understand the potential of new fabrication methods, new ways of materializing and constructing, copying and reconstructing. The specific context for these questions at Winchester School of Art (WSA) has been determined by a research culture that emphasizes technical histories and a growing relation with the wider community of the University of Southampton, through dialogue across the Digital Humanities and in particular with the Archaeological Computing Research Group (ACRG).

Over the past four years we have worked through a series of copy projects in the undergraduate Fine Art studios. We began by remaking historic art objects including Anthony Caro's *Early One Morning* (1962) and Jean Tinguely's *Homage to New York* (1960).

Rather than an orthodox relation to the copy that could be mapped back to an academic Beaux Arts tradition, we have placed a critical emphasis on understanding by doing. Our goal was not to produce an exact facsimile or replica; rather to work out, refigure and to focus attention, folding in our failures and discontinuities along the way. These projects became a channel to reveal and discuss the complex intentionalities around contemporary ideas of copy and original, data and material, object and representation. Beyond making versions of art objects, we began to construct the tools and apparatus of practice. Camera cranes and tracks were built from open source plans, alongside an ingenious rotational moulder and portable print workshop devices. Processes included the hacking and repurposing of domestic objects, presses built from carjacks and pasta machines. The ethos of communal working and skill sharing extended to the preparation and delivery of practical workshops by students, initially within college and focused around a publication event on World Book Day, but latterly to a broader public including workshops at Winchester

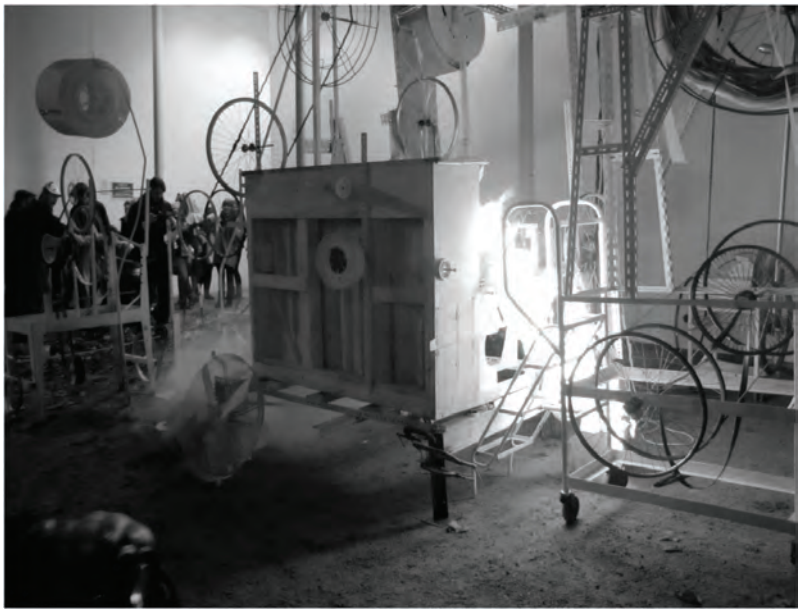

Figure 1: Homage to New York *reconstructed at WSA, 2011.*

Discovery Centre, Chapel Arts Andover and the East Festival at London's Olympic Park in 2013.

Our reconstructions of technical apparatus include the drawing machine pictured in Albrecht Dürer's *Man Drawing a Lute* from 1525. Dürer's machine functions like a laser scanner, accurately measuring the point between 'eye' and

Figure 2: Drawing machine, WSA, 2011.

object and neatly inscribing it into a picture plane. The eye is effectively externalized, the point of view disembodied. In restaging obsolete technological positions we found that we gained a better understanding of current image cultures.

PHOTOSCULPTURE

A research lecture by Alexander Galloway from New York University inspired us to rebuild François Willème's Photosculpture apparatus: an obscure machine that provides a genealogical ancestor for 3D prototyping. This device produced a 3D model of a sitter quickly and seemingly by enchanted means. The sitter entered a top-lit room and posed on a central podium for a few moments. Three days later they collected a perfect, detailed portrait statue. How was it done? Twenty-four hidden cameras, triggered simultaneously around the periphery of the space produced a set of silhouettes. Each was projected sequentially onto a screen where a craftsman used a pantograph to trace the outline into a block of clay, rotating it 15° each time. The pantograph is rational, a device of ratio, it scales mathematically, producing image via vector, a kind of abstract data visualization. The sum of the profiles produces a 3D model, an accurate likeness, efficiently achieved and at little cost. The principles of assembly are interesting here. This is already a multimedia process, a spatial articulation of image. Aggregated images are turned into a 3D object. Galloway's thesis is that it provides an antecedent for parallel processing, it effectively spatializes synchronous images rather than deploying the serial frames of chronophotography, which form the more familiar cinematic model of image.

Archival research into Willème's process was worked through practically in the studio to re-imagine his apparatus. It was a 'hands on' way to experience and understand different ideologies of making. The process itself raised questions of craft, manufacture and the 'signature' of the artist; questions that have a renewed currency in relation to contemporary technologies of visualization and fabrication. Photosculpture was a novel invention, popular in its time, with studios established in Paris, London and the United States. Sitters included the

Figure 3: Experiments with synchronizing cameras, WSA, 2012.

King of Spain and the President of the United States, but it was celebrated less for representations of sovereignty than for democratizing the portrait, privileging the mundane 'realism' of buttons and crinolines over the signature or gesture of the virtuoso artist. The critic Théophile Gautier remarked: 'Photosculpture is not so daunting as statuary … [it] is used to modest proportions and is content with a set of shelves for pedestal' (Benjamin 1999: 689). It operates as souvenir. This quotation is located in Konvolut Y of Walter Benjamin's encyclopaedic Arcades Project, where diverse material is structured through the methods of a rag-picker to produce a 'primal history' of the nineteenth century. Benjamin situates Photosculpture appropriately between Marx and The Automaton. Photosculpture was an articulated process, functioning by division of labour. Procedural and mechanistic, it has an uneasy interface between artisan and operator.

Willème's device is an assemblage of machines and machinic arrays: prescriptions are embodied within it. It presents a production system. To build our version we organized the students into communities of practice: data capture, data processing, environment, documentation. Students worked collaboratively to investigate and construct an ambitious, functioning apparatus, deducing its operation from photographs and period descriptions. In the process they acquired construction techniques, documentation skills and practice-based research methodologies. One aspect of a practice-based research methodology is how to credit the errors, the blunders made when working from a point of incomplete knowledge. In this instance difficulties and mistakes produced some curious outcomes, objects produced within this enquiry were novel, a misapplied camera setting for example, would generate new implications that were shared and discussed by the group.

An operational structure was set in place with one day a week set aside for the collective project. On this day the workshop space was extended temporarily into the studio allowing groups to cohere around tasks in a 'public' space, promoting exchange and making research in progress visible and open to

Figure 4: Pantograph construction, WSA, 2012.

interrogation. Technical and academic staff worked alongside students. We also brought specialists from other fields into the workshops, historians, media theorists and archaeologists, who discussed the tasks at hand and their contexts whilst students worked. The aim was to establish a practice that operates seamlessly to explore making, history and theory in a collective studio context. Alongside the physical space we developed an active social media community, a forum where images, references and questions were posted. This social space both documented and developed the ongoing project, adding cohesion to the weekly sessions. The process as a whole served to chase an idea into material by introducing students to skill sets, to deductive and inductive thinking, to engaging with and sharing research questions and moving a collective enquiry into inventive solutions within individual practice. This process emphasized in the first place cultural experience, in Winnicott's terms 'shared reality', the opposite trajectory to conventional tutorial teaching, where attention is first focused on the articulation of 'psychic reality', a drawing out of the personal and inward. The project emphasized communal learning by establishing temporary spaces within the timetable and in the studio, reconvening over a period of weeks to explore and develop work as a kind of hive activity:

> A nomadic hive is an aesthetic practice, not just a means of survival but an aesthetic mode of existence that proceeds through producing networks, means of communications, protest, relations and assemblages: collective machines and situations for thinking and acting.
>
> (The Hive 2010)

The work was then staged at an end of term event, giving a celebratory impetus to the project and providing a forum for participants to make their research public. The term moved from the implementation of research methodologies to the exploration of structures for dissemination: publication, exhibition and performance.

The process shares characteristics with a Brechtian Lehrstück or learning play:

> [The Lehrstück] is an *object of instruction* and falls into two parts. The first part … is meant to help the exercise, i.e. introduce it and interrupt it – which is best done by an apparatus. The other, *paedagogical* part […] is the text for the exercise […] in this way collaboration develops between participant and apparatus, in which expression is more important than accuracy.
>
> (Brecht 1964: 31, original emphasis)

The Photosculpture apparatus itself became a means of production. Once built it could be used, its structure revised for different environments. It functions to set the scene for an event that draws operators and subjects together, it brings 'consumers' directly into contact with the production process, turning the spectator into a collaborator. It also produces an interesting reversal of the paradigm of the panopticon as an ideological space. Within the architecture of this device the subject is surveilled from every point.

Assembling the still images produced by the mechanism as gifs rather than sculpture demonstrates the 360° spin looping recursively at the heart of automation. Data from the nineteenth century capture process was also pushed through an array of consumer level software, including 123D Catch,

Figure 5: Capture apparatus installed at Central Saint Martins, 2013.

Figure 6: Lorna Barnshaw, B.A. Sculpture student, experiments with 3D scanning and printing WSA, 2013.

Blender and Cinema 4D, the process was updated to a crowd-sourced version using smart phones, constructing further data objects and revealing the characteristics of different data processing software. One characteristic of 3D modelling applications is the production of a hollow body, so that the data itself takes on a new presence as skin; a digital flaying or appropriation that leads us to think of data capture as a form of spoliation; a form subject both to algorithmic aestheticization and to reuse and reconfiguration through the procedures of collage.

NEOLITHIC STONE BALLS

Reconstruction is familiar within archaeological practice. Replicas of structures and objects are fabricated using historically specific techniques and materials. The process tests hypotheses and by working through how things might have been done, produces material solutions to problems of method. Questions of context make it is a speculative and unreliable tool in the field of experimental archaeology, nevertheless, by extension it provokes a question, one familiar in political terms and aimed very much at the future: how is it to be done? The aim of our projects is not to produce a replica, but through communal deduction, systematic description and lines of flight, to engage with the system of transformations that constitutes change. Our copies are essentially and not accidentally inexact – you could call them vague or vagabond. What we are doing works with paradigmatic transformations, a method of substitution or transposition.

Over this process, which we characterize as a material historiography, we have worked collaboratively with archaeologists at the University of Southampton to share practice and knowledge around both contemporary visualization technologies and ancient processes, most recently working speculatively through the production process of Neolithic carved stone balls. In working and talking with archaeologists from both the Archaeological Computing Research Group and the Centre for the Archaeology of Human Origins at Southampton, we have come across useful models to think about art practice: the complexity of objects, process and ensembles – theories of operations and in particular how the mediating object marks out social structures and performative operations.

If the Photosculpture project represented an axis between industrial manufacture, craftsmanship and art practice, carving the stone balls operated by rule of thumb. We discovered it to work as an enactment, a processual remaking, rather than producing replica objects. Over the initial one-day project we worked together with archaeologists in the sculpture studio. The day was structured around working into precast plaster blocks to produce a sphere and then using reductive methods on clay balls to think though the shapes we would produce from the sphere. The Neolithic balls have multiple nodes, most have six but some as many as 200. They are consistent in size, being handheld, portable objects carved mostly from the granites and basalts local to North East Scotland. As the group prepared to carve, archaeologists introduced their research on the stone balls. These objects have no firm interpretation or use. They are stumbling blocks to signifying practices, their inscrutability makes us pay attention and take care. As opposed to the consistent objects of modernity produced by the process of manufacture in Photosculpture, the Neolithic stone balls show iteration and variation, repetition here has a diversifying effect. They are persistent objects, demonstrating a technique of transmission, arguably a spatialization of memory.

Figure 7: Carving stone balls, WSA, 2013.

Having set the scene, the carving itself proved a social activity: it began to constitute a society where innovation was shared quickly and active trans-disciplinary discussion ensued. 'Social space, the support of social time, is ceaselessly re-run, recommenced, reformed, deformed and transformed by the individuals who re-temporalise it' (Stiegler 2012: 4). The initial task of making a sphere proved more intuitive than we would have thought, turning and turning as a measure of equivalence, the process itself engrossing and metronomic. The process of making could be figured, after Ernst Bloch, as *objective fantasy*: the capacity to develop the latency in an object. The objects revealed themselves as stages in a developing process.

If the media record of visualization belongs to reality testing, so does throwing stones. We speculated that these carved, stone balls were thrown by the ancestor to develop our imagination; a fragment of their labour, a time bomb. Throwing a stone can startle us. It is a moment of hope – the jump or start, or jolt which is a leap from the ground, a change in circumstance that must be adjusted for, the Benjaminian jolt of an image passed. In practice, considering an object produced so far outside the orthodoxies of contemporary art discourse provides a useful jolt for artists to reconsider why and how and what we make. For archaeologists the event provides a form of paradata: information about human processes of understanding and interpretations of objects. Trans-disciplinary readings can help to work against the passivity that

can sometimes act as a short circuit within a subject area, questioning our too easily accepted orthodoxies. Bernard Stiegler describes instead:

> … an unconscious space of long circuits. These unconscious spaces link generations along very, very long spans of time. What is produced within these long circuits is the material of the dream, for example, which is at stake in Freud's interpretation of dreams, as well as clearly being the matter from which artists operate and produce.
>
> (Stiegler and Rogoff 2010: 2)

The long circuit back to the Neolithic may offer exemplary object lessons: ways forward in the reorganization of perception we currently experience, the reconstitution of forms of knowledge and new educational spaces.

Together these copy projects practically propose that the subject matter of a work of art (*Die Sache*), *the concern or matter in hand*, is limitless, that it remains incomplete and that 'the language of art is with an unfinished event' (Gadamer 1975: 99). Gadamer is critical of the established role of modern theory where 'theoretical knowledge is conceived in terms of the will to dominate what exists' (Gadamer 1975: 454) whereas perhaps reopening the unfinished event contributes to the re-articulation of theory as contemplation (*theoria*) and participation (*theoros*). Here 'the aim is not to recover the forgotten per se, but use the difference between past and present usage to create a space in which new meanings might arise' (Davey 2006: 26). Both projects are encounters with the development of *Die Sache* where everyone involved experiences and participates in the ongoing manipulation of the subject.

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THE WANDERER'S NIGHTSONG II

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CURATED BY AND IN COLLABORATION WITH IAN DAWSON

KATE ATKIN
CATHY DE MONCHAUX
CHRIS HAWTIN
NEIL GALL
GAVIN TURK

C&C GALLERY

03.04.2015 -10.05.2015

GAVIN TURK, THE SWIMMER, 2003, EARTHENWARE, 10 X 10 X 12CM

Notes on The Wanderer's Nightsong II

(1) Babies are illogical;
(2) Nobody is despised who can manage a crocodile;
(3) Illogical persons are despised.
(Concl.) Babies cannot manage crocodiles.
Lewis Carroll, Symbolic Logic

(1) I remember trying to mimic my elder brother when I was a teenager- sneaking into his room, flicking the switches on his musical equipment and amplifier, becoming entranced in the trippy noises created from his Moog and Roland synthesizers - altering the wavelength and pitch settings- I remember the echo pedal- the right mix of frequency, delay and intensity and there would be a heady mix of sound adding to itself creating wave after wave of new reverberations built from the previous one- a self swallowing creature that copied, enveloped and evolved. I remember this buzz, its a sensation that returns whenever encountering an artwork that is both of and about itself; self-referencing- recursive - language about language.
(2) In Argyll, Scotland, some four-thousand years ago, neolithic humans performed acts of carving onto selected rocks across the landscape; embedding and interweaving an array of ring, cup, and triangular marks into the existing network of cracks and fissures. 'Rather than a process of imposition' as the archaeologist Andrew Jones explains these rock art motifs, 'are *worked into* the pre-existing geological features of the rock'(1). Patterns of glacial erosion were even copied, replicating the *natural* rock for it to become part of the ancestral design.
(3) a piece of quartz as the tool, an example of what it is to be human, of possessing an inadequate body needing added technology to both survive and make sense of the world, what Bernard Stiegler would call 'originary prostheticity'(2). This piece of quartz like all other tools is exploited because it has a capacity to have an effect, of 'inflicting some kind of blow on reality', one could say a tool isn't 'used' it 'is' (3). The chisel doesn't need to be re-invented for us to carve. Tools, equipment and the technologies they support, they amass information, from the earliest times until now, passing its practices across the generations.
(Concl.) "..the food-gatherer reappears incongruously as the information-gatherer" Marshal McLuhan 1967(4)

(1) Information. Physicists wonder whether it is a principal factor, more essential than matter, the essence of existence, 'all things physical are information theoretic,' wrote John Archibald Wheeler, it's now 'a participatory universe.'(5) We are no longer merely blood and guts, more six billion encoded bits.
2) Veronese's The Wedding at Cana, a depiction of Jesus' party-trick miracle of turning wine into water, painted for a Benedictine Monastery in Venice in 1563, plundered 235 years later by Napoleon and hanging in the Louvre, now has multiple lives; 210 years after its abduction an exact facsimile was unveiled on the original site- the refectory of San Giorgio. Here visitors can now consider an exact copy in relation to its authentic surroundings, whilst simultaneously visitors to the Louvre are experiencing the original work of art.
(3) The kind of mediation that produces exact copies is not efficient- the translation of data is a track that leads inexorably to mutation. It is an entropic process - creating a counter-intuitive position- the instinct to create order- of regimenting the translation of data - will tend towards a final entropic state and the death of information- when it is no longer meaningful. Copying that seeks to eradicate mutation comes at a high price as it increases noise within the system to the extent that future emergence and invention becomes problematic.(6)
(Concl.)'Cripples and handicaps lie like corpses along the technical path to the present' Friedrich Kittler 2010 (7)

(1) The 'knotty problem of mimesis'(8) is central to Western notions of representation; concerned with making through imitation, it is, as such a blind activity, a parasitic action that nonetheless augments through depiction. Appropriation and mimesis permeate Gavin Turk's work- here five ceramic studies of Ariadne, are presented on columns. In history Ariadne pops up, over and over, Roman copies of Hellenistic sculptures, De Chirico, the reclining recurrence - and Turk takes the form again, but this time legless, in the shape of a rough sleeper in a sleeping bag.
(2) The emergence of any new art-form seems to simultaneously inspire an imitation, an echo, constructed to respond, disrupt, mess with the original- and in parody, there is something more than just mere imitation for a comic response, the reiteration becomes exaggerated, exposing the conventions of a genre, questioning its modes of production. When rules are momentarily revealed as rules.
(3) A photogrammetric scan has produced a print of Turk's studio, one can peer inside the object and just about make out two small ariadne sculptures about the size of peas, petrified within this cave. This amorphous looking lump converts Turks studio into a memetic Henry Moore version of Ariadne.
(Concl.) 'It is humor that makes language stammer' Gilles Deleuze (9)

(1) Human memory is fragile and finite(10), and human societies have constantly created devices for storing memories via extra bodily form, from stone tablets to cuneiform to the printing press and the computer, 3D printing and scanning has now entered the fray.
(2) In The Wanderer's Nightsong II, I wanted to explore some of the issues that arise out of our current position, as smart phones become digital devotional objects, and it emerges that media are not extensions of the human but are extensions of the planet. What is the function of representation when image making depends on the algorithm? Data does not need to be visual.
(3) *Statistical imagery*- used by Paul Virilio to describe artificial images that only exist through accelerated computer processing power. 'Such images create 'rational' visual illusions that damage peoples comprehension as well as their ability to interpret the real world'(11)
(4) I wanted to collaborate with artists to explore what would happen if a part of these new technologies intruded into their practice. I was to be an agent in this process, wanting to act as a technician of sorts. And I am indebted to the artists- to their openness and willingness to make such a consideration. Gavin Turk suggested that it was perhaps like pulling up a ladder to a brick wall and peering over. And I enjoyed that sentiment, whilst being uneasy about the implication- of witnessing the driverless car departing the forecourt.
(conc.) '.., have you heard of a writer who writes for his pen...?' Paul Virilio, Vision Machine (12)

(1) It was Ariadne who gifted Theseus with the ball of string to escape the labyrinth, and it is the story of his ship that gives rise to Theseus' paradox; of whether an object is real if all its constituent parts are ever replaced.
(2) Chris Hawtin's paintings preside over the show- post-human -mutant-cybernetic- figureheads rendered wistfully, glazed oil on canvas, these are portraits- Seth, Clio, Gregor, Photeus, -standards- that act as both an anchor and extension of ourselves- for both remembrance and reconnaissance(13). These paintings that are part figured in our own image, part machinic perhaps come to represent a Faustian impulse, to converge art with a universal desire to re-create life non-biologically. These are dimly hued paintings- with deep shade- the figure blanketed in darkness and silhouetted in a shaft of light. Light, the basis for all image making- energizes the figures while the surrounding dimness perhaps manifests a fear of the dark, the most primordial of phobias.
(4) Ghostly white 3D prints, are arranged as both fragments recovered from an aseptic archaeological dig- miniature ancestors to those from Luxor- whilst also operating as prototypes- Do the paintings act as a genotypes to the phenotypes of the printed copy?
(Concl.) As Walter Benjamin noted in the Arcades Project 'In nature the new is mythic because its potential is not yet realized; in consciousness, the old is mythic, because its desires never were fulfilled.' (14)

1) A range of cultural and art historical references operate within Neil Gall's work, his paintings make reference to Velazquez, Bronzino, Magritte and Poussin, whilst painting illusory, life-like depictions of assemblages of a particular range of poor materials- pingpong balls- electrical tape- cardboard. This precise visual style is achieved in some part by discarding the irregularity of the object in favour of painting from a meticulously lit photographic print. Here a maquette bonded by red electrical tape was laser scanned -and printed- the copy was dense, stable- the tape solidified and smoothed into gentle undulations- becoming a landscape highlighting the topography of the printing process -the z-depth.
2) Gall, photographed the 3D print and painted Walpurgis Nacht (2015) whilst an altogether different mesh was being constructed- the original model was being re-photographed again- multiple times from multiple angles- these photographs then aligned, the common points located the camera positions identified, and a mesh constructed, the distance and geometry extrapolated from the combined jpeg information- a much more complex model was rendered.

3) This virtual model spins on a monitor- in its current status too imperfect to print. The rotation of the object, like that of a potter's wheel, or a pizza in a microwave; illustrative of the process of data capture, the spin as a prevailing gesture in the rendering of 3D data. Can the loop be a new narrative form? Instead of a narrative That progresses through a line of unique events- that avoids repetition, can the loop be the 'engine' that puts a different narrative in motion(15).
4) The monitor is the black box from inside which a piece of magic is conjured. In folklore Walpurgis Nacht is the mystical meeting of witches on a german mountain- here two accounts of the model congregate- creating a complex chronicle of events in and between themselves.
(Concl.) 'In the universe now there was no longer a container and a thing contained, but only a general thickness of signs superimposed and coagulated, occupying the whole volume of space...the Galaxy went on turning but I could no longer count the revolutions, any point could be the point of departure, any sign heaped up with the others could be mine, but discovering it would have served no purpose, because it was clear that, independent of signs, space didn't exist and perhaps had never existed.' Italo Calvino(16)

(1) On the evening of September 7th (or 6th) 1780, (or 1783) historians are still debating, Goethe scratched an eight-line poem onto the walls of a mountain lodge. This poem known as 'The Wanderer's Nightsong II' describes a progression from mineral through animal to human, of a natural process becoming language. The poems power- three simple factual statements followed by an assertion for the future is constructed without the use of simile, metaphor or symbol.(17)

Über allen Gipfeln
Ist Ruh,
In allen Wipfeln
Spürest du
Kaum einen Hauch;
Die Vögelein schweigen im Walde.
Warte nur, balde
Ruhest du auch.

(2) A constructed environment of printed wood on MDF echoes the mountain lodge. The collage of wood, garnered from scraps from my studio- has become lavish- instead of the poem etched on the surface, bitmaps- a memory organization file- from the 3D scans – are juxtaposed in strips alongside the wood-grain; the artwork migrating into the fabric of the space.
(3)The mountain lodge- the ground for the poem- burnt down in 1870 and was rebuilt four years later, a perspex plaque with an english language translation currently resides in the rebuilt cabin. It goes;

Over all of the hills
Peace comes anew,
The woodland stills
All through;
The birds make no sound on the bough.
Wait a while,
Soon now
Peace comes to you.

(Concl.) 'The certitude that everything has been written turns us into phantoms' Jorge Luis Borge, The Library of Babel(18)

(1) It is easy to forget that copying isn't primarily the preserve of the mechanical process, it is the basic tenet behind life- a cell copies and splits- reproduces- we are all copies- its how organic information passes down the generations. Kate Atkin evocatively captures this in the elaborately titled drawing '..and all the time the forms kept growing out of my egg like cracker snakes'/Mein Freund Der Baum Ist Tot', an arc of now dead growth extrudes from a tree trunk, this outer bark- the dead cells of the tree are scrutinized and rendered in pencil. Representing an organism that displays its damage in such a way might be considered a study of function. This arc appears to capture another part of the lifecycle, its shape clearly reminiscent of larvae, an immature form not yet ready for metamorphosis and in another twist- the image is faded, blurred, and it turns out that in a final phase the drawing has begun to be erased by the artist. A buzz returns again- as the action re-inscribes the content.
(2) Reminiscent of Rauschenberg's erased de Kooning drawing of 1956. The effect of light on the sheet of paper is heightened as erasure reveals the deeply embedded lines etched on the paper. What remains is a shadow, addressing the notion that something negative might have positive consequences, of determining function by way of malfunction.
(3) On her studio shelf, sat a small sculpture, a model of a prawn- wire board tape and glue- thats how I remember it- thoughtfully constructed- as if to understand the logic of the structure, wire snaking along the spine the card describing the vertabrae- line and plane, Here the 3D printed copy becomes animal again, the modernist construction undergoing a metamorphosis of its own.
(Concl.) 'A nightmare has haunted me since childhood: I am looking at a text I can't read, or only a tiny part of it decipherable. I pretend to read it, aware that I'm inventing it; then suddenly the text is completely scrambled, I can no longer read anything or even invent it, my throat tightens and I wake up' Michel Foucault (19)

(1) A skeuomorph; an archaeological term that denotes artefacts made from one material to imitate the form of another, it's a curious copy, at times thought to be deceptive, the 'aping' of shapes that are proper in one medium that then become amiss in another(20). An axe-head fabricated from chalk - a violent object safely displaced into the symbolic; a fossil(21), the sound of a camera shutter on a smart phone. A skeuomorph can be about acceptance- forms from a traditional technique can be employed on a new material in order for it to become conventional. Others might try to betray, attempting to erase their origins in their imitation of a higher status. An alchemical process, the 3D scanner makes skeuomorphs- extracting its precise geometric coordinates and points and reconstructing those in vector form.
(2) A figurine- appears calcified as if literally unearthed from Chauvet, *THE CAVE OF FORGOTTEN DREAMS*(22). This is a copy of Cathy de Monchaux's new works where tiny figures handmade from copper wire and paper pulp are amassed into networks, the image becoming slowly retrievable from the depths and tangle of filament. These are fragile sculptures often housed within a 3 dimensional frame, and here the scanner dismantled a single figure, into a blizzard of points- reforming the root complex as a linear network, tethering the figure in another way.
(3) Within the exhibition this pregnant print has no associate.
(Concl.) "....the machine does work, be sure of it. there is no danger of this machine going mad, it has been mad from the beginning and that is where its rationality comes from.' Deleuze(23)

(1) Who is addressing the wanderer? In Discourse Networks, Kittler asked that simple question of Goethe's poem, whose is the voice 'speaking to the wanderer of the way that nature is speaking to him' (24). Kittler begins by locating the voice as that of a 'mother', that the poems mimicry of a saxony lullaby recreates the prominent features of a voice teaching a child language, of imbuing profound meaning onto the most minimal of utterances. Thus triggering in the wanderer, and the reader, a response similar to that of an infant listening to hush-a-bye-baby. The poem thus both describes and brings about a sense of poetic bliss precisely because it re-stages that which made us receptive to it in the first place. In revealing how the mechanisms of the development of language are wholly bound within the essence of the poem Kittler exposes how the medium is the message.(25)
(2) A bare white piece of paper hangs on a final panel, Kate Atkin's Self portrait, an incised copy of a previous drawing. Indented marks on the sheet depict the back of her head, the twirls and eddy's of her hair sucks the viewer into the picture-placing the viewer in the same position as the subject in the drawing. I imagine a mirror both infront and behind.
(3)
(Concl.)Whoever wrote in block letters would not be an in-dividual. Kittler(26)

Ian Dawson 2015

Notes

1 Jones, A. 2014 Prehistoric Materialities, Becoming Material in Prehistoric Britain. Oxford University Press.
2 Steigler, B. 1998 Technics and Time 1: The Fault of Epimetheus Stanford University Press
3 Harman, G. 1999 Tool Being, UMI Press
4 Gleick, J. 2011 The Information, The Fourth Estate
5 IBID
6 Cubitt, S. 2015 The Practice Of Light, MIT Press
7 Kittler, F 2010 Optical Media Cambridge Polity
8 Bishop, R. 2013 Comedy and Cultural Critique in Film, Edinburgh University Press
9 IBID
10 Jones, A. 2007 Memory and Material Culture
11 Armitage 2012 Virilio and the Media, Polity Books
12 Virilio P, 1994 The Vision Machine, Indiana University Press
13 Schwartz, H. The Culture of The Copy, Zone Books
14 Buck-Morrs, S. The dialectics of Seeing. MIT Press
15 Manovich, L. 2001 The Language of New Media MIT press
16 Calvino, I, 1963 CosmiComics
17 Winthrop-Young, G. 2011 Kittler and the Media, Polity Books
18 Gleick, J. 2011 The Information, The Fourth Estate
19 Kluitenberg, E. 2008 Delusive Spaces NAi publishers
20 Conneller, C. 2013 Deception and (Mis)Representation, In *Beyond Representation*, Left Coast Press
21 Dawson Minkin, 2014 Grave Goods, ualresearchonline.arts.ac.uk/7023/
22 Herzog, W. 2010, Cave of Forgotten Dreams, IFC Films
23 Bishop, R. 2013 Comedy and Cultural Critique in Film, Edinburgh University Press
24 Winthrop-Young, G. 2011 Kittler and the Media, Polity Books
25 IBID
26 IBID


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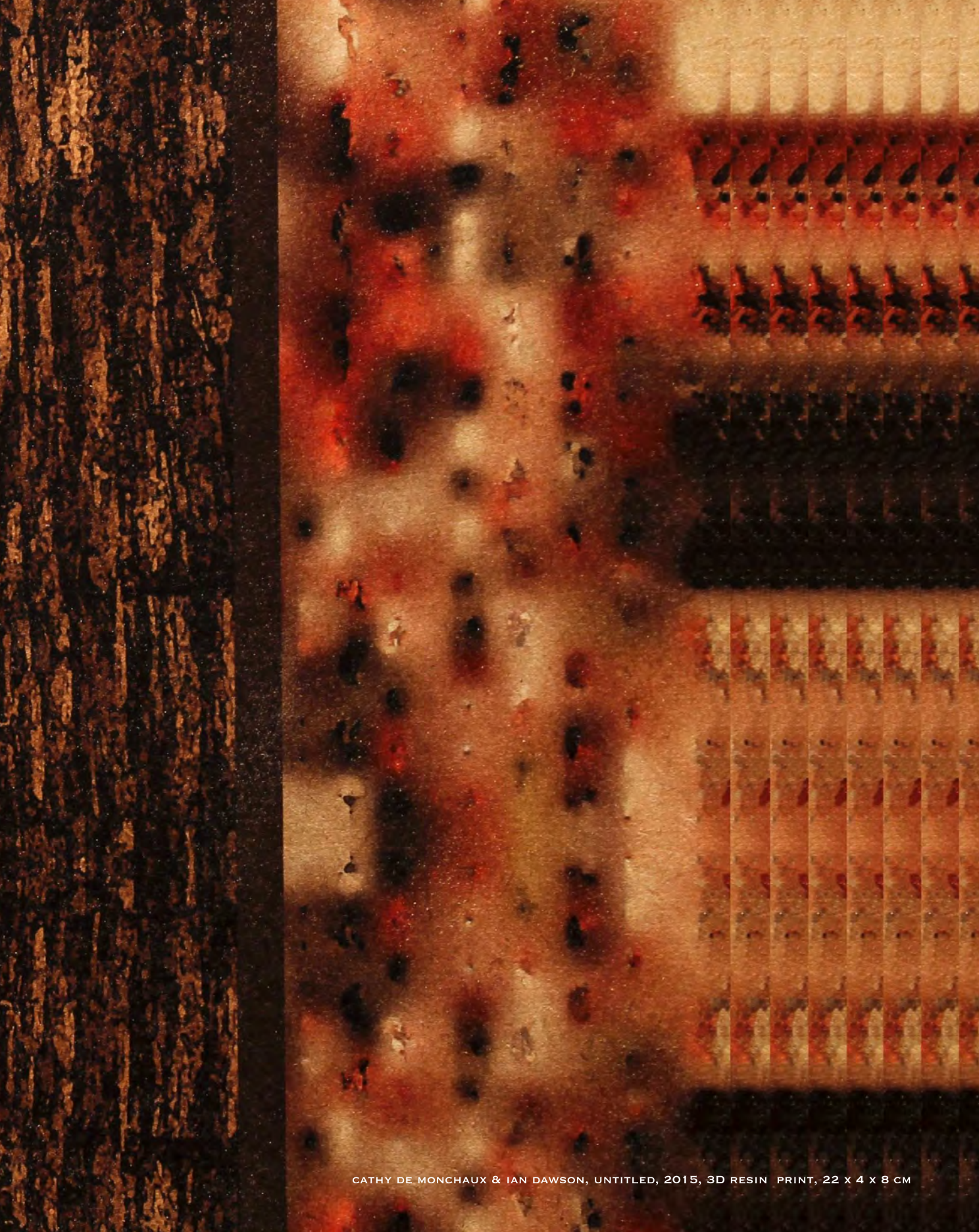
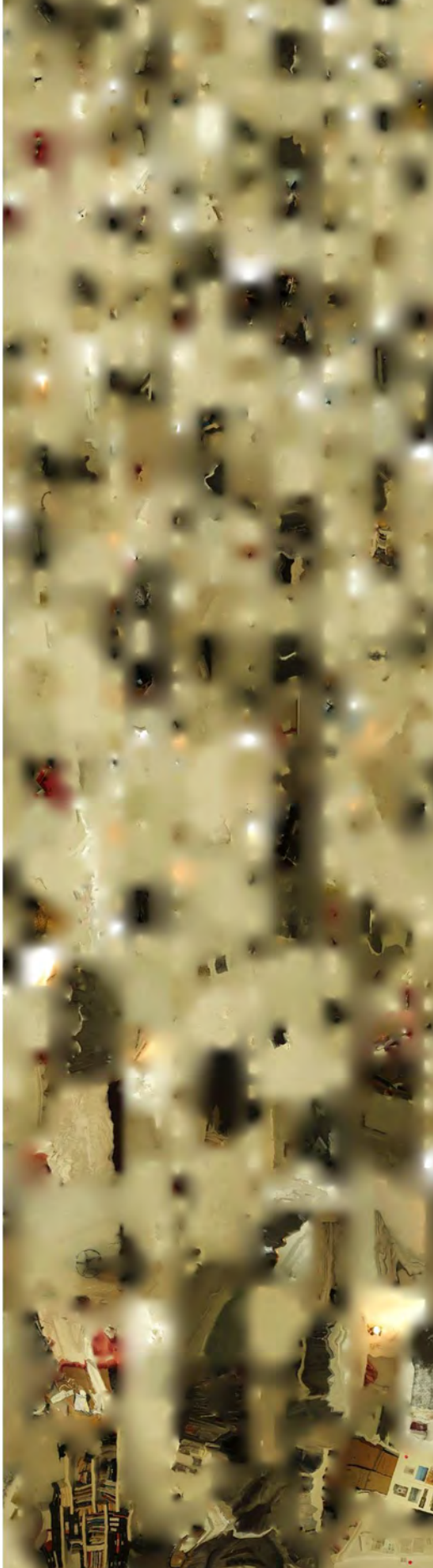
GALLERY



CATHY DE MONCHAUX & IAN DAWSON, UNTITLED, 2015, 3D RESIN PRINT, 22 X 4 X 8 CM

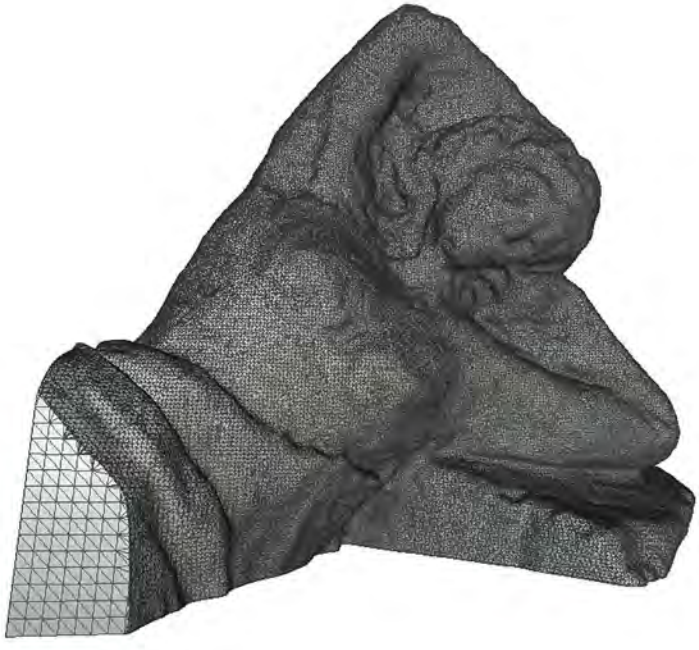


NEIL GALL, WALPURGIS NACHT, 2015, OIL ON LINEN, 55.3 X 48.6CM

NEIL GALL & IAN DAWSON, UNTITLED, 2015, DIGITAL HD VIDEO

GAVIN TURK, CYCLOPS, 2003, EARTHENWARE, 7 X 7 X 16.6 CM

GAVIN TURK, RECLINING FIGURE, 2003, EARTHENWARE, 7 x 9 x 20 CM

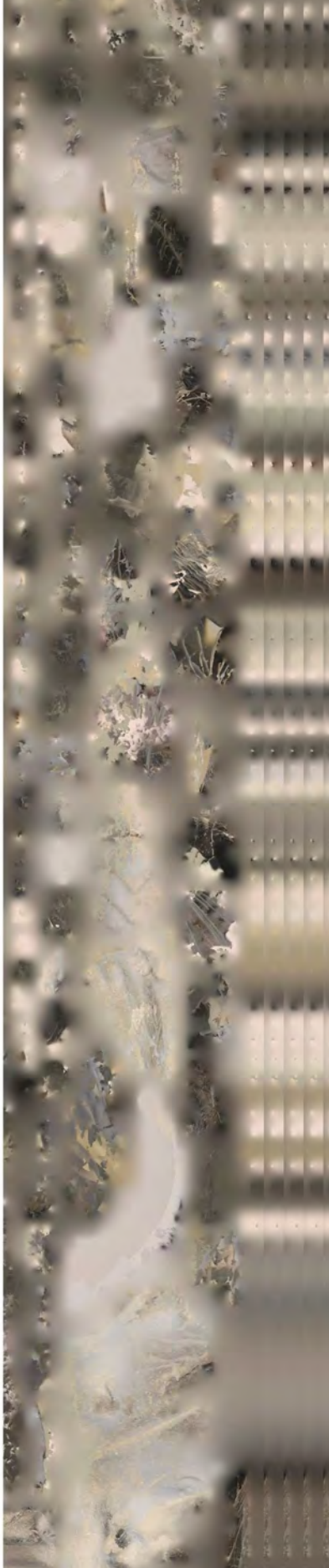


GAVIN TURK, ROUGH SLEEPER, 2003, EARTHENWARE, 9 X 8 X 17.5CM

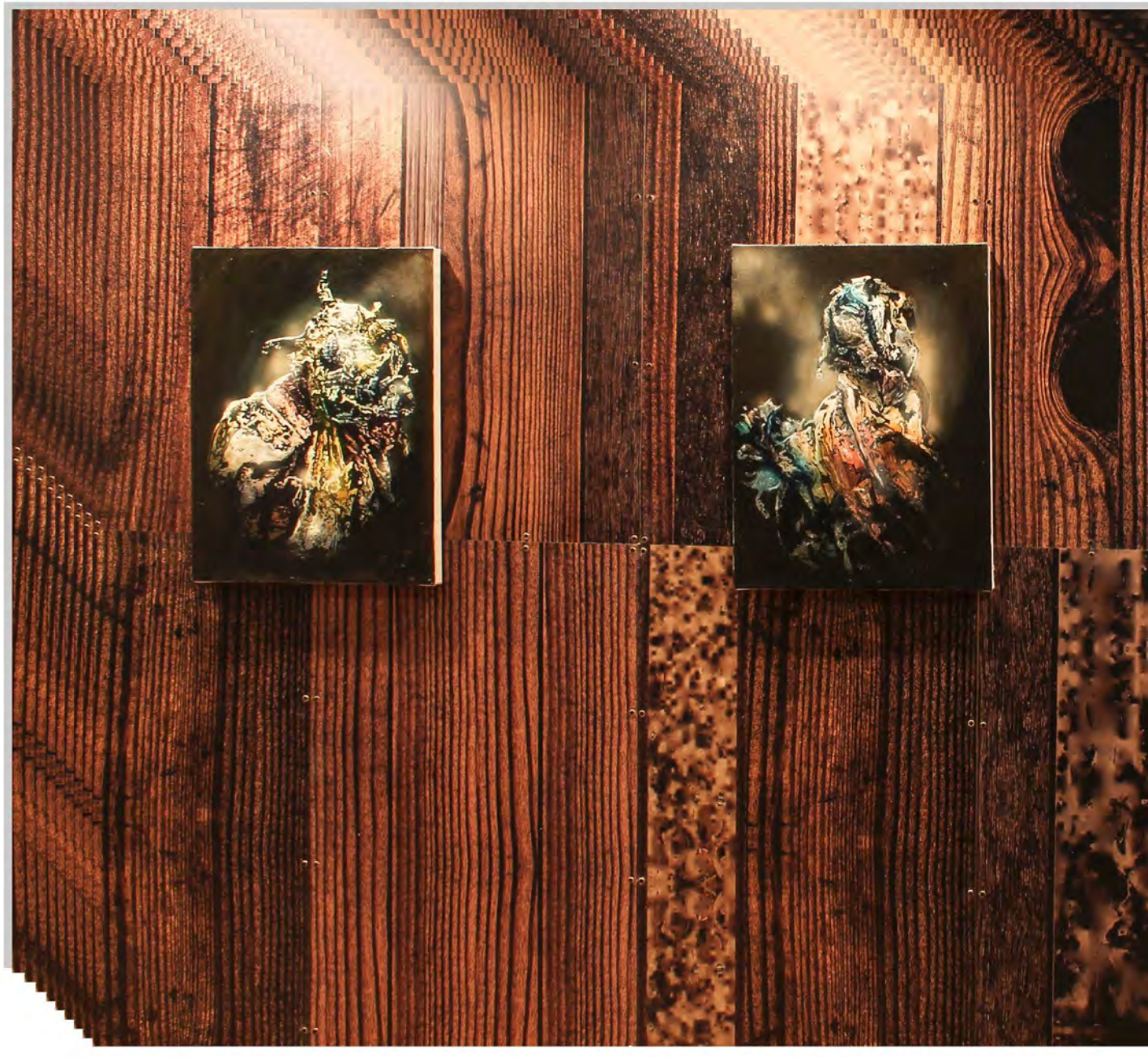
GAVIN TURK, MATISSE WOMAN, 2003, EARTHENWARE, 6 x 7 x 20CM

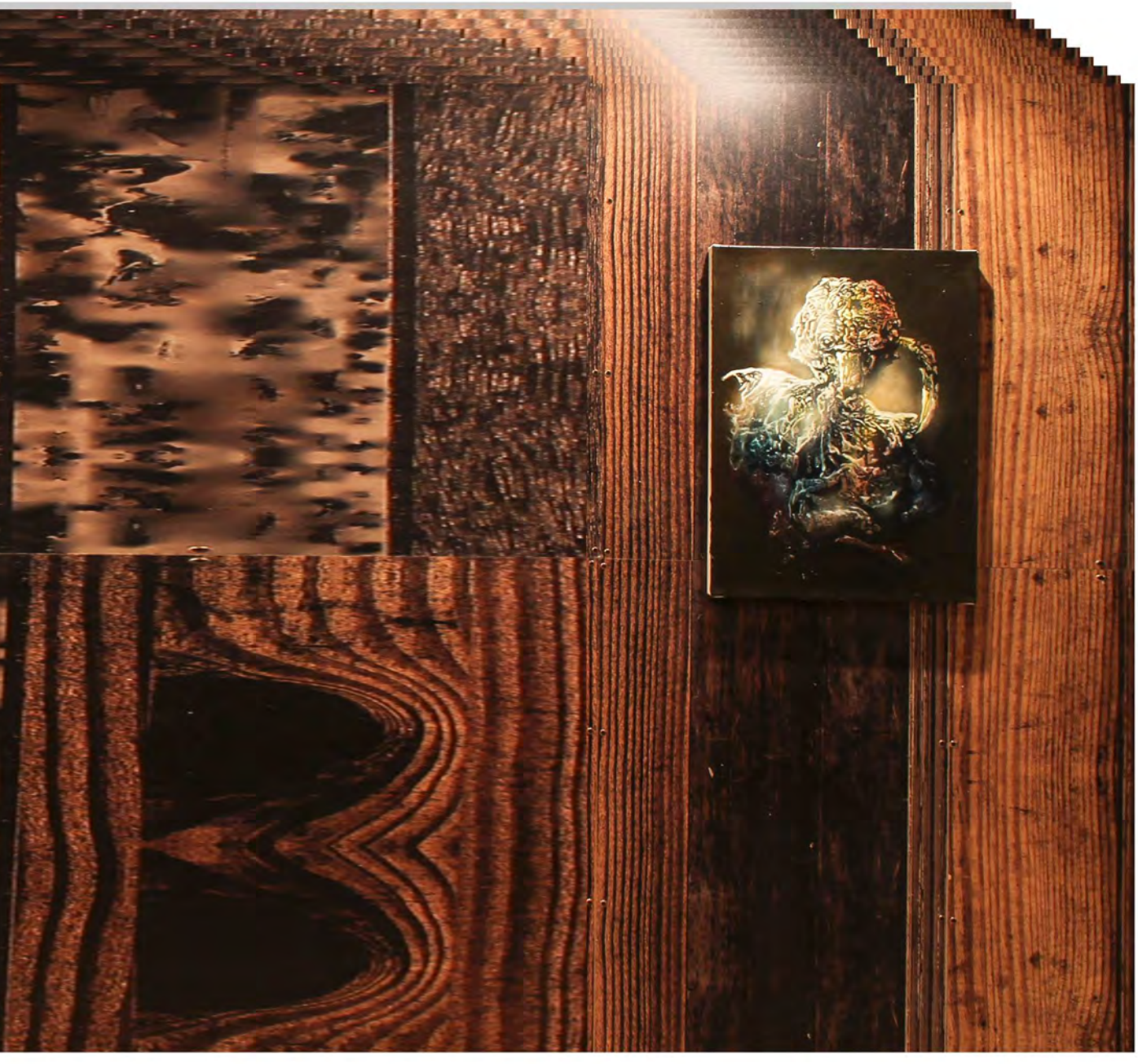
IAN DAWSON & GAVIN TURK, UNTITLED, 2015, RESIN 3D PRINT, 12 X 8 X 8CM

IAN DAWSON & GAVIN TURK, UNTITLED, 2015, 3D RESIN PRINT AND MIXED MEDIA 15 X 20 X 18CM



GAVIN TURK, THE SWIMMER, 2003 AND CHRIS HAWTIN, GREGOR, 2015



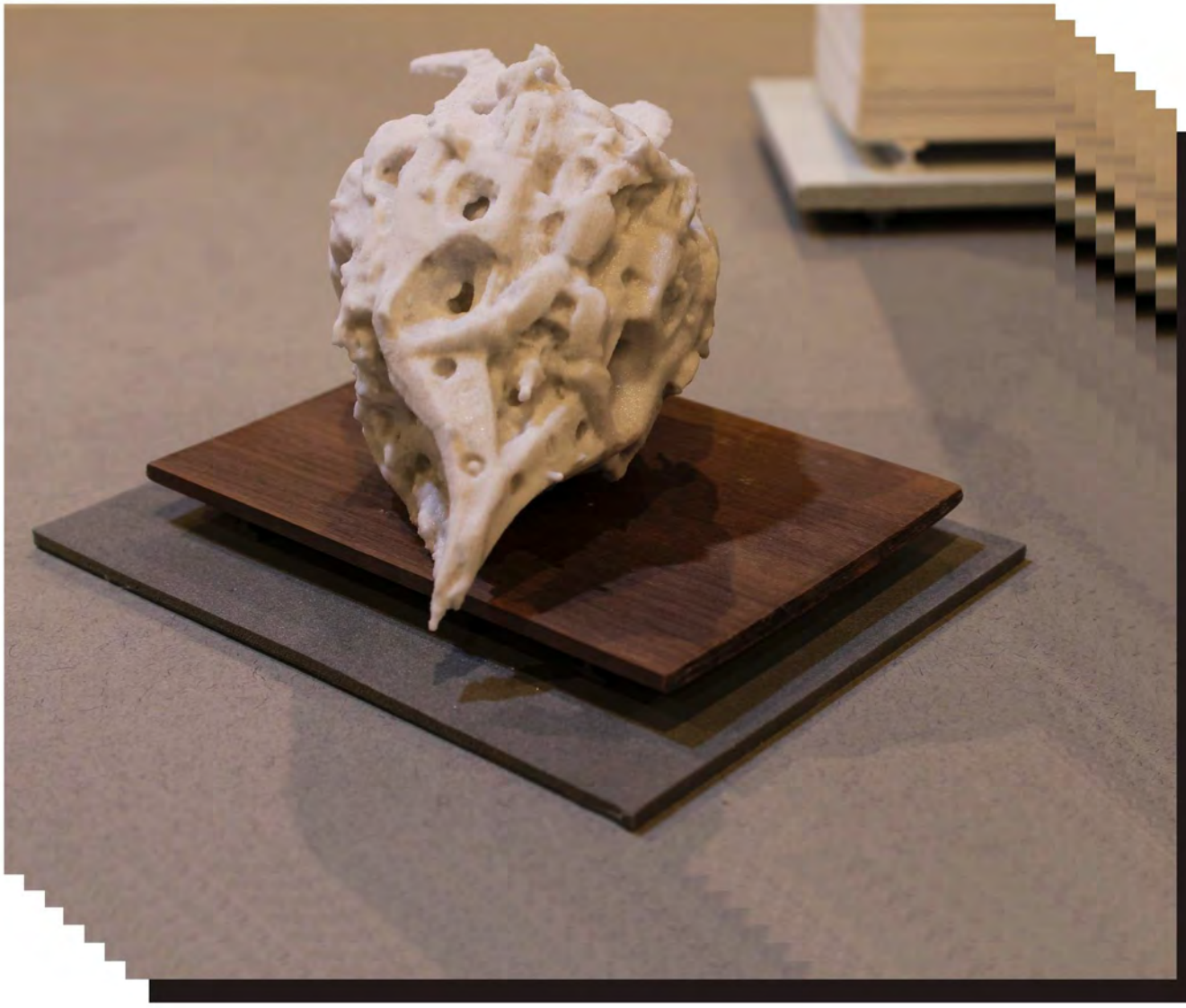


CHRIS HAWTIN, PHOTEUS, 2015, OIL ON CANVAS, 60 X 40CM

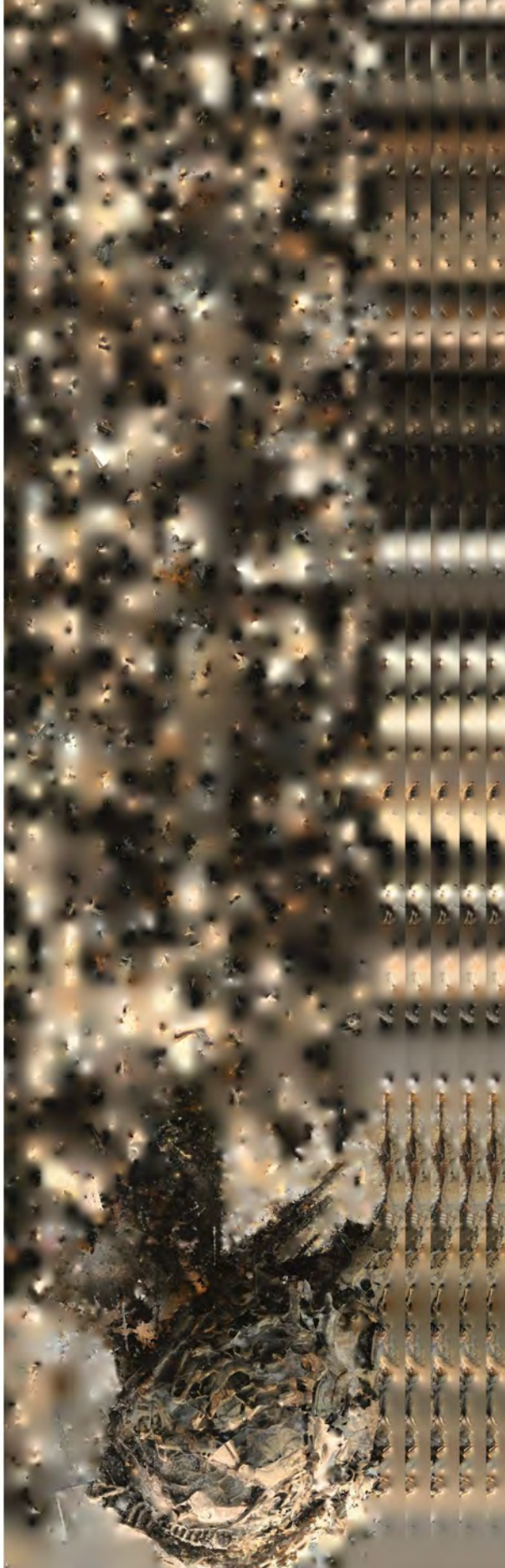
CHRIS HAWTIN, CLIO, 2015, OIL ON CANVAS, 60 X 40CM

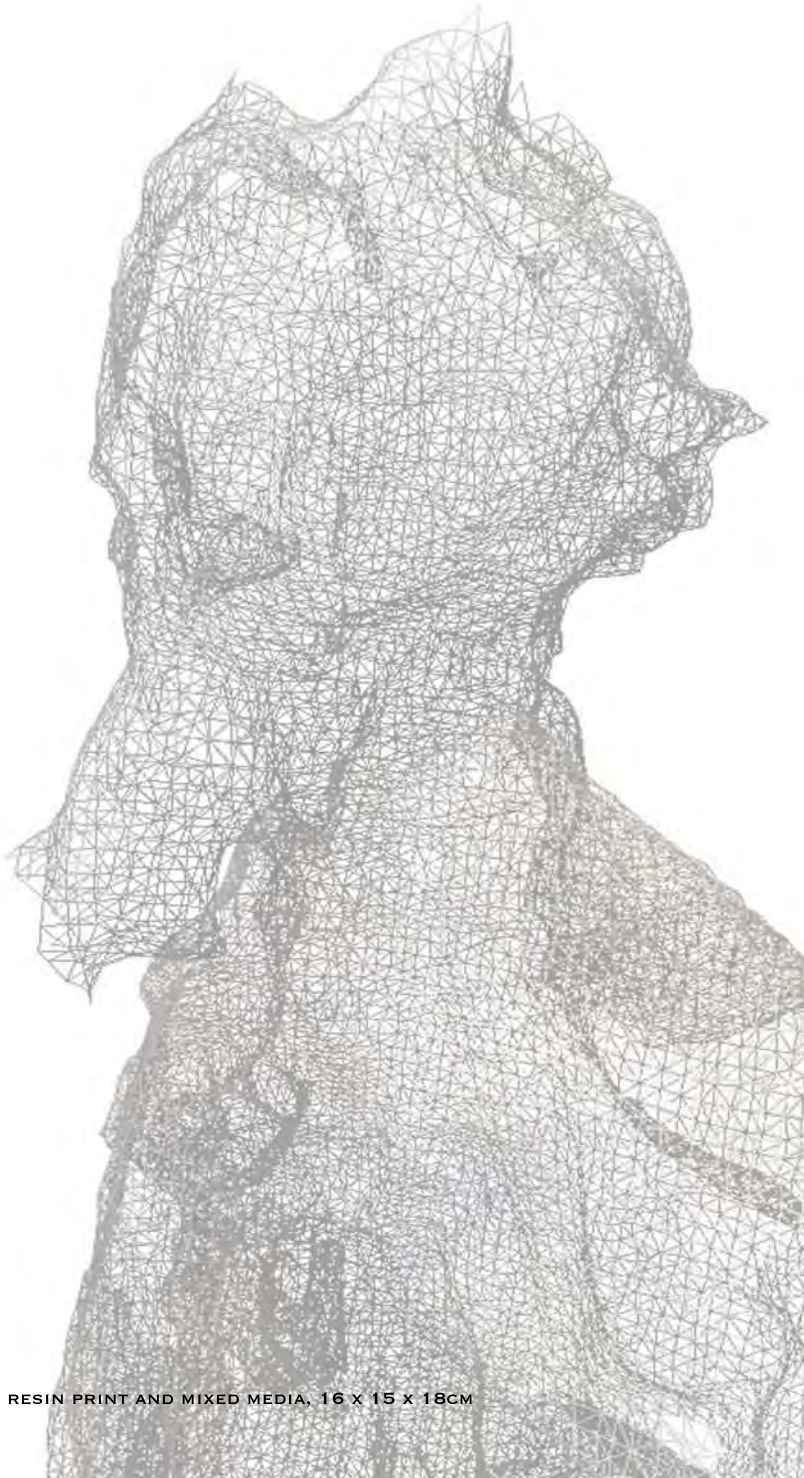
CHRIS HAWTIN, SETH, 2015, OIL ON CANVAS, 60 X 40CM

CHRIS HAWTIN & IAN DAWSON, 3D RESIN PRINT AND MIXED MEDIA, 13 X 12 X 18 CM



chris hawtin & ian dawson, 3D resin print and mixed media, 10 x 13 x 8cm





CHRIS HAWTIN & IAN DAWSON, 3D RESIN PRINT AND MIXED MEDIA, 16 X 15 X 18CM

KATE ATKIN, '..AND ALL THE TMES FORMS KEPT GROWING OUT OF MY EGG LIKE CRACKER SNALES' /MEIN FREUND DER BAUM IST TOT, 2009-20015, PENCIL ON PAPER/ NO PENCIL ON PAPER,136.5 X 202CM

KATE ATKIN,'..AND ALL THE TMES FORMS KEPT GROWING OUT OF MY EGG LIKE CRACKER SNALES'/MEIN FREUND DER BAUM IST TOT, (DETAIL)

KATE ATKIN & IAN DAWSON, UNTITLED, 2015, 3D PRINT AND MIXED MEDIA, 38 X 18 X 20CM

kate atkin, a faintest impression of 'reverse self portrait, paper, 2015, 61 x 55cm

acknowledgements
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Thanks also to Serena Zacheo, Paul Rushworth, George Watson, George Thom, James Briggs, Alex Goulden, Christian Carter, Andrew Brook, Celeste Carleton, Adrian Baxter and Meri Atkin, for making the show possible. Grateful thanks must also go to Helen Hayward, Martin Westwood, Andrew Jones, Louisa Minkin and Ryan Bishop for stimulating, supporting and spurring in innumerable ways.

Photo credits:
Gavin Turk, The Swimmer © Andy Keates
Gavin Turk, Cyclops © Andy Keates
Gavin Turk, Rough Sleeper © Andy Keates
Gavin Turk, Reclining Figure © Andy Keates
Gavin Turk, Matisse Woman © Andy Keates
All other photographs © Ian Dawson

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www.ccgallery.co.uk

Old Minster (2017)
dimensions variable, aluminium, 3d prints and digital files.

Exhibited at Along the Riverrun, curated by Alex Goulden and George Watson
ArtSway, 24.07017-30.07.17
Annihilation Event, Lethaby Gallery, London, 22.03.17- 29.03.17

http://www.iandawsonstudio.com/ian-dawson-along-the-riverrun.html
http://www.iandawsonstudio.com/annihilation-event.html

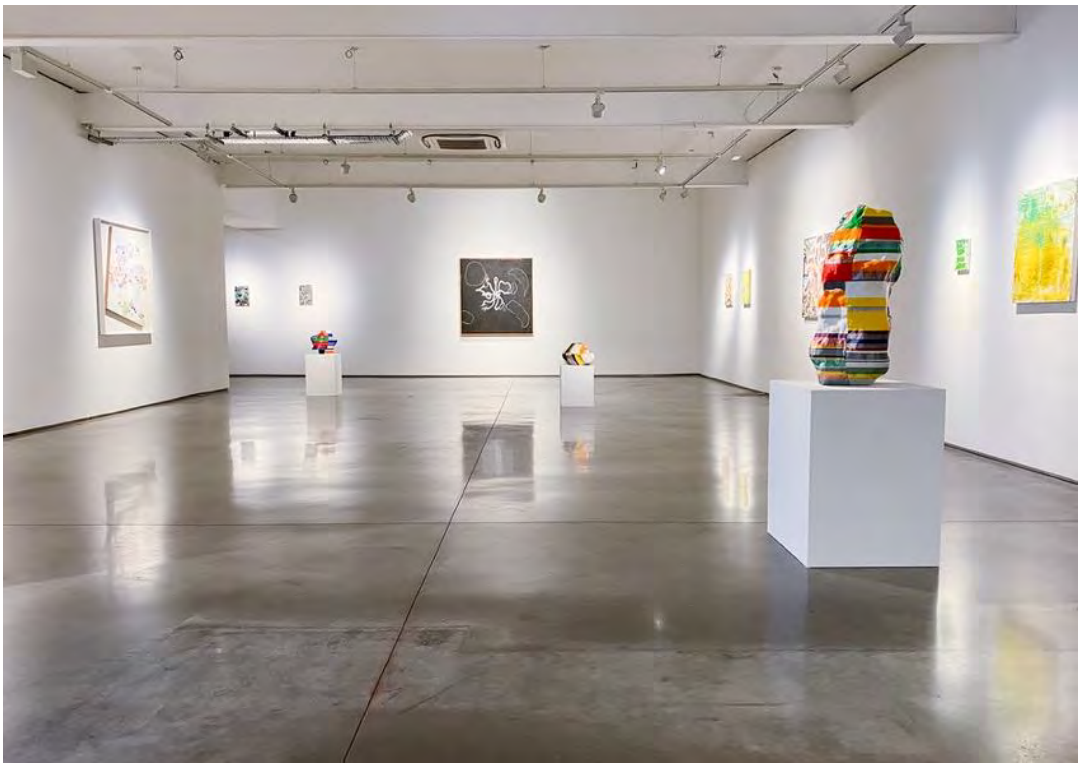
Metalithic Sculpture Series 2019-2022

C328remix, 2022, 3d printed PLA, 170x100x100cm

Orkney Star Stone 2021, 3D Printed PLA, 60cm x 50cm x 25cm

Motisfont 4, 2021, 3D printed PLA, 30 x 54 x 29 cm

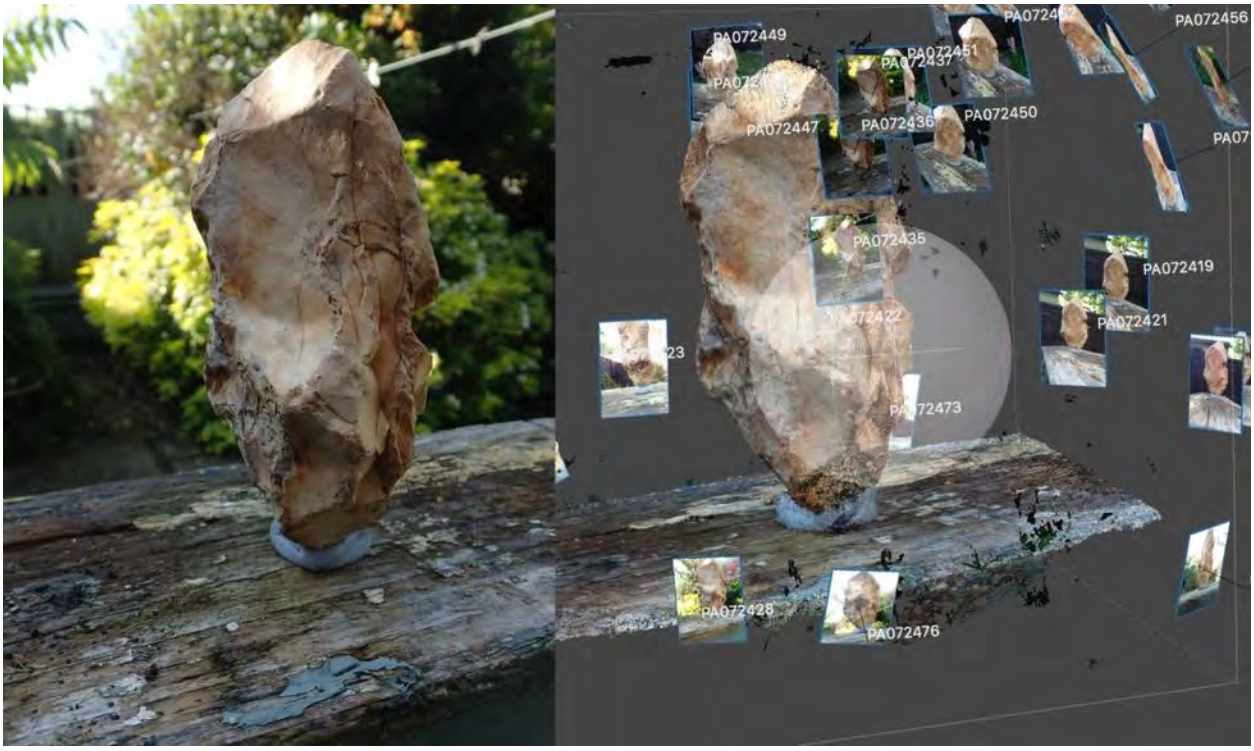
Dawson, Cornpick 2021, 3D printed PLA 85 x 40 x 50 cm



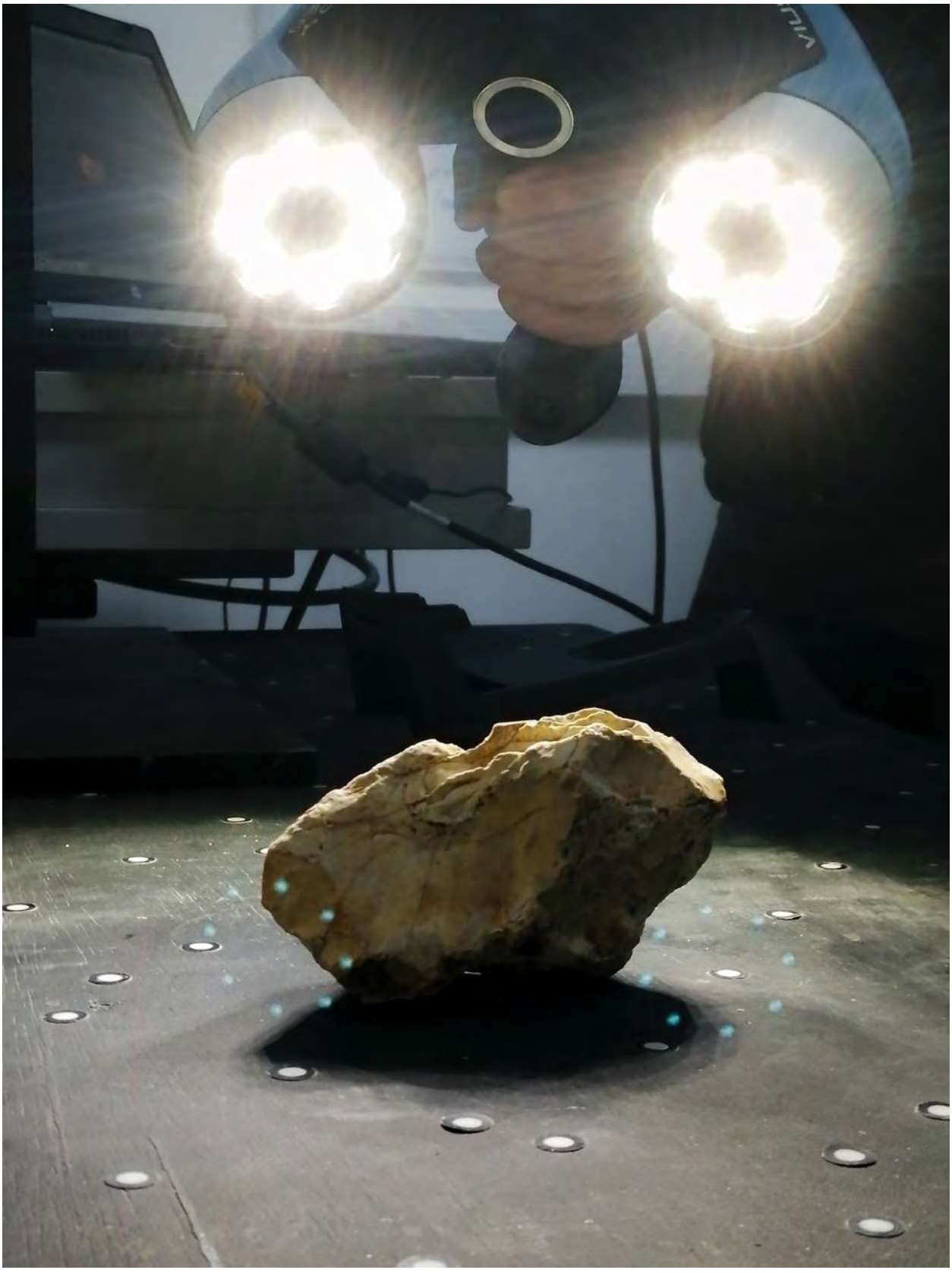
Autumn Attic Installation view

Patternicity, installation view

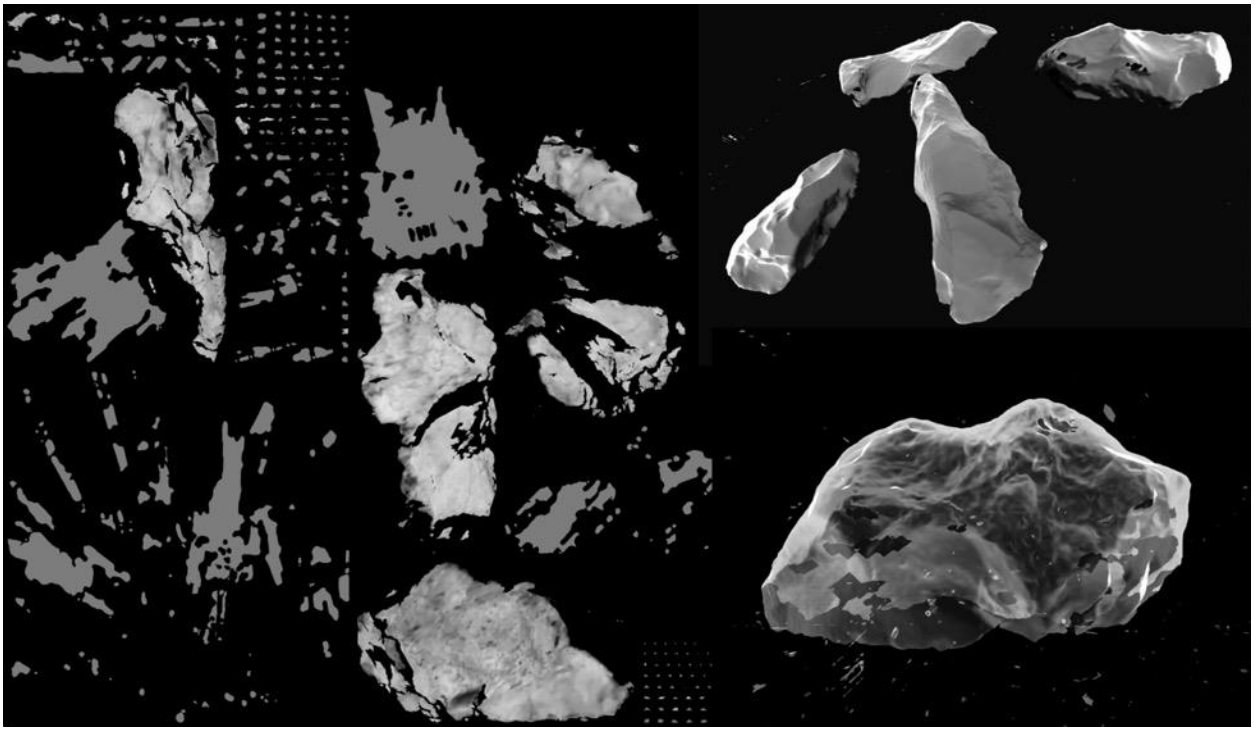
Dawson and Reilly Postcard 1: A silica entangled act of discovery. Image montage 2021



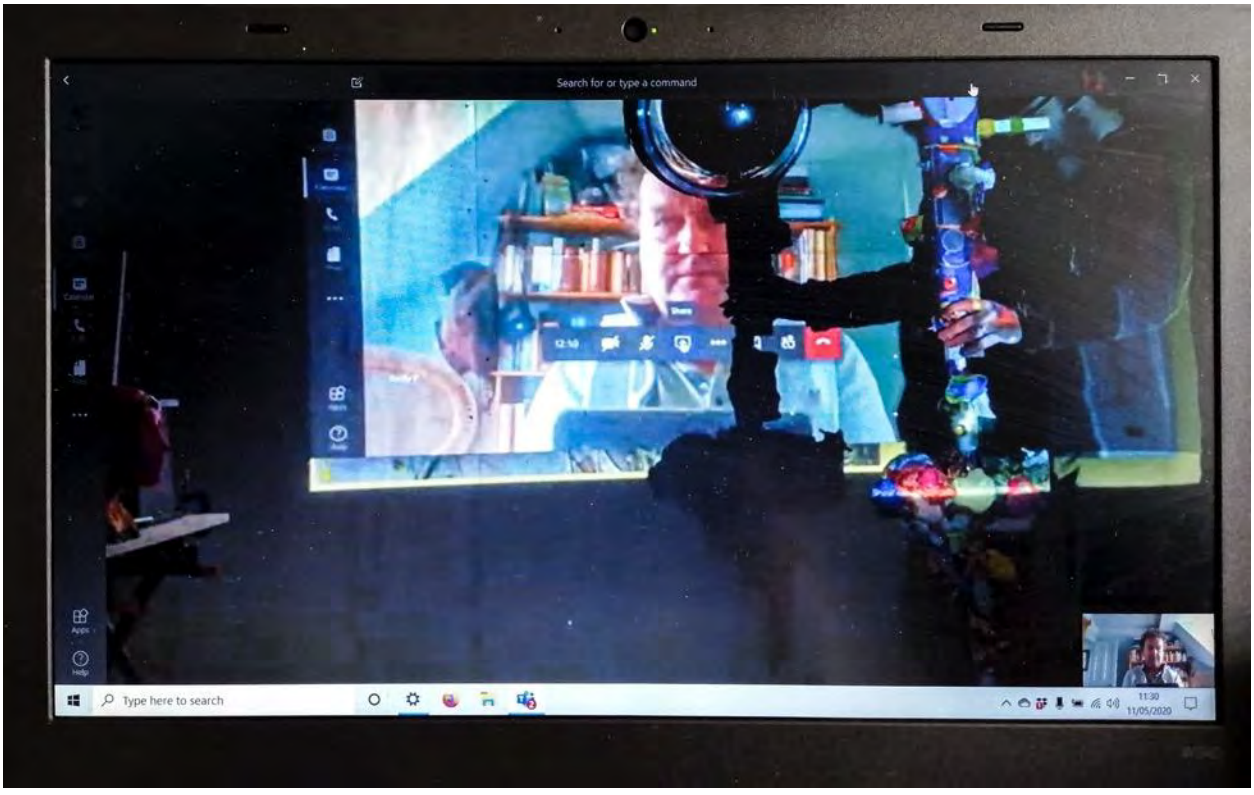
Dawson and Reilly Postcard 2: Structure from Motion (SfM), image montage. Left side; photographic still. Right side; screenshot using Agisoft Metashape. 2021



Dawson and Reilly, Postcard 6: Gaze of the Machines; grasping the artefact remotely. Creaform EXAscan. 2021



Dawson and Reilly, Postcard 7: Robot Vision meets Lucretius; collage of sloughing off digital skins. Composite image. Left side; BMP file. Right side; screenshot of the render mode on MeshLab. 2021



Dawson and Reilly, Postcard 12: Spacetimemattering in a digital mise en abyme; recursive RTI 2021

Dawson and Reilly, Postcard 8: Track and Trace - Ontological itineraries (Wrapper detail and contents)

Dawson and Reilly Postcard 9: Ontological Crossroad 2021

Dawson and Reilly, Motisfont 1, 2019

Works exhibited in:

Autumn Attic, Flowers Gallery, Shoreditch London, 12th August -18th September 2021

Patternicity, ASC Gallery London 26th March - 23rd April 2022 and Exeter Phoenix Galleries 30th April - 26th June 2022

Crucible, Thameside Studio's Gallery, London 8th- 23rd April 2022

http://www.iandawsonstudio.com/dawson-crucible.html
http://www.iandawsonstudio.com/dawson-patternicity.html
http://www.iandawsonstudio.com/autumn-attic.html
http://www.iandawsonstudio.com/metalithics.html

Messy Assemblages, Residuality and Recursion within a Phygital Nexus

Ian Dawson[1] and Paul Reilly[2]

Abstract

This visual essay is a reflection on the movement of objects and images within the *phygital* and, in particular, how different components of assemblages meet, mingle and sometimes experience ontological shifts, when an artist and an archaeologist, and their practices and apparatus, intra-act within a 'phygital nexus'. Phygital objects are digitally defined but can be invoked, instantiated and brought into constellation with other entities both physically and virtually. A phygital nexus can be thought of as a no-place and an every-place where digital and physical worlds intersect; a space where novel, 'messy assemblages' can emerge. In our collaboration, we constantly subvert the phygital nexus to appropriate and remix components of multifaceted, multi-(im)material, and multi-temporal phygital objects that recall themselves - nested and extended assemblages of persistent (im)material artefacts and other residues - and refract them through both our distinct, and combined interdisciplinary, critical practices, to produce new *ontological assemblages*, further residues of an ongoing collaboration.

The residues and traces of this reflexive collaboration, includes this essay and an assemblage of art/archaeology forms that comment, recursively, on both previous and subsequent assemblages, and our practices.

Keywords: art/archaeology; collaging; lossyness; messy; ontological assemblages; paradata; phygital.

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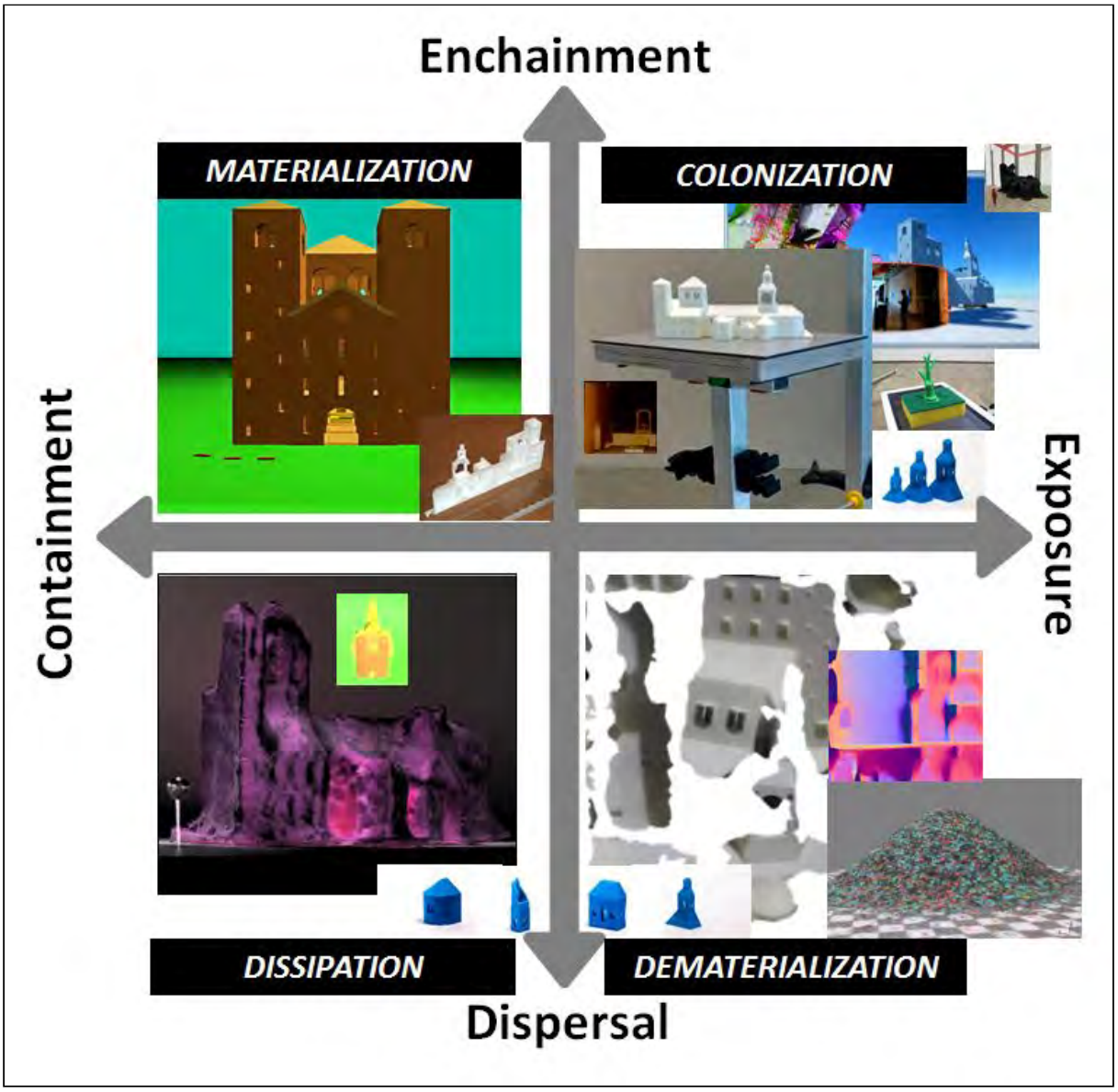
Visual Abstract



Introduction

This visual essay is a reflection on the movement of objects and images within the *phygital* and, in particular, how different components of assemblages meet, mingle and sometimes experience ontological shifts, when an artist and an archaeologist, and their contrasting practices and apparatus intra-act (sensu Barad 2007) within a *phygital nexus* (e.g., Gant and Reilly 2017). A phygital nexus can be thought of as a no-place and an everyplace in which the boundaries between what is physical and what is virtual are blurred, where digitally-defined objects (actants) are susceptible to transmutations and may be (re)deposited within multiple parallel or intersecting physical and digital assemblages (e.g. Reinhard 2019a), and are able to 'jump' almost anywhere in our digitally hyper-connected universe. In addition, phygital objects can be invoked, instantiated and brought into constellation with other practices[3] and entities both physical and virtual, and 'messy' assemblages can, and do, emerge from these interventions. Phygital transformations, moreover, may be multi-directional: digital objects can become physical and, conversely, material instantiations can be virtualised.

In our collaboration, we constantly subvert the phygital nexus to enable us to appropriate and remix components of multifaceted, multi-(im)material, and multi-temporal phygital artefacts that recall themselves - nested and extended assemblages of persistent (im)material artefacts[4] and other residues - and refract them through both our distinct, and combined interdisciplinary, critical practices, to produce new *ontological assemblages*, further residues of an ongoing collaboration. The residues and traces of this reflexive, *team SHaG*-like collaboration, has evolved iteratively as we each handed over work in progress to the other (Figure 1) to be enriched and developed (see Sillman, Humphrey and Green n.d.), and includes this essay and an assemblage of art/archaeology pieces that comment, recursively, on both previous and subsequent assemblages, and our practices.

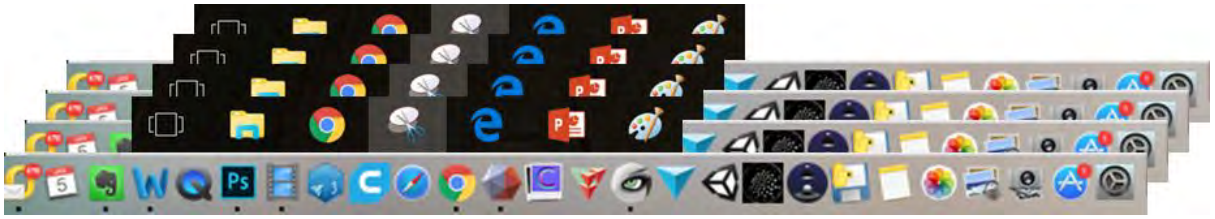


Figure 1: Interlaced studios

[3] Although it will not be explored at this stage, we recognise and embrace the potential to learn from the embodied practices of other maker communities in the phygital. For example, Bettina Nissen (2014) used small 3D sensors to track the gestures of crochet makers and 3D printed their creative movements. Elsewhere, another maker, Janelle Shane (2018), trained a neural net to create new knitting instructions, which members of the online knitting community *Ravelry* interpret in creative ways into physical creations.

[4] Being (im)material is a grey zone where material and immaterial aspects of an entity coalesce. An example of an (im)material entity would be the combination of the immaterial code definition of an object and its 3D material printed output (Buchli 2015). See also Figure 27.

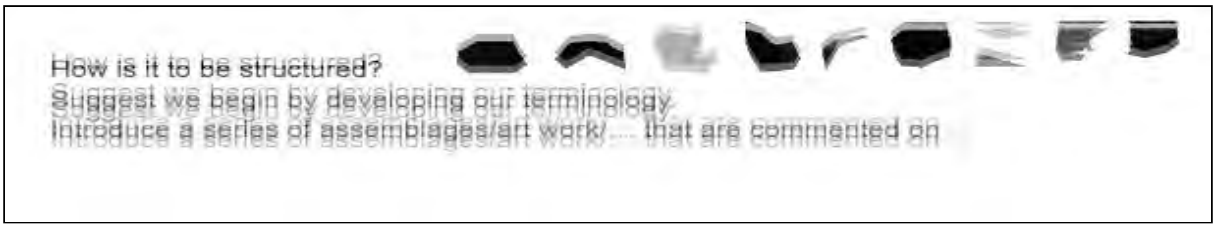


Figure 2: phygital Old Minster UV fragments collage

Assemblages and Residuality

The term ‘assemblage’ has many connotations. In art it refers to the combination of found and collected objects into a composition (e.g. Figure 2). In western tradition, it is commonly asserted to have begun with Picasso in 1918 and extends like collage as a methodology (e.g. Craig 2008) to take images and objects away from their proper function so as to see them for what they might be (Hamilakis and Jones 2017, 77-79). As Theodor Adorno would say “Art is magic delivered from the lie of being truth”. In archaeology, the concept of assemblage has traditionally had two main distinct, but overlapping, meanings. It can refer to “a collection of objects associated on the basis of their depositional or spatial find-context (e.g. midden assemblage) and a collection of one type of object found within a site or area (e.g. pottery assemblage)” (Lucas 2012, 193-4). However, Gavin Lucas, building on Manuel DeLanda’s assemblage theory, who draws, residually, on the philosophy of Giles Deleuze and Felix Guattari, has rearticulated the concept of archaeological assemblages to foreground their external relationships, such as their relations to their environment and other assemblages, as opposed to the internal configurations of their component parts, which are recognized as having a certain amount of autonomy, insofar as they can move between assemblages and recombine elsewhere in other spatiotemporal contexts.

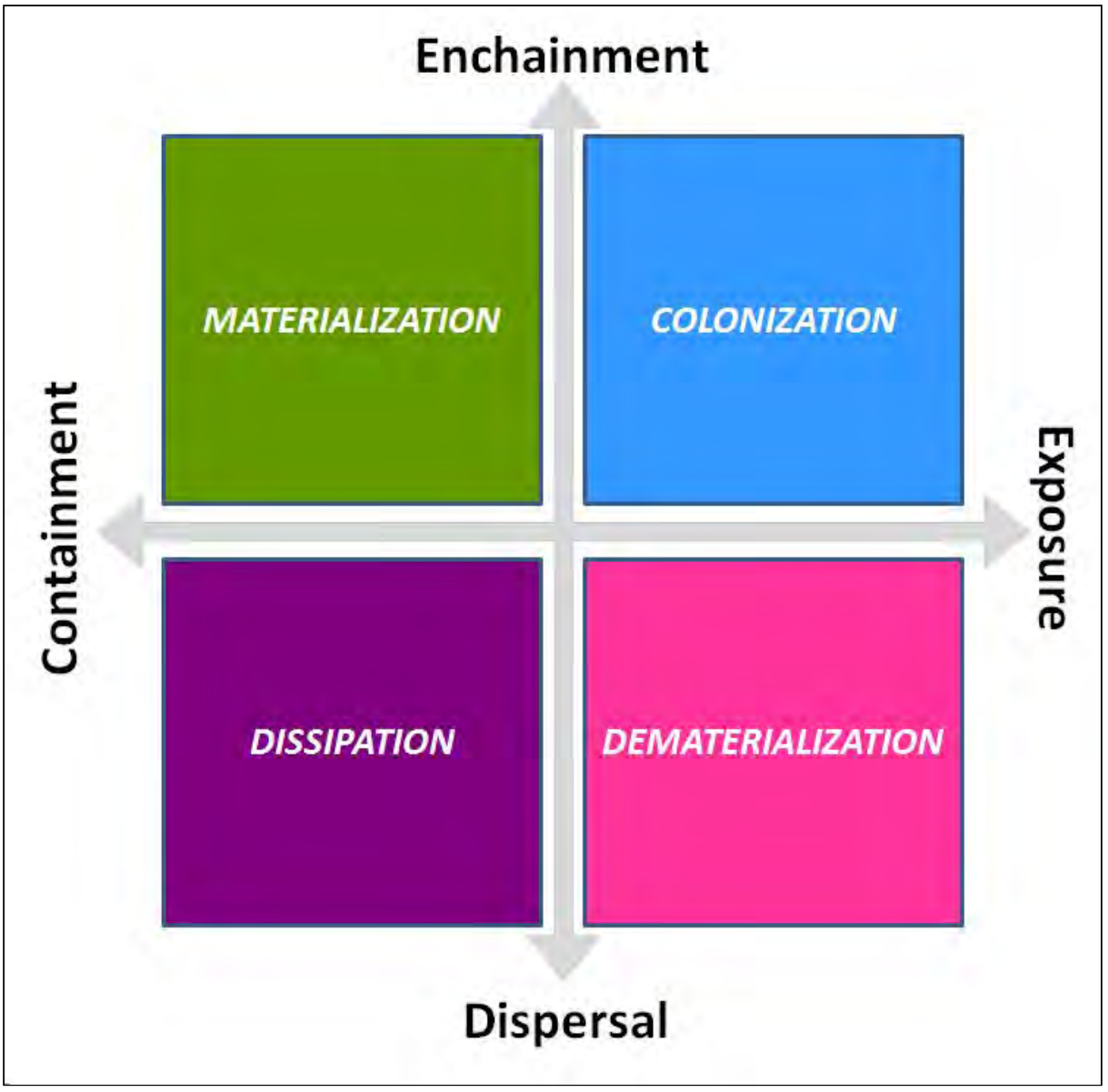


Figure 3: Modified Enchainment versus Containment Grid of Forces (after Lucas 2012, Fig. 16, p.213)

As Lucas (2012, 204) observes, '[a]lmost all, if not all, objects are strictly speaking residues of prior assemblages'. He deploys two analytical frameworks he describes as 'grids of forces' in order to inject theoretical depth into the study of archaeological assemblages: the first grid analyses *permeability* versus *persistence*, the second allows us to investigate the tension between the forces of *assembly* versus *disassembly*. It is this latter grid of forces operating on assemblages that our collaboration is currently most concerned with. Within this framework (see Figure 3) Lucas' focus of attention is firmly on the tension between the processes of *(re)materialization* and *dematerialization* (Lucas 2012, p. 213, Fig. 16). However, Reilly (2015) also foregrounded the two other active forces operating in the complimentary spaces of this framework. *Colonization* and *dissipation* also have vital roles to play within assemblages, principally in reconfiguring or extending them, particularly in the phygital. Colonization is shaped by the dual processes of enchainment (also described as coding, or citation) and exposure (or deterritorialization). This force maintains the material coherence of the assemblage even though it might be displaced, perhaps far away, in time and space from its original setting. However, the vastly accelerated rates of recursion and

residuality enabled in the phygital nexus opens up the possibility of uncontrollable mutations and glitches, both miniscule and major, and other accidents of context or reproduction (e.g., Virilio 2003; Minkin 2016). Colonization can thus radically reconfigure the topology and boundaries of assemblages. By contrast, the entropic force of *dissipation* harnesses the twin processes of containment and dispersal, meaning that elements of an assemblage break up and disintegrate, but largely remain close to their original setting. Whether or not the assemblage is subject to the processes of containment or deterritorialization, persistent components that transfer into new contexts and assemblages can also be considered both 'itinerant objects' (Joyce and Gillespie 2015) and residuals.

'Residuality' refers to the phenomenon of objects, fragments or materials that persist and reoccur in contexts other than those they originated in (e.g., Brown 1995; Lucas 2017).

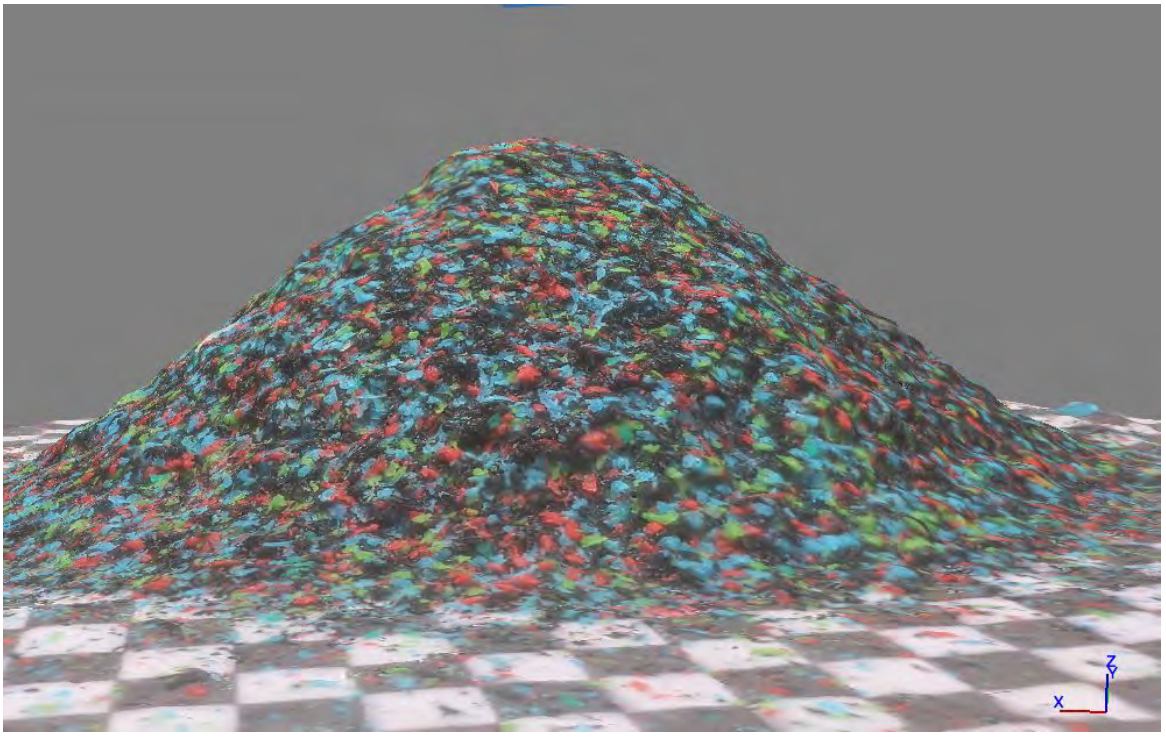


Figure 4: PLA spoil heap - a study in phygital Disassembly/Assembly

Residuality introduces an element of stochastic variability into assemblages as new relational properties, and alternative agentic impact may develop depending on the (re)configuration of their components (e.g., Figure 4) and the particular capacities and agencies of the elements from which it is composed (see Hamilakis and Jones 2017; Jones 2018, 23).

Some things last longer than others and may acquire quite extensive biographies. Pottery and plastics, for example, are particularly persistent and are constantly being dug up from one context and removed into new ones. Consider the sinking of a well. The excavator cuts through pre-existing deposits, redepositing materials from earlier temporal horizons into subsequent, increasingly messy, assemblages and contexts containing (re)mixed, or reworked, components originating from multiple temporal horizons. In this shift of context some residual objects within the assemblage may experience ontological transformations. For instance, a flat, circular ceramic object may originally serve as a plate, but if it is broken its material residues - principally sherds - can start to disperse. Every residual object has the

potential to become a fresh component of one or more subsequent new contexts in which the ceramic material might become, for example, pieces in a mosaic, or rubbish items in a pit, rubble in a trampled floor, packing material in a posthole, and archaeological evidence.

The residual objects outlined above are more or less materially persistent. Their shape may have been radically altered, but some of the original material they were composed of is still present. However, sometimes it is only the form of the object that persists, while the material in which it was previously instantiated is recursively replaced. Reilly (2015a), for instance, traces different objects made from the voids encountered at Pompeii (e.g., casts, effigies, pseudomorphs, skeuomorphs and 3D prints, amongst others). The recursive, or self-referencing, component here is the form of the original or prototype. Consider the maintenance of an ancient church. Over the centuries elements of the fabric and furniture of the building degrade and must be replaced. Probably every major minster still in use in Europe has a team of masons replacing elements of the persistent conformation we share with previous generations, but using freshly quarried stone.

Figure 5: PLA reprint iteration 3

Figure 6: UV fragments II

Phygital assemblages can be both, or either, residual or recursive in nature, since phygital objects are easily replicated, aggregated, augmented, resampled, processed, or transcoded into other formats, and can be redeposited in different materials and at different scales (e.g., Figures 4, 5, 6, 7, 8 & 9). Moreover, dimensions can be flattened (e.g., Loyless 2018), and planes turned (e.g., Figure 10), recalling the strange loops and paradoxes of the recursive structures and processes that fascinated the likes of Gödel, Escher, and Bach (Hofstadter 1979).

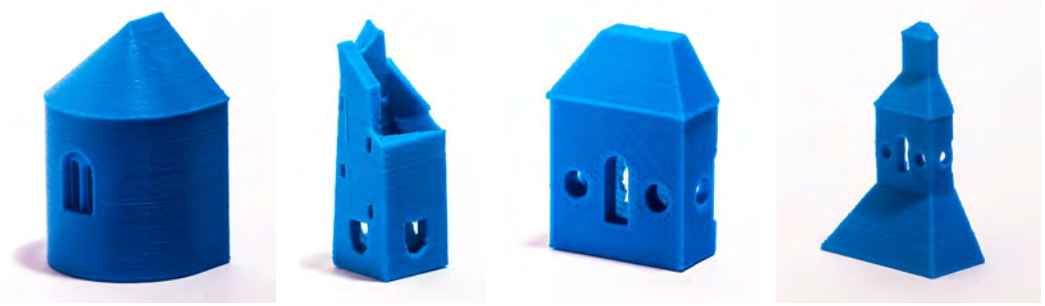


Figure 7: Hack Minster Hoard

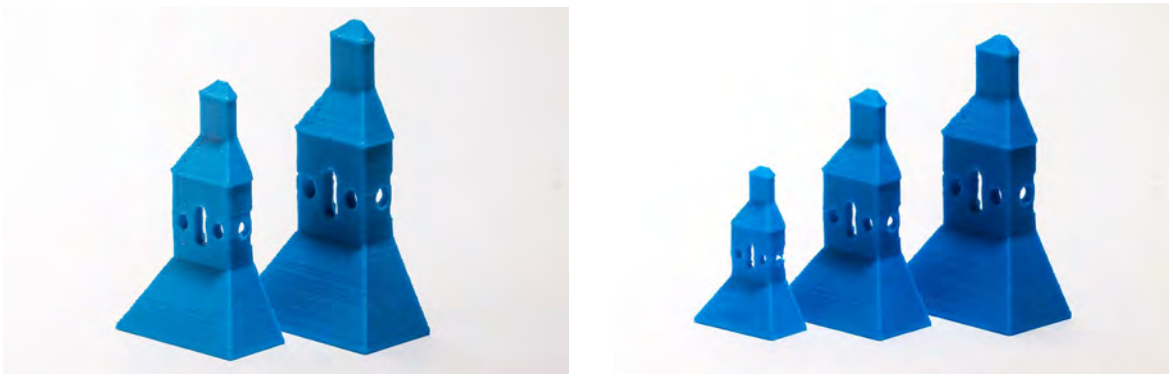


Figure 8: Scale as recursion +/- 1

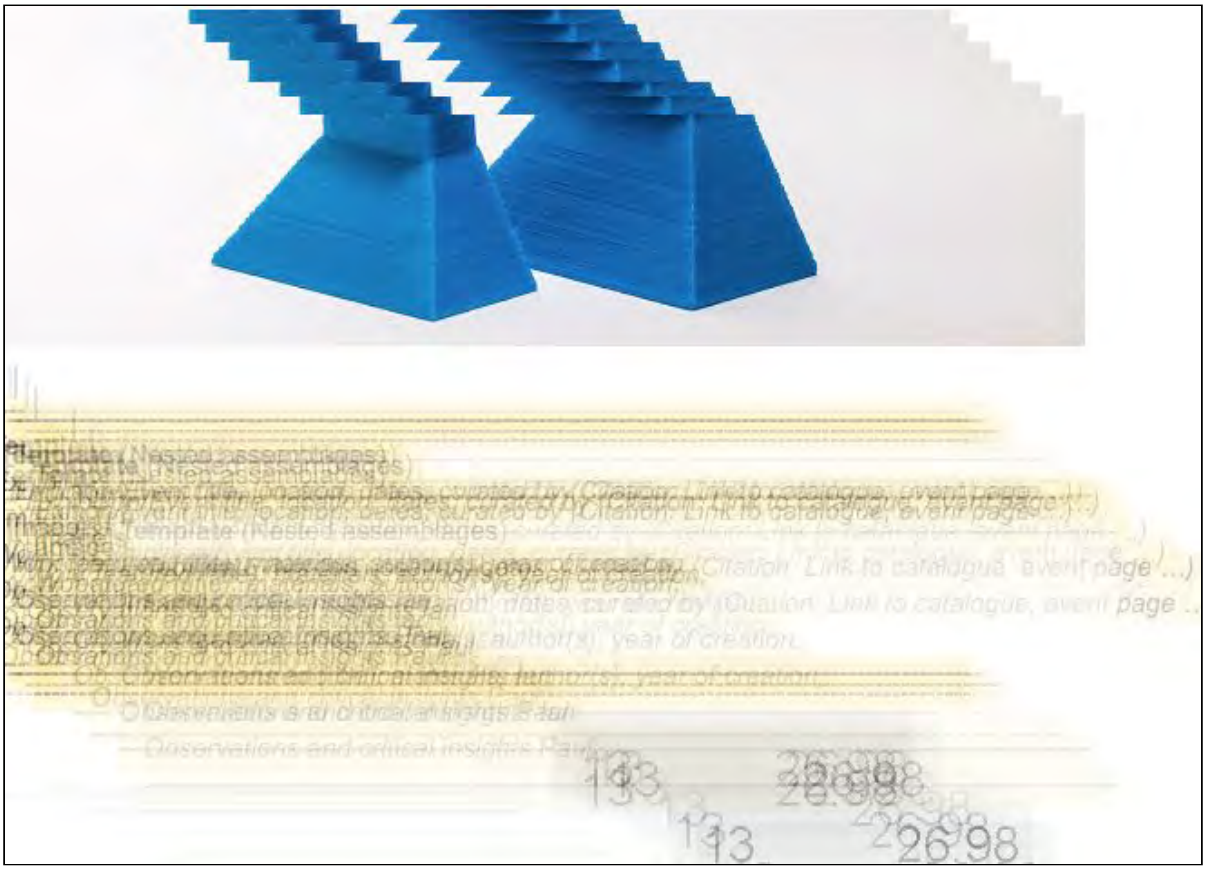
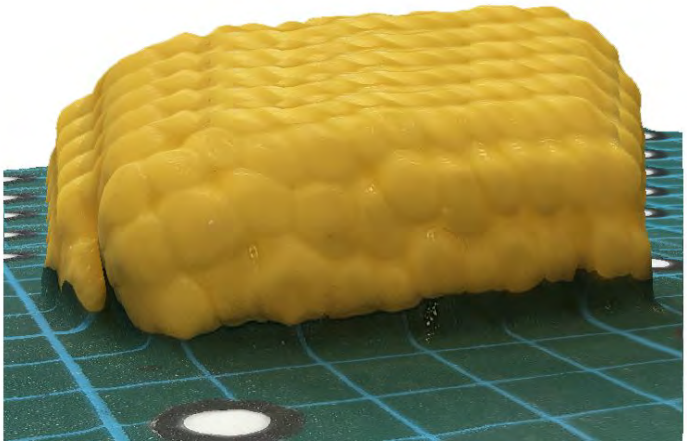
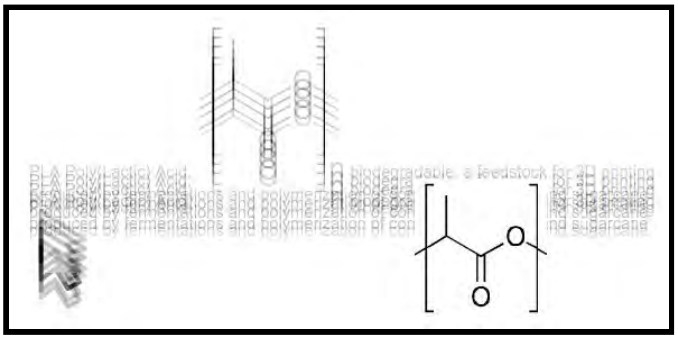


Figure 10: Stair of churches

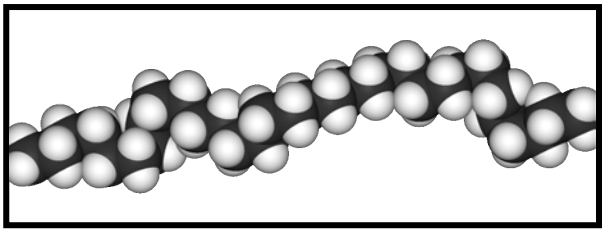
Thus extended, these phygital assemblages are susceptible to new kinds of exploration and analysis, and may be productively recontextualized, reiterated, (re)materialized, reconceptualized, re(con)figured, and (re)discovered. For instance, a digitally rendered edifice may at one moment shrink away as the virtual explorer flys - angel-like - around it, but in the next instant the virtual pedestrian explorer can be enveloped by the interior of the same so-called ‘solid’ model. Both journeys can also be endlessly transformed by adjusting lighting schemes and the resolution used. Equally, the identical digital solid model definition code may produce a 3D material print. Here too myriad perspectives disclose themselves and new registers of intra-action emerge. At one end of the scale, such a physical model might be 3D printed as a hand-holdable and discoverable plastic miniature which might furnish a small-scale diorama. At the other, it is also theoretically possible to 3D fabricate the same digitally defined assemblage in almost any material (e.g. Figures 11, 12, 13 & 14), or indeed multiple, or composite, materials, at any scale, including life size (Reilly, 2015b).



Starch substrate



Layered Polylactic Acid (PLA)



Polyethylene chain

Aluminium Powder

Figure 8: 3D printing deposits

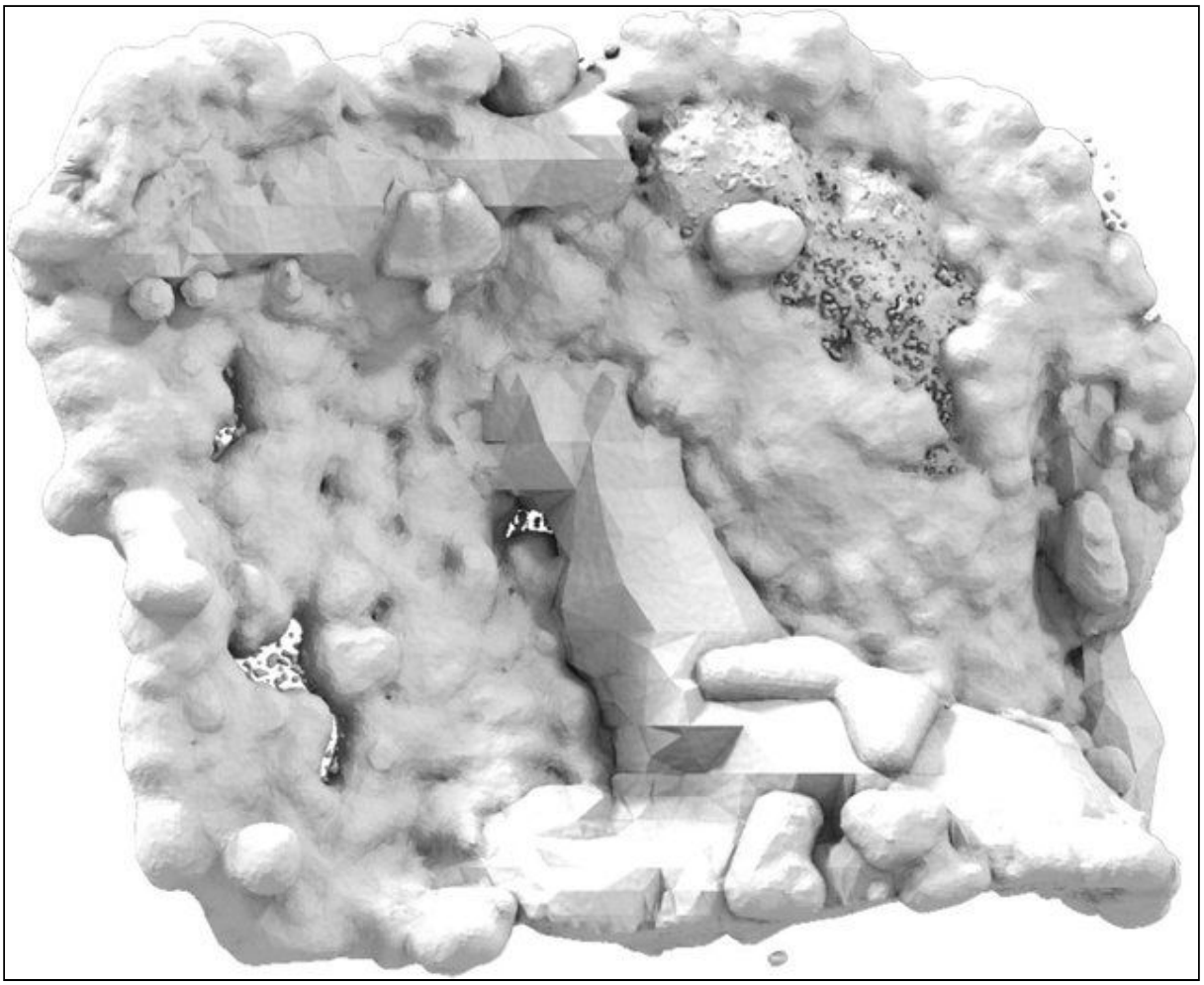


Figure 10: Plastic Print derived from aggregated images of the Devil's Chair, Avebury (Louisa Minkin 2015, with permission)

Many other ontological transformations abound in the phygital and can occur in very rapid succession. Consider Louisa Minkin's *Plastic Print derived from aggregated images of the Devil's Chair, Avebury* (2015). For this piece (reproduced in Figure 10), Minkin aggregated images taken by tourists adopting the same pose at this iconic megalith over many years to produce a 3D material 'souvenir object of uncertain spatio-temporal status' (Minkin 2016, p.122, & figure 3, p.123). This disturbing temporal-frankenstein-like simulacrum is also a phygital coloniser. Reversing the same technology flows, born-digital physical instantiations can break back into the virtual realm via computational photography, such as photogrammetry (Figure 16) or Reflectance Transformation Imaging (RTI) (e.g., Figures 11 & 12), and a rapidly expanding assemblage of other scanning technologies. Such apparatus has been characterised by Jeremy Huggett (2017) as 'cognitive artefacts' that encapsulate *hidden* recursions of the practices, techniques, calculations, and interventions that help us explore, reveal, capture, and characterise archaeological objects (see also Jones 2002; Latour and Woolgar 1986). Black-boxes or not, such instruments (of colonisation) are now commonplace in both archaeological (e.g., Beale and Reilly 2017; Graham 2018; 2019; Jones and Díaz-Guardamino 2019) and artist practice (e.g., Beale *et al*. 2013; Minkin 2016; Petch 2019; Dawson in press). However, all DSLR images and digital scans are based on point measurements and no matter what resolution is adopted they are still only digital *surface samples,* and consequently always less than the original subject under examination. When such point readings are interpolated into meshes for 3D renders or 3D printing a significant proportion of these sampled data are discarded algorithmically. In other words

more detail is being lost with each new recursive rendering, print or scan. We also explore this phenomenon in our collaboration which presents itself in second or third generation print-outs as a gradual softening of form as once sharply defined conformations are digitally eroded (e.g. compare Figures 5 and 17).

Figure 11: Double assemblage

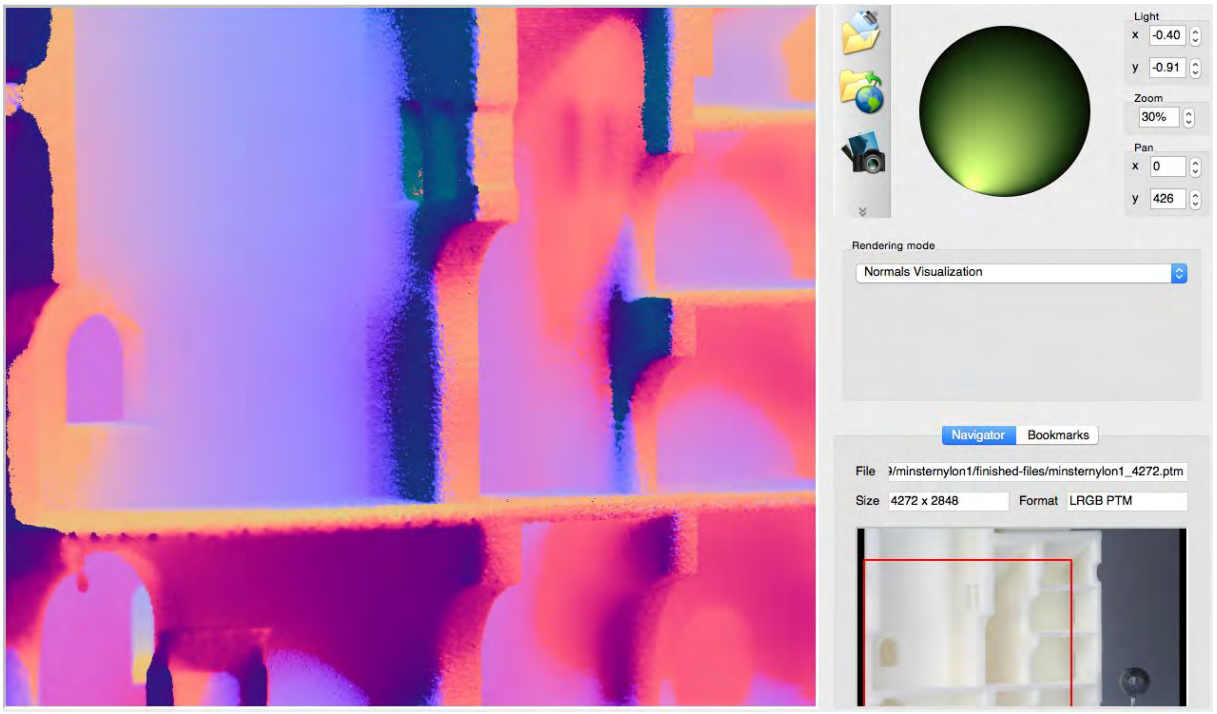
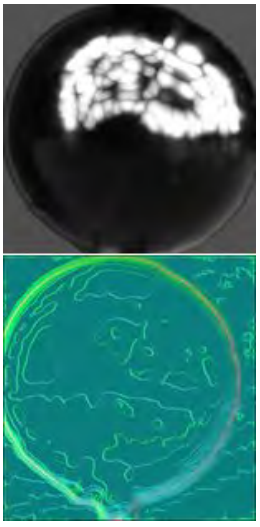


Figure 12: Triple spoof chameleon architecture: interior RTI image of a 3D print of an archaeological Constructive Solid Geometry (CSG) modelled re-imagination of a building annihilated in CE 1093/4

Many of RTIs featured in this essay virtually (re)presence a 3D printed re-imagination of the digital Old Minster of Winchester. RTI is a computational photography technique in which known lighting information derived from multiple digital photographs is mathematically synthesised to build a model of the subject's surface shape and properties[5]. However, as Andy Jones and Marta Díaz-Guardamino (2019, 213) make clear, "[i]t would be a mistake to assume that RTI images were simply photographs; they are ontologically complex composite

[5] Refer to Cultural Heritage Imaging for an excellent up-to-date introduction to, and state of the art examples of, RTI practices (@chi): http://culturalheritageimaging.org/Technologies/RTI/

constructed images, with a certain kinship to the photographic". In a sense, the initial geometry and surface properties of the object of study retreat, or dissipate, into residual 'surface normals' and morphing shadows as the RTI algorithms generate a kind of mathematical mirage, yet another recursion accompanied by another ontological shift, and representing a second or third order 'spoof' of the initial geometric re-imagination (Figure 12).



When viewer, subject and RTI parameters playfully intra-act, the mirage is continually reinvented, chameleon-like, producing a stream of surrealist visualisations, radically altering our apprehension of light, space and surface[6]. For example, applying specular enhancement to a previously dull matt surface has the effect of shining harsh raking lights across a now shiny surface, producing almost haptic highlights and shadows (e.g., Figure 13), which can often reveal surface information that is not immediately disclosed under direct empirical examination of the original physical object or, indeed, the individual initial digital photographs. Key to the production of RTIs is the inclusion of a highly polished sphere in the assemblage; the highlights produced on the sphere by each differently positioned flash of the strobe are used to derive the surface geometry of the subject of study.

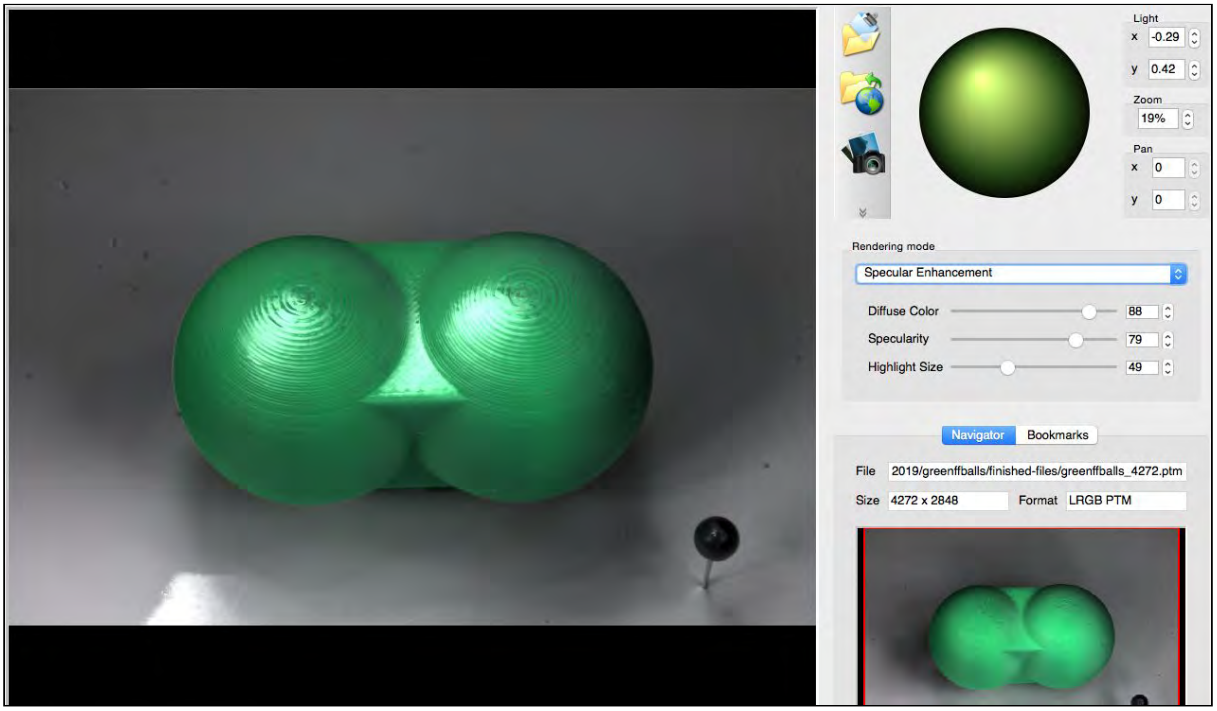


Figure 13: Specular RTI Balls

Another significant set of recursions emerges through the mirror-surface of the sphere with every strobe of the flash. During each of these entangled intra-actions, the 3D object, the camera, the flash, the reflective sphere itself, and the photographer (archaeologist/artist) mark one other with residual traces of light. In fact, the recursive reflections caught in the surface of the sphere create the total assemblage's spontaneous and co-authored signature. The entangled traces of light embedded in the RTI may also be conceptualised as

[6] Recalling the work of film collage artist Joseph Cornell (1942).

auto-archived paradata[7] (Bentkowska-Kafel, Baker and Denard 2012) recording, as they do, the circumstances, environment, relative position, and the condition of all the actants and their intra-actions in this emerging polynomial assemblage as it unfolds from frame to frame (Figure 14).

Figure 14: Meeting the assemblage halfway with auto-archived paradata

In summary, by placing assemblages within a phygital nexus, we open up fresh possibilities for digitally creative, and perhaps productive disarticulations, repurposing, and disruptive interventions (Bailey 2017), offering phygital 'acts of discovery' beyond the spade and the screen (see Edgeworth 2014), and in so doing unleash new potential for novel and, perhaps, productively provocative conceptions of residuality and recursion.

In the next section we develop our case study: the extending phygital assemblage of the Old Minster of Winchester.

Initial residues and recursions of the Old Minster of Winchester

In CE 1092, the Anglo-Saxon cathedral of Winchester known as the "Old Minster" was probably the most imposing building in pre-Norman Britain. However, in 1093/4, the Old Minster was completely obliterated to make way for the construction of the Norman complex

[7] To be distinguished from intentional metadata, that is the explicitly defined descriptions or attributes of the logged data (e.g., camera model, image size and format, date and time, specularity, diffuse gain parameters etc.) and the recorded reasoning and evidence embedded in the virtual anastylosis.

we can still visit today. A substantial part of the site of the Old Minster was excavated by archaeologists in the early 1960s who discovered that this once imposing ecclesiastical edifice had been entirely dismantled down to, and including, its foundations (Biddle 2018; Kjølbye-Biddle and Biddle forthcoming). Indeed, by 1963, the only trace of the Old Minster was it's footprint and some rubble, captured by the robber trenches left and subsequently buried after the Old Minster's foundations had been removed at the end of the 11th century. A decade after these excavations had closed, the principal archaeological investigators wanted to convey the scale and form of the Old Minster to the general public in an easily accessible way. They turned to what was then cutting-edge digital technology and, in 1984-6, several software encoded models describing distinct phases in the development of the Old Minster were created and rendered using IBM proprietary experimental solid-modelling software to produce the first digital recursions (Reilly 1989; 1992; 1996).

Expanding the Old Minster Assemblage into a Phygital Nexus

By recursively generating single view static images ('frames') from incremental simulated viewpoints (e.g. Figure 15) the world's first computer-animated virtual tour of an archaeological re-imagination emerged. Versions (further recursions) of *The Old Minster, Winchester* 'movie' were shown on TV and exhibited at the British Museum, others were encoded in PAL, NTSC, and SECAM and distributed initially on VHS, U-matic and Betamax video cassette (tape) formats, and later using CD and DVD formats burned into the next generation of material substrates.

Figure 15: Old Minster *frame*, 1984/5

Figure 16: Lossy Old Minster PAL-U-matic-VHS copy

Figure 17: Re-imagined final phase c.1092 Old MInster CSG model using OpenSCAD, 2015

Unfortunately, the only surviving residue of the first minster movie is a JPEG3 recursion of a VHS PAL tape video, which itself was copied from a U-matic video tape master. It serves to remind us that while the initial geometric definition of the re-imagined Old Minster may have been orthothetic in nature (Stiegler n.d.), each instantiation, re-registration (e.g. scan, JPEG photographs, video, or 3D print) and, more often than we might realise, every time such digital instantiations are compressed for transmission, introduces a degree of digital decay or entropy (e.g., Figures 16, 21 & 22). With each new codec decoding/encoding recursion the video image resolution was decreased, and more information dissipated through the inherent *lossyness* of each successive encoding (see Horowitz 1998; Cubitt 2014, 249).

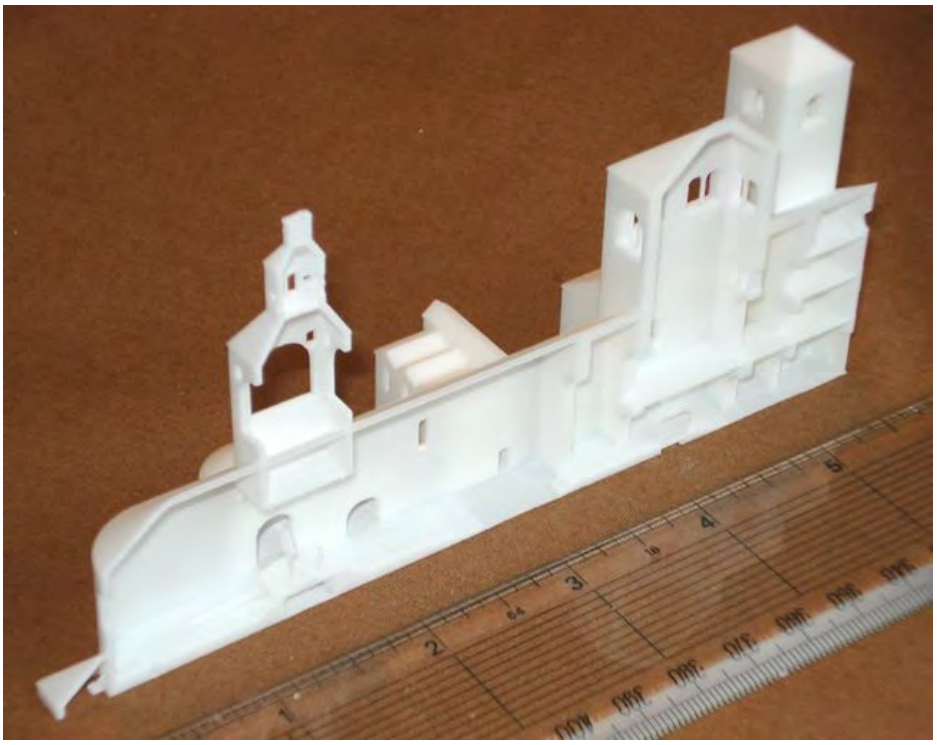
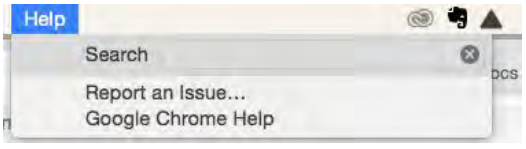


Figure 18: Initial phygital Old Minster, 2015.

However, as technology advanced, the experimental software, hardware and distribution media standards that the digital Old Minster model was built on became obsolete, and the models retreated into the background. Actually, the makers thought them to be lost. However, in 2015 residues of the digital Old Minster in the form of the original proprietary model definition files were rediscovered buried within layers of unsupported experimental code and recovered[8]. Fortunately, although the models were written in a dead language, these seminal virtual artefacts could be restored and reaccessed by translating them into a modern orthothetic definition using open source code[9] (Figure 17). Such open code and digital technology offers many new and productive affordances for exploring and recontextualising the digital Old Minster. For example, besides supporting virtual settings in interactive graphical contexts (e.g., programbits.co.uk/minster/minst.html), the same digital objects can be explored in VR (e.g., Figure 29) or materialised in different and multiple materials as 3D prints (Figure 23), effectively moving the setting off the screen and onto the stage as it were, and giving substance to digital objects which would otherwise be, as Monika Stobiecka (2019) wryly puts it, 'deprived of their matter'. Critically, in this latest ontological shift, we gain multisensorial, multimodal, and embodied experiences with tangible objects of increased cognitive depth.

The digital Old Minster is thus an expanding, constantly morphing, ontological assemblage of (im)material digital objects within our phygital nexus. To recap, its geometric properties were initially presented virtually, that is on screen using ray-casting algorithms, but decades later the same geometry was instantiated as a material 3D print. As we have already observed, 3D prints, like any other artefact, can be photogrammetrically (re)captured or scanned and (re)virtualised as, for example, point-clouds or mesh recursions which can in their turn be (re)deposited and recontextualised (e.g., Figures 19, 20, 21, 22 & 23).

For the remainder of this visual essay we will intra-act with several ontological assemblages drawn from the phygital nexus of the digital Old Minster.



[8] Increasingly, digital archaeologists are starting to explore the archaeology of code (e.g., Reinhard 2019b) and obsolete hardware and media platforms (e.g., Moshenka 2014; Perry and Morgan 2015; Beale, Schofield and Austin 2019).
[9] A detailed account of the making of both the original and the new open digital models can be found in Reilly, Todd and Walter 2016.

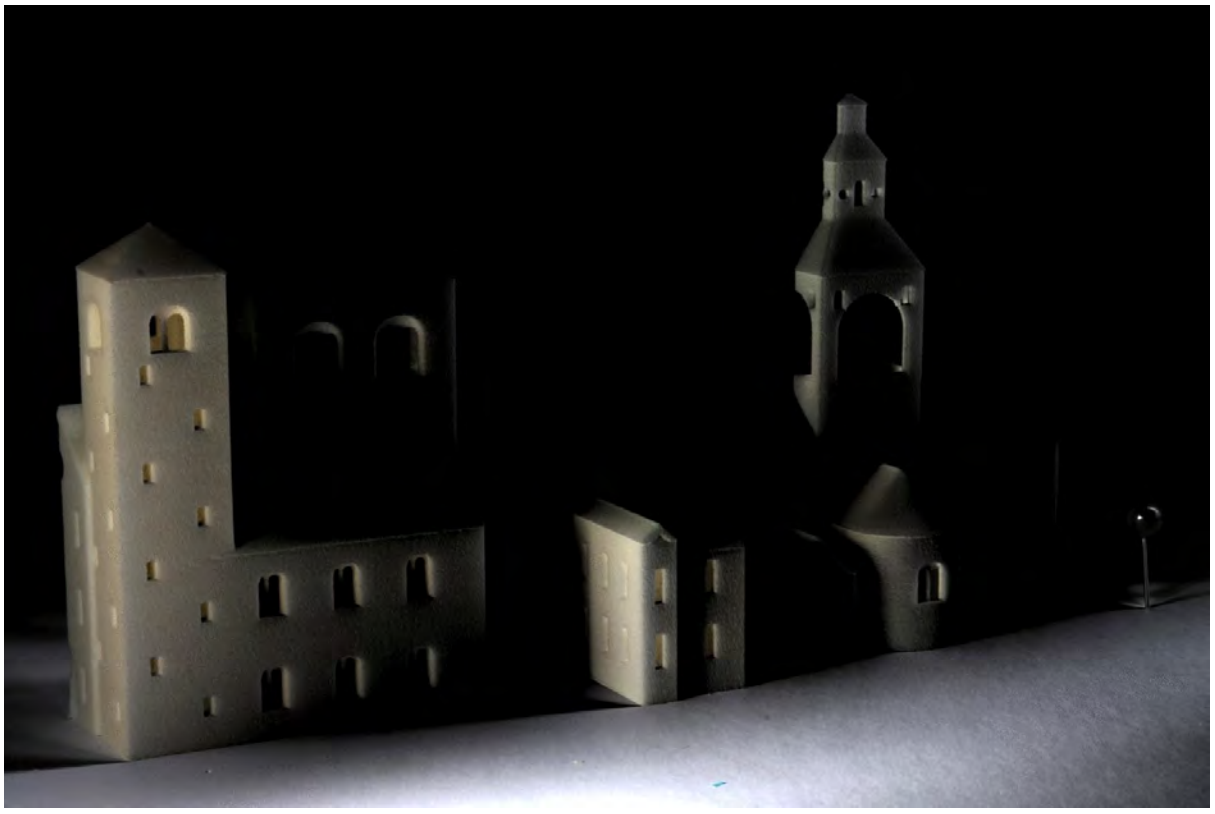


Figure 19: Phygital Old Minster Synthetic Sundial (RTI GIF 3D)

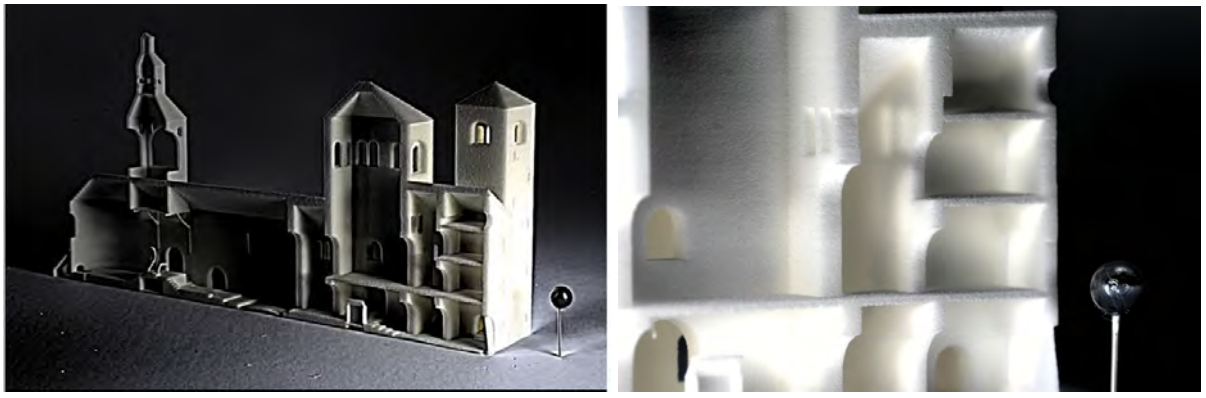
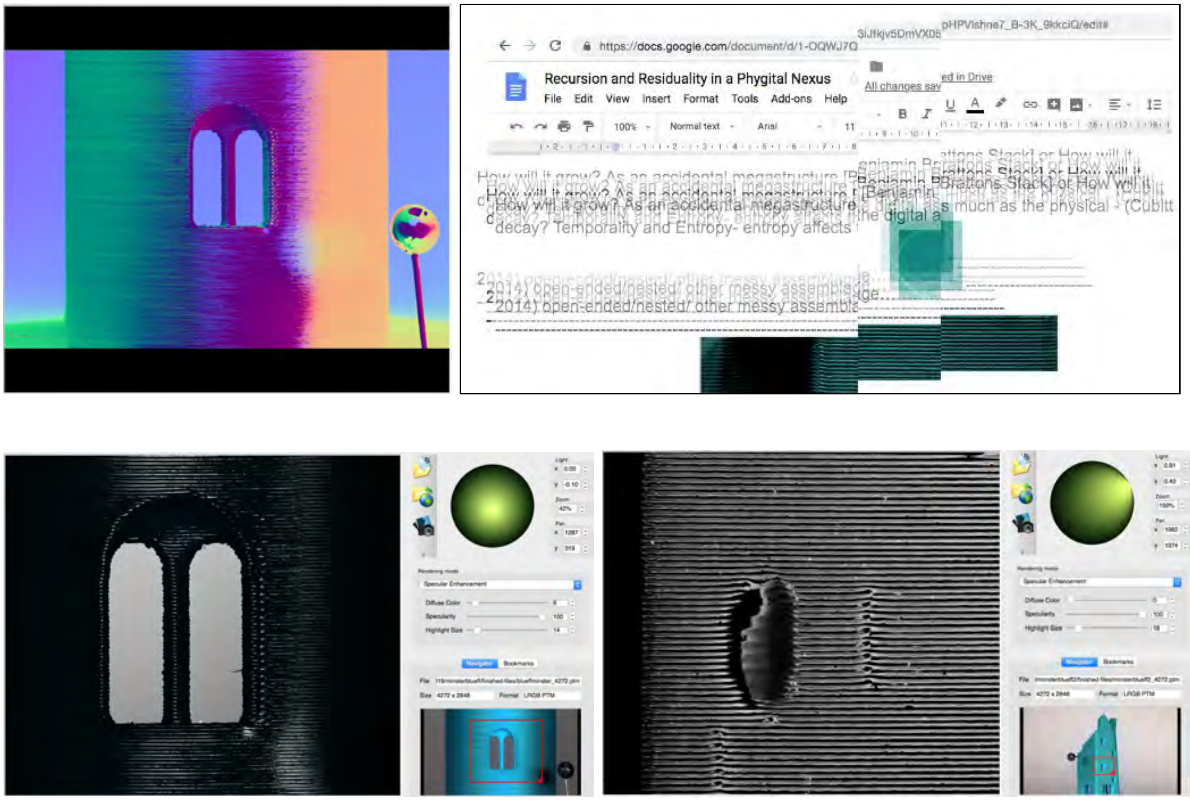


Figure 20: Old Minster section RTI Mirage (RTI and RTI GIF detail)

Figure 21: Dissipating Phygital Old Minster v.3 (RTI GIF 3D print)



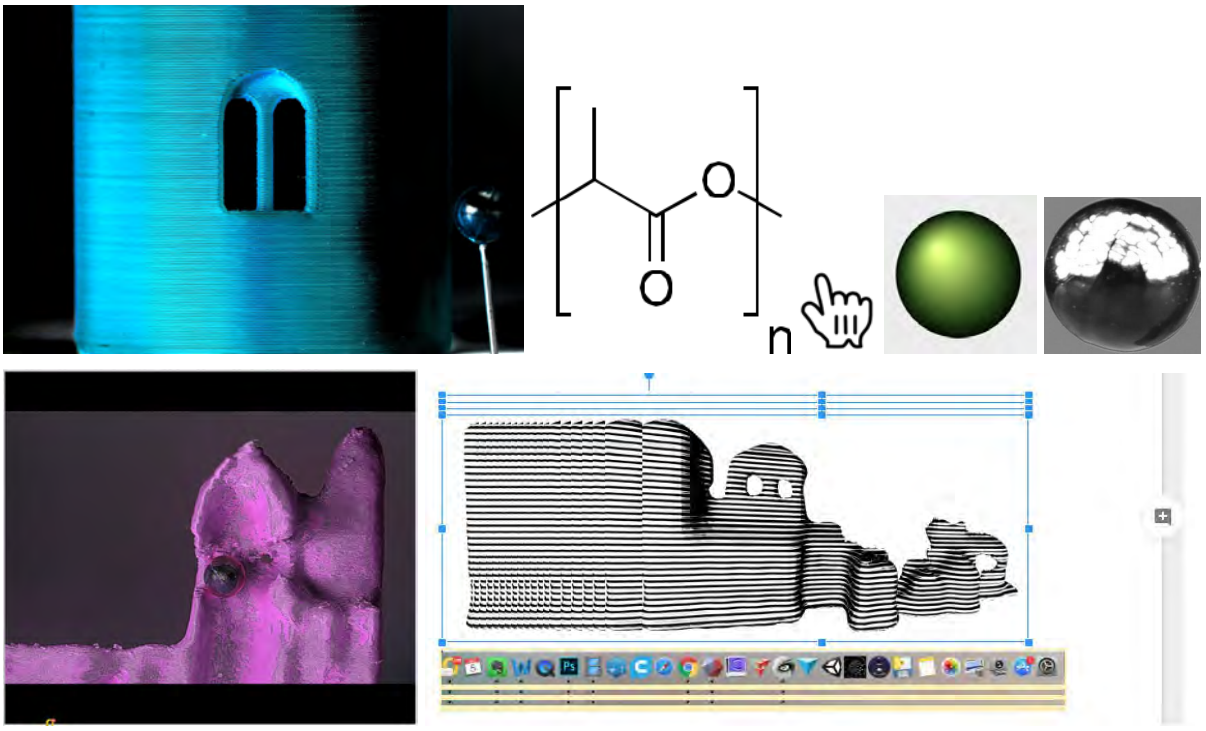


Figure 22: Messy Ontological Assemblage Collage

Further Recursions and Residues: Exhibitions

Throughout this collaboration, our interdisciplinary (art/archaeology) conversation about assemblages has been, and continues to be, syncopated with exhibitions in which we attempt to distil some of our insights into art forms, and yet further recursions and residues from prior assemblages. Like the assemblages we feature, our commentary is messy, as we interject our reflections using a combination of text and collaging.

Sightations, TAG 2016, Southampton (19.12.16 –21.12.16)

Curated by Joana Valdez-Tullett, Helen Chittock, Kate Rogers, Eleonora Gandolfi, Emilia Mataix-Ferrandiz, and Grant Cox

The Sightations exhibition[10] at the Theoretical Archaeology Group conference held at the University of Southampton in December 2016 provided an important focal point where art and archaeology practices could come into constellation. The work featured by Ian Dawson was called *ten* (Figure 23).

[10] See also https://www.southampton.ac.uk/tag2016/events/art-exhibition.page, https://www.academia.edu/28934530/Sightations_Caf%C3%A9_session_Theoretical_Archaeology_group_TAG_Southampton_19-21_december_2016, and https://drpaulreilly.wordpress.com/2017/03/27/annihilation-event-digital-old-minster-the-archaeology-of-a-digital-file/

Figure 23: *ten* (Ian Dawson, 2016, Aluminium, fused filament 3D prints and ranging rod)

Despite being exhorted by an artist ‘not to over analyse it’, it is difficult for an archaeologist not to respond to *ten* other as an treatise on archaeological excavation recording. At a distance, the succession of red, white and black marks, evenly distributed down the length of the square-profiled aluminium bar, shouted out ‘levelling staff’ - a surveying companion on many excavations. The juxtaposition with the 2m red and white ranging rod, typically used as a photographic scale on site, reinforces this reading. Looking closer, the archaeological excavation narrative really seems to come alive as the ‘graduation marks’ resolve themselves into well-known artefacts, physical memories, waymarking temporal horizons, being registered by the staff (Figure 24).

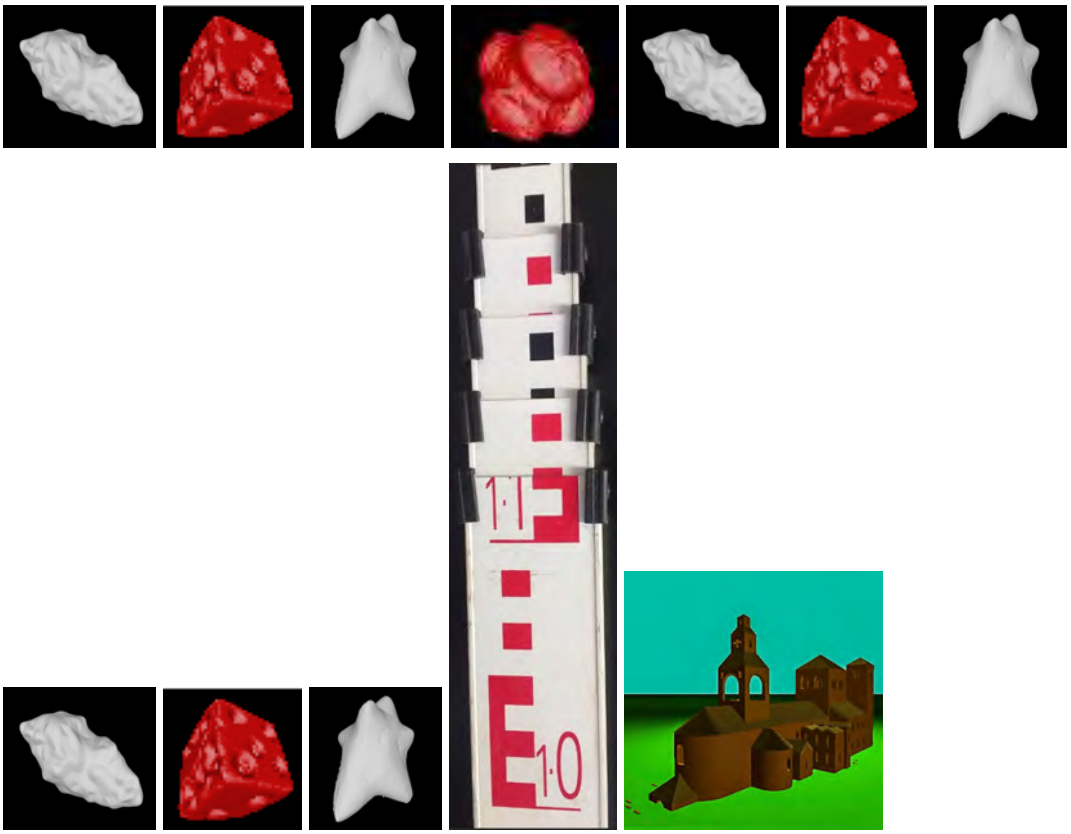


Figure 24: *ten* temporal horizons

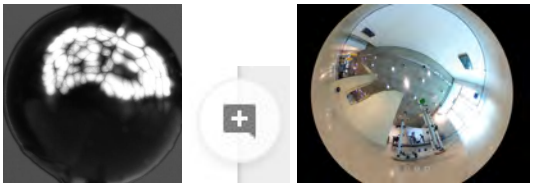
Figure 25: (Im)material Old Minster (Winchester) 2016 continued *(*Fused filament 3D print and printed photographs on paper)

In the same room, Paul Reilly's featured work was called: *(Im)material Old Minster (Winchester), 2016*. This piece also alluded to time depth and persistence (Figure 25). The little white mono-material 3D print, fabricated via the web using shapeways.com in 2016, was accompanied by two 2D colour prints of the same digital object as it was rendered 30 years previously, each residual artefact, from different time horizons, a recursion embedded in a shared, but fleeting present, beckoning new residual assemblages to emerge.

Annihilation Event, Lethaby Gallery London (22.03.17- 29.03.17)

Curated by Louisa Minkin and Elizabeth Wright

The next opportunity to develop our conversation, was the Annihilation Event, held in the Lethaby Gallery, UAL, London. The assemblage was billed as having "no singular origin, but many strands and streams ... a project about copies, prints, scans, derivations, reconstructions, casts, and virtual models". The work we featured was titled Digital Old Minster, the archaeology of a digital file (Paul Reilly & Ian Dawson, 2017, Aluminium and fused filament 3D prints). Here aluminium bars affixed with residual 3D printed objects frame the plastic Saxon minster in a rather gothicesque assemblage of gargoyles and flying-buttresses.




JPEG

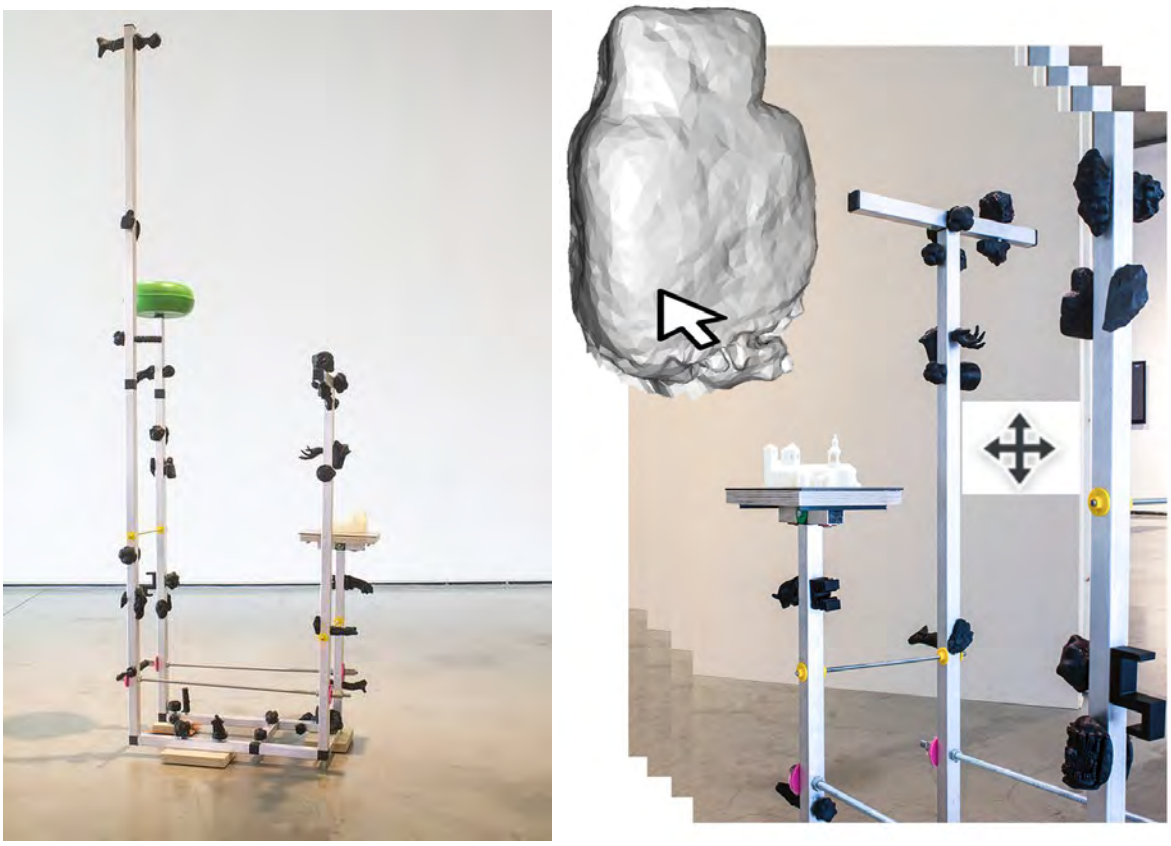


Figure 26: *Digital Old Minster, the archaeology of a digital file,* 2017 (Paul Reilly & Ian Dawson, Aluminium, fused filament 3D prints)

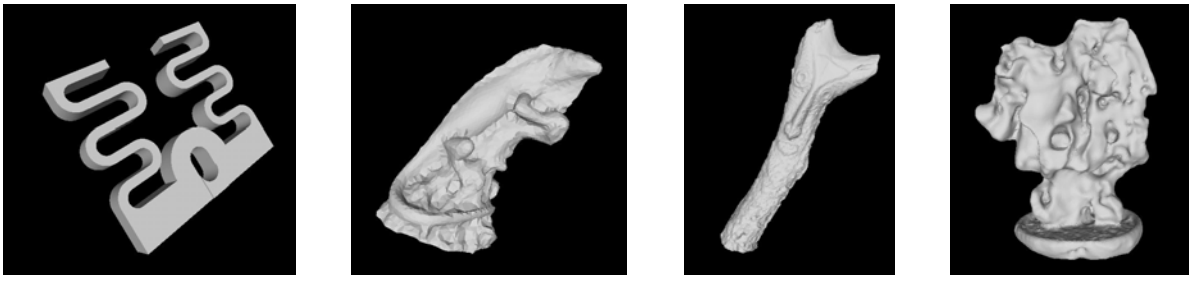


Figure 27: Material prints embodying immaterial code introduce the (im)material grey zone

Figure 28: Recursive Assemblage (exhibition space). Screengrab from Unity VR build, Annihilation Event, 2017 (Louisa Minkin, with permission)

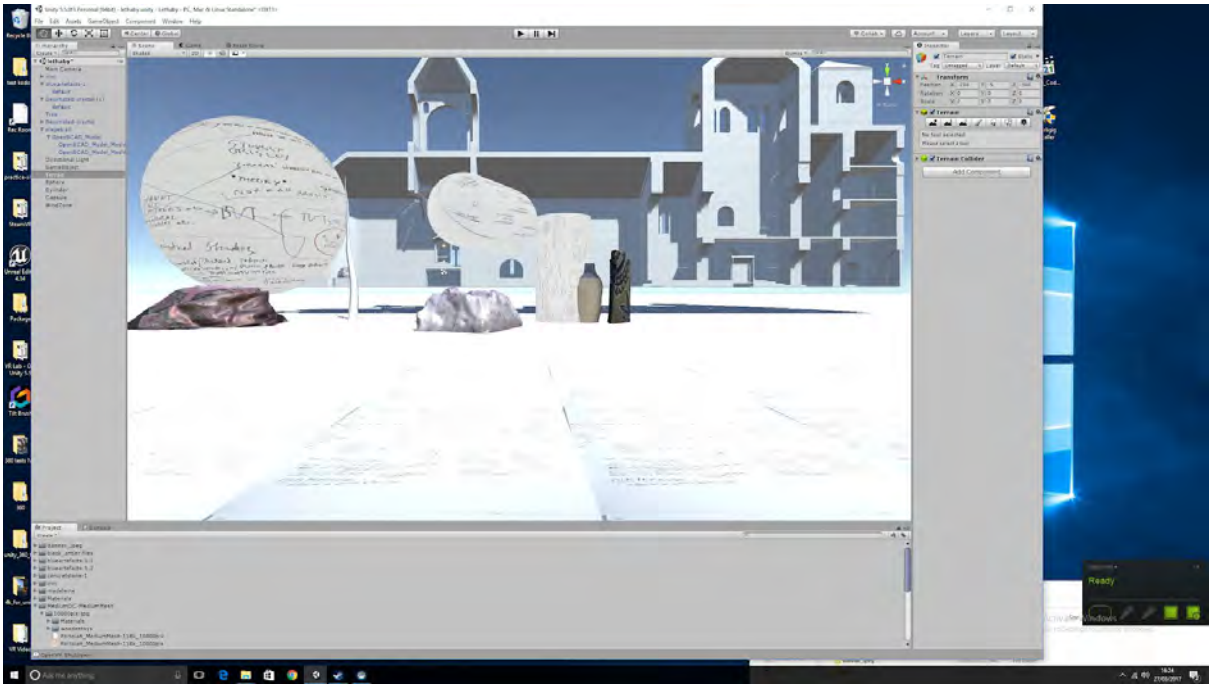


Figure 29: Recursive Assemblage (guest exhibits) Screengrab from Unity VR build, *Annihilation Event*, 2017 (Louisa Minkin, with permission)

As part of the *Digital Old Minster, the archaeology of a digital file* exhibit, we extended the assemblage, in collaboration with Louisa Minkin, by creating a virtual reality installation of the Old Minster (Figures 28 & 29). Visitors were allowed to deposit virtual objects within the VR Old Minster, thus creating a recursive exhibition space within the exhibit itself, which was of course also within the main exhibition space, and so producing a kind of Old Minster 'Tardis'[11], where space and scale were weirdly warped.

[11] The TARDIS is a cult British TV Sci-Fi time and space craft that appears much bigger inside compared to its outward appearance and possesses innumerable rooms, corridors and spaces within.

Along the Riverrun, ArtSway, Sway (24.07.17-30.07.17)

Curated by Alex Goulden and George Watson

Figure 30: *Old Minster, 2017* (Ian Dawson and Paul Reilly, Aluminium, fused filament 3D prints, digital picture frame, scouring pads, G-clamps, dimensions variable)

Our evolving assemblage was again reconfigured and augmented for the *Along the Riverrun* exhibition at ArtSway[12]. In *Old Minster, 2017* a version of the 'Minster Movie' is played through a tablet incorporated into this artwork, the looping guided tour endlessly returning to its opening frame. The tablet is laid horizontally, and the viewer needs to lean over to see the screen, but the screen has been partially occluded by a scouring pad, on top of which stands a plastic tree. This seemingly ecceletic assemblage recalls an 'archaeological site' prior to excavation; the stratigraphic sequence seemingly lifted whole from the trench and implicating an unseen void of the archaeologist's trench, pre-translation into very *mutable mobiles*.

[12] **http://www.iandawsonstudio.com/ian-dawson-along-the-riverrun.html**

Figure 31: *Old Minster, 2017 details* (Ian Dawson and Paul Reilly)

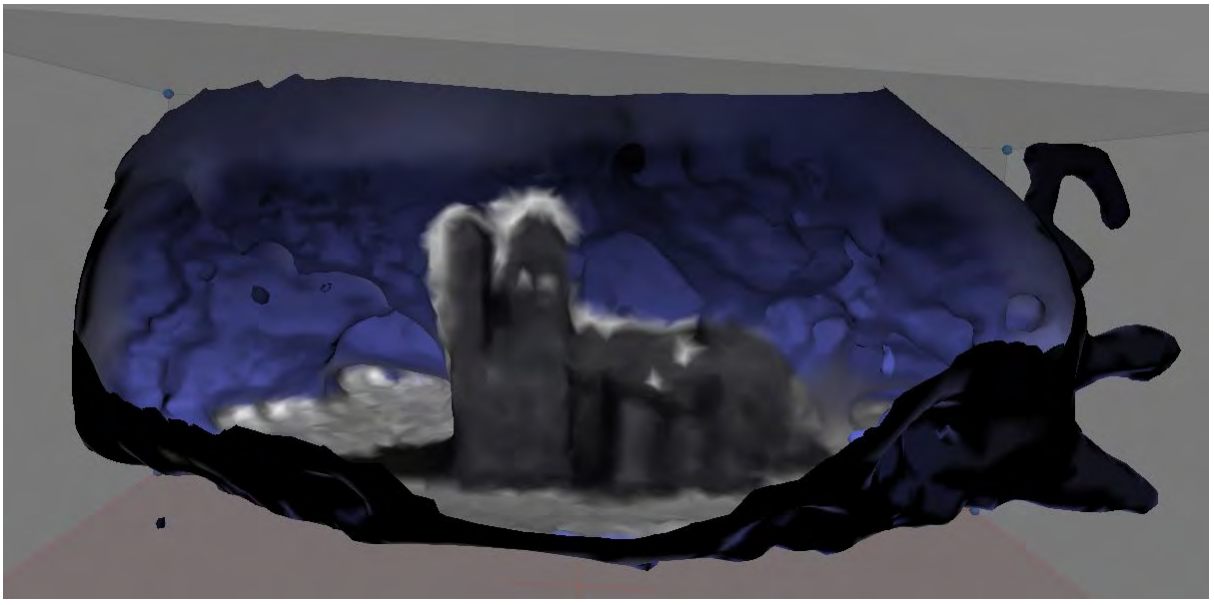
Groock's Gallery, Cyberspace (11.11.18-)

Curated by George Peter Thom

Our most recent collaboration is a cyberpunk piece of conceptual art on display in Groock's Gallery. This unique cloud-based VR gallery is housed in a converted digital temple, designed around an archetypal building (that is non-archeological), aimed at contemporary participatory mythological practice in cyberspace[13]. In this piece, titled *"Minster" - Obj with black tone* (Paul Reilly and Ian Dawson 2018), the phygital Old Minster has broken back in to the virtual once again.

[13] One portal into Groock's Gallery is: https://robotgroock.wordpress.com/groocks-gallery-free-entry/

Figure 32: *“Minster” - Obj with black tone* (Paul Reilly and Ian Dawson 2018)



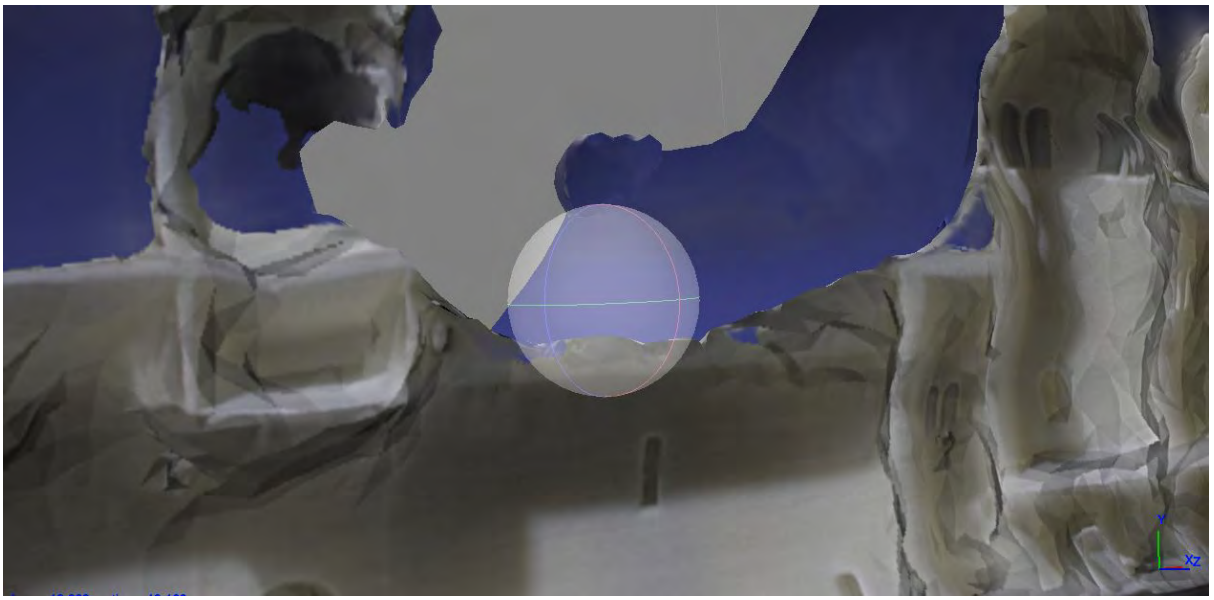


Figure 33: A recursive photogrammetric model reconstructed from meshlab screenshots of previous photogrammetric models

Provisional Reflections on a Messy Assemblage

In subverting the phygital nexus, our collage of (im)material art/archaeology has spread across the entire assembly versus disassembly grid of forces, with certain elements participating residually or recursively in several, sometimes overlapping, sub-assemblages where their ontological status is not necessarily settled (Figure 34).

Integral to this reflexive collaboration has been the re-imagination of the Saxon Old Minster of Winchester as it may have looked just before it was demolished in CE 1093. In principle, the geometric definition of any assemblage is immutable and may be retained in digital statis indefinitely. One such geometric hypothesis (the digital Old Minster) went into digital stasis in 1984 when the Old Minster was encoded, as it was then interpreted, in Constructive Solid Geometry modelling software. However, subsequent phygital recursions, and their residues, derived from this specific geometric hypothesis, may be significantly less persistent and more mutable when exposed to the forces of (re)materialization, dematerialization, colonization and dissipation. Crucially, *time* is required to activate this grid of forces. Without time there can be neither movement nor change. Without movement there can be no dislocations, no adjustments of perspective, and no shift in our thinking. Without change there is no entropy, no decay, no erosion, no exposure, and no possibility of serendipity.

The first materializations of the digital Old Minster were rather fleeting 8-bit VGA resolution static images rendered on specialist hardware, and more or less contained within research laboratories. However, when these digital images rematerialized on photographic film, using analogue cameras, they became somewhat more persistent and decidedly more mobile recursions. These images could now be shared as 35mm slides for projection presentations or as photographic illustrations in articles and posters. Later, further low-resolution recursions were concatenated and transformed into highly choreographed animations that could be transmitted to wider audiences. The introduction of apparent movement into the mix had the side effect of permeating the entire assemblage with time and duration. Time enables new types of relationships to emerge between actants. In particular it causes a

subtle, yet profound, shift in the relationship between the artist/archaeologist, the model, and the original prototypes. Adding time, or duration, and movement transforms the static geometric description of a space into an immersive and interactive place that can be explored, and challenges us to think more deeply about how this place might be used. With virtually no fanfare, the first new ontological portal cracked open, allowing a trickle of phygital colonists to emerge, encounter and adapt to new media. We started to think differently about, *and with*, these newly constructed relational assemblages.

It was the recursive potential of *open source* that was really the key to opening the floodgates for colonization of the phygital nexus, and exposing the colonists to new ontological possibilities. Applying modern standard off-the-shelf technologies to the transcoded prototype allows 24-bit, high-resolution and interactive screen-based and virtually immersive immaterial recursions, each offering added apparent movement perception and sophisticated lighting arrangements to enrich the experience. In addition, the same open source code can output physical 3D fabricated instantiations which lend additional modalities of exteroception, such as tactile comprehension, on top of the already familiar scopic discourses.

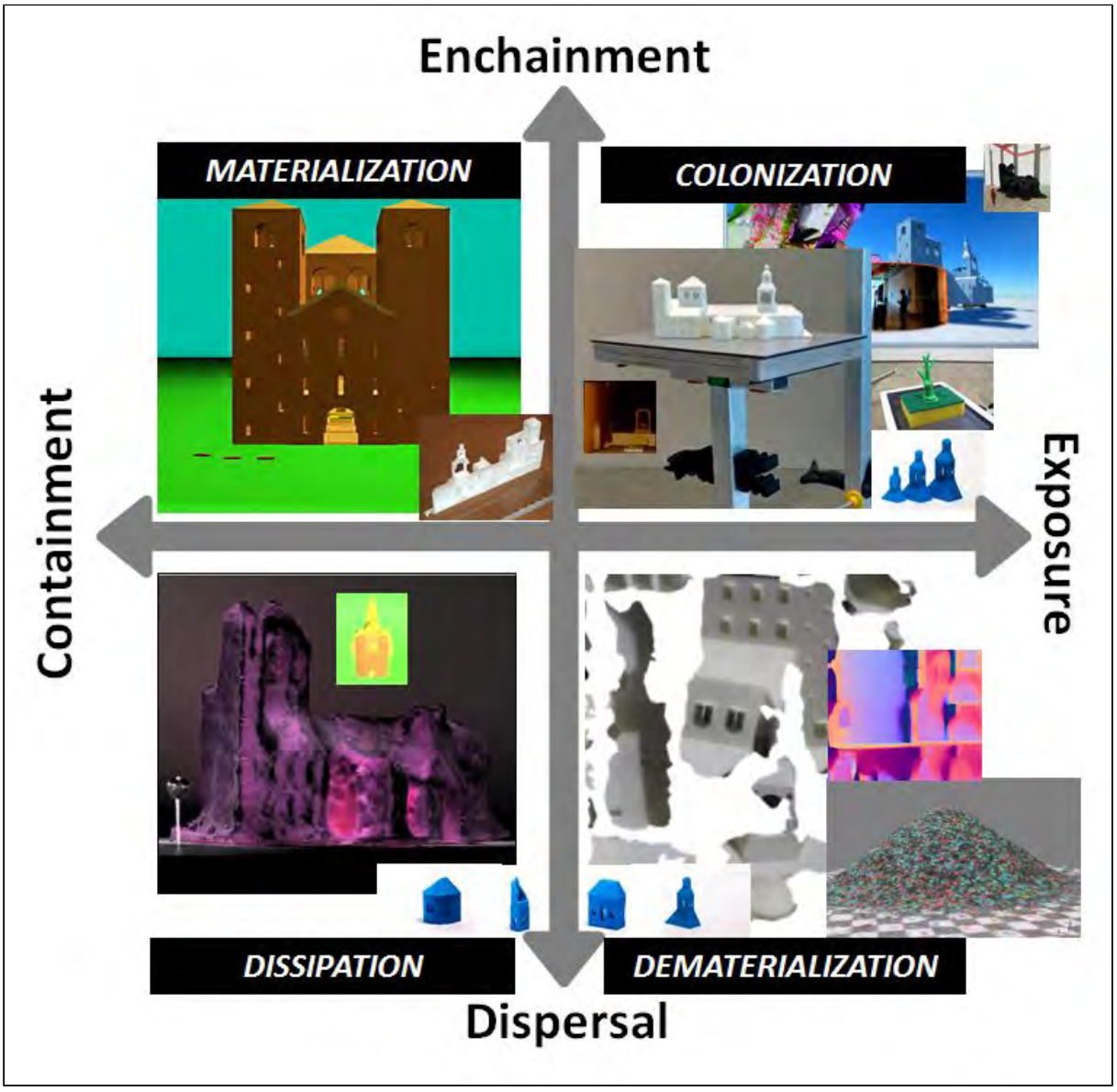


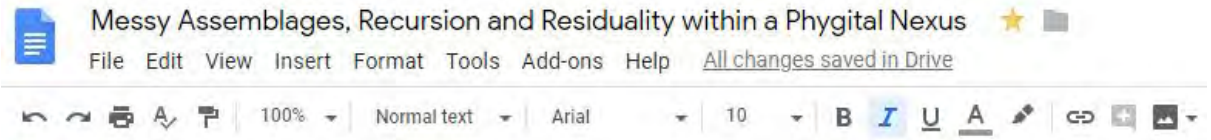
Figure 34: Extending messy ontological assemblage

What becomes obvious is that even apparently simple encounters with an instantiation of the phygital Old Minster can never be neutral. They are always complex, mediated, intra-active events. When these instantiations are combined and augmented, as in our featured art/archaeology works, new insights into, and paradoxes within, our practices are added to our extending ontological assemblage as their relational agencies are purposefully articulated and entwined. For example, the conformation of the phygital Old Minster can endure in near perfection in the materialization and colonization recursions we have produced so far. However, that geometric stability is radically compromised when the phygital Old Minster is permeated with time and exposed to the entropic forces of dissipation and dematerialization. Lossyness, digital decay and phygital erosion are a few of the prime protagonists of dissipation we encountered, lurking in the nexus, during this collaboration. For example, every time an instantiation of the phygital Old Minster is compressed or (re)encoded for a new media format, details of the model are progressively, but haphazardly, lost in each successive recursion. Similarly, significant and intriguing differences emerge each time the phygital Old Minster is transformed when a physical instantiation breaks back into the virtual and then returns into the physical world (e.g. photogrammetrically recording a 3D print and then reprinting a new recursion by recapturing the 3D print through another computational photography intervention). After only one or two cycles, the initial sharply defined edges and vertices of the digital Old Minster seem to melt as its geometry collapses into itself. In exceptional circumstances, even the software model is not entirely immutable and certainly not guaranteed immortality. It too can dissipate if, for example, it is deliberately hacked to produce phygital fragments and form hoards. Of course, the model can also be obliterated if deleted.

However, these fragments, if not contained, will tend to disperse and gradually become more exposed to the force of dematerialization. Once activated, the effects of dematerialisation in the phygital nexus can range from coarse and emphatic to subtle, deceptively beguiling and beautiful. The former is exemplified by the polymer spoil heaps and scaffolding left by the 3D printing process. The latter are encountered in, for example, the ephemeral UV fragments produced as a byproduct of the photogrammetry, and the surreal images that are created as the ‘surface’ of the phygital Old Minster is totally dematerialized and transformed into a virtual RTI assemblage of strikingly-coloured surface normals. In our featured exhibits, different ontological instantiations (recursions and residues) of the phygital Old Minster have been brought, purposefully, into constellation to confront us with this multiplicity of being, and expose the ontological ambiguities obtained through the plethora of different techniques, transformations and tropes we rely on in the course of our art/archaeology practices,

In conclusion, appearances can be very deceptive. Emerging out of our continuing collaboration is an extending, messy ontological assemblage, including. Within it, we include ontological mirages conjured out of algorithmic illusions, process-driven scale and shape shifters, chameleon-like skin changers, superficially simple material 3D prints, and ‘classic’ virtual animated tours; all recursions and residues. However, so far we have barely scratched its surface. This assemblage is not intended to, nor should it, be a static lasting comment on, or an inert record of, our collaboration with the (im)material entities with which we have begun to mix and mingle. Rather, it should be considered as an emerging, dynamic and intra-active conversation involving many actants, some yet to appear. The focus and meaning of this conversation is contingent on the shifting relationships of all actants which unfolds over time. These include our developing intentions as makers (both archaeologist

and artist), refracted through our distinct and combined practices, the materials we work with, the application of highly trained modes of perception and expression, and our instruments of inquiry and presentation. All are agential participants and co-producers in this collaboration. In the case of the RTIs, the signatures of all the main actants and their intra-actions have been auto-archived interstitially as aesthetic paradata within this entangled art/archaeology ontological assemblage.



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Research Article

Paul Reilly*, Ian Dawson

Track and Trace, and Other Collaborative Art/Archaeology Bubbles in the Phygital Pandemic

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Abstract: This paper describes our creative responses to a surface assemblage (a scatter) of lithic artefacts encountered on either side of a worn track across a field early on in the pandemic. Our art/archaeology response takes place within a phygital nexus in which artefacts or assemblages can be instantiated either physically or digitally, or both. In the nexus we create, connect and explore an ontological multiplicity of – more or less – physical and digital skeuomorphs and other more standard forms of records for sharing (i.e. Latour's immutable mobiles, such as photographs), but rendered with radically different properties and affordances, at different scales, with different apparatus. These include interactive Reflectance Transformation Images, graphical surface models, machine intelligence style transfer, and 3D prints, all of which were produced in a variety of isolated analytical "bubble" settings and transmitted to and from (both digitally and physically) a home office in an isolated Hampshire village and a home studio in a London suburb. Our approach is to describe, diffractively, the ontological shifts and itineraries associated with some of these objects and assess how this assemblage came to matter as an art/archaeology installation. Ultimately, some of these deterritorialised, (re)colourised, affective, biodegradable, and diffractively born metamorphic instars, now inscribed with new meanings, are returned to the original findspot of the lithics to be (re)discovered.

Keywords: 3D printing, art/archaeology, cognitive assemblages, diffraction, phygital

1 Introduction

In 1967, the later to be famous sculptor Richard Long hitch-hiked from his home in Bristol to his art school at St. Martins. In between hitches, he decided to retrace his steps repeatedly backwards and forwards until he had flattened the grass into a transient line across a field in Wiltshire. Before he left, he photographed his work (Renfrew, 2003, pp. 35, 36). A "gelatin silver print on paper and graphite on board" fixed this intervention within the "art object" now preserved in the Tate collections (Burgon, 2012). History doesn't record what Long was looking at as he tracked to and fro across that particular field tracing his line. Had any archaeologists happened across Long's ephemeral sculpture in the landscape, they would probably have paused to consider what it was and question how it came to be there, who made it, and for how long

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Figure 1: A line made by walking in Hampshire.

had it existed? Equally likely, they would have examined the ground on either side of the line to determine if the track had been cleared, like the Nazca lines, or indeed Long's later works, such as *A Line in Bolivia* (Renfrew, 2003, p. 32), or whether it was unintentional and just a by-product of the action of walkers. Actually, when Paul Reilly encountered a very similar line crossing a comparable field just over the county border in Hampshire in 2020, that was precisely what he did. Like Long, he also took a photograph (Figure 1).

Since the crop (corn/maize) in the field was still very sparse, and the world that day was paralysed by the COVID-19 pandemic, Reilly having few other distractions took the time to look very closely at everything along and either side of this beaten track. A distinctive banana-shaped stone caught his attention. Leaning down for a closer look, he encountered a beautiful knapped flint object whose form corresponded to what archaeologists would typically characterise as a mesolithic period "pick."

By chance, this encounter happened on the weekday on which aficionados of the Lithic Society often share tweets using the hashtag #FlintFriday. Friday mornings were also the regular slot for the authors and two other archaeological and fine art colleagues to meet up, virtually, and progress a volume on trans-disciplinary *Diffractive Images* we were co-editing (Dawson, Jones, Minkin, & Reilly, forthcoming). During our wide ranging discussions, we had already touched upon how lithic artefacts were presented in art. For example, the left-hand panel of the *Melun Diptych*, by French court painter Jean Fouquet (c.1452), depicts *Etienne Chevalier with St. Stephen* with oils painted on oak in the Northern Renaissance style. The patron saint is bearing what looks distinctly like a patinated flint core (Dawson & Minkin, 2019, pp. 234–235). Inspired by this early juxtaposition of art and archaeology, the present authors agreed to develop this encounter in the cornfield and further explore, diffractively, the materiality and temporality of this particular assemblage as an *art/archaeology* collaborative project. Art/archaeology, as conceived by Doug Bailey (Bailey, 2014, 2017a, 2017b), aims to *disarticulate, repurpose, and disrupt* "artefacts from their pasts and to release them into the contested dynamics of the present, through the making of new creative works, not traditionally seen as historic or archaeological in form, display or intention" (Bailey, 2017b, p. 700). Importantly, "[r]ather than producing institutionally safe narratives conventionally certified as truth, archaeologists should follow the lead of artists who use the past as a source of materials to be reconfigured in new ways to help people see in new ways" (ibid, p. 691). Here we include archaeologists trying "to

challenge their own practice-based research *creatively*" (Thomas et al., 2017, p. 121 original emphasis) or, put another way, those applying their creative imagination (e.g. Gheorghiu & Barth, 2019; Gheorghiu, 2020). Our challenge would be to overcome the impact of the pandemic and turn it into a positive stimulus to generate creative new art/archaeology assemblages, practices, and insights.

2 Pandemic Problems in a Phygital Nexus

When the 2020 Coronavirus lockdowns hit, like everyone else, our everyday lives and work activities were dislocated dramatically. "Track and Trace," besides being an allusion to the trodden path across the field, is a term that can be applied to the category of programmes aimed at testing for contagions and the subsequent contact tracing operations to quarantine potentially infectious individuals or clusters. In the UK, "bubbles" were introduced to strictly limit social contact and help reduce transmission of the coronavirus. Defined categories of people (e.g. single parent families, senior citizens, and special needs individuals) were permitted to "bubble up" in small, tightly defined, social groups to alleviate the effects of lengthy social isolation. The impact of social distancing policies for most of the population was profound and lengthy. Social isolation did not simply entail remote working for more than a year, it also suspended access to key equipment housed in our departments; apparatus that we normally relied on to help progress our transdisciplinary art/archaeology research project exploring the affordances of something previously described as a *phygital nexus* (Gant & Reilly, 2018). Phygital is a neologism which refers to an increasingly apparent universe in which *phy*sical and di*gital* artefacts intersect one another, holding out the promise of substantive new ways to (re) consider the materiality and ontology of objects (Ingold, 2012). We conceive of this nexus "as a no-place and an everyplace in which the boundaries between what is physical and what is virtual are blurred, where digitally defined objects. are susceptible to transmutations and may be (re) deposited within multiple parallel or intersecting physical and digital assemblages (e.g. Reinhard, 2019), and are able to "jump" almost anywhere in our digitally hyper-connected universe. In addition, phygital objects can be invoked, instantiated and brought into constellation with other practices and entities both physical and virtual, and "messy" [ontological] assemblages can, and do, emerge from these interventions. Phygital transformations, moreover, may be multi-directional: digital objects can become physical and, conversely, material instantiations can be virtualised (Dawson & Reilly, 2019). In short, assemblages in the phygital nexus are not only physically, digitally, spatially, and temporally itinerant, they are also ontologically itinerant as objects mutate and glitch in accelerated transformations as they move through physical, digital, and hybrid realms (Opitz, 2019; Reilly, 2015b).

To continue our long running collaboration (Callery, Dawson & Reilly, forthcoming; Dawson & Reilly, 2019) under the severe restrictions imposed to curtail the pandemic required us to discover expedient substitutes for key elements of apparatus no longer at hand and then develop novel remote collaboration workflows across our depleted phygital nexus. The most productively problematic aspect of this project was that only Reilly had "met" and maintained direct physical contact with the lithic assemblage at the core of this project. Initially, Dawson could only watch and listen to Reilly handling, gesturing, and describing the artefacts via Microsoft *Team* sessions. To enable meaningful collaborative work on this lithic assemblage, it first had to be ingested into our phygital nexus so that we could share and develop our practice-based insights and *phygital acts of discovery*. We pick up on Matt Edgeworth's insight that in the shift from fieldwork to screenwork it "is clear that a general rethinking of archaeological discovery is necessary, taking due account of computers and the Internet as intrinsic elements of the mixture of human and nonhuman flows, forces and materials that together make up contemporary archaeological assemblages and encounters" (Edgeworth, 2014, p. 51) and extend it into our art/archaeology phygital nexus. Within this nexus, we adopt an "agential realist" perspective, and our point of departure is Karen Barad's (2007, p. 210) key insight: "Matter is substance in its intra-active becoming – not a thing, but a doing, a congealing of agency. Matter is a stabilizing and destabilizing process of iterative intra-activity."

To be clear at the outset, our project does not attempt to offer any kind of autoethnography or reflect on our working practices through the critical filters of Science and Technology Studies (STS). While such

approaches clearly have merit, we consciously try to eschew fixing our outputs as translations (Lucas, 2012; Olsen, Shanks, Webmoor, & Witmore, 2012) into immutable mobiles (Latour, 1987), which might stabilise our practices in standardised hinterlands of method assemblages (Law, 2004), or the values embedded in the socio-technological infrastructures (e.g. Bowker & Star, 1999) associated with our phygital nexus. We certainly acknowledge that our approach has parallels to Suchman's (2012) trope of (re)configuration. However, our focus, intent, and approach are fundamentally different. In this art/archaeology paper, we are not taking congealed socio-technical relations and reenacting them differently, we are actively disarticulating and *diffracting* our archaeological and artistic practices and images, subsuming our quotidian methods, techniques, tools, and apparatus, and rearticulating and repurposing them as *art/archaeology*-imbued stepping stones to enable us to step, as it were, outside the bubble of our own and our apparatus's cognitive faculties. Where these stepping stones lead is not yet clear. They are, however, significant points of departure. Perhaps, we should be more apprehensive. Regardless, the notion of a bubble allows us to apprehend a scene from both inside and outside, and to look away (Derrida, 1993), thus bursting the boundaries of what can be apprehended. Bubbles of various kinds emerge throughout this paper because we see in them much generative potential. Be they physical, digital, phygital, social, disciplinary, theoretical, technological, metaphorical, or allegorical, bubbles can separate and isolate, as well as bound and interface between things, all at the same time. Bubbles can also exist inside other bubbles. They can be beautifully parametric, or fascinatingly irregular. They can also be light and flexible, hard and durable, transparent, translucent, or opaque. They exist in both inorganic and organic realms. Eggs and cocoons are particularly inspiring examples of nascent bubbles of becoming. Cocoons are special kinds of bubbles, being places for both refuge, regeneration, and *metamorphosis*, that is safe environments for spontaneous and amazing transformation (Ingold, 2020). Bubbles are also diffractive objects and a form of lens. Our approach is to describe, diffractively, our subversive transdisciplinary experiments within, and through, our bubbles of creative digital practice and the consequent ontological shifts and itineraries associated with our lithic objects, and then assess how this extended assemblage came to matter as an art/archaeology installation.

Despite an impaired and imperfect phygital nexus, artefacts or assemblages can still be instantiated either physically or digitally, or both, radically transformed. Indeed, phygital objects can be changed back and forth from one materiality to many potential others. Within our nexus, we create, connect, and explore an ontological multiplicity of – more or less – physical and digital skeuomorphs and other more, but generally less, standard forms of records for sharing such as photographs, at different scales, with different apparatus. These include interactive 360° spherical panoramas, 3D Structure from Motion (SfM) graphical surface models, Reflectance Transformation Images (RTIs), and 3D prints which were produced in, and transmitted to and from (both digitally and physically), a home office in an isolated Hampshire village and a home studio in a London suburb.

3 Phygital Acts of Discovery and (Dis)location

Returning to the initial "act of discovery" (see Edgeworth, 2003), the flint artefact by the path crossing that chalkland field was photographed in situ. An interesting moment of diffraction began to unfold around the geometry and material (silica) of the glass lens of the camera, which is both perfectly symmetrical and materially an amorphous solid and the isomorphic cryptocrystalline lithic, which is scarred and asymmetrical, in their chalk and corn setting. Reilly made a 360° panoramic mosaic of overlapping photographs using Google's *Street View* app to produce an interactive spherical panoramic photograph. Unlike a conventional photograph, which locks the subject within the tight constraints of the enfolding rectilinear frame, the spherical panorama enables the cyborg viewer to look both "inwards" at the lithic subject, but also "outwards," situating the artefact in the context of a wider landscape. Land, sky, and artefact are digitally meshed together. Strangely, as in traditional archaeological photography (inter alia, Bohrer, 2011; Conlon, 1973; McFadyen & Hicks, 2019; Morgan, 2016; Shanks, 1997; Shanks & Svabo, 2013), in this form of "bubble vision" (Steyerl, 2018) the photographer has been dislocated and anonymised, an absence

Figure 2: Unwrapped 360° panoramic photo of a flint tool encounter in a Hampshire field.

presence in the centre of this empty orb. That aside, this spherical panorama provides more spatial context about the findspot than a conventional photograph, and the interactive viewer in *Street View* affords users semi-autonomous capabilities of rotation, pan, and zoom around these digitally painted bubbles. But like all interactive media exploration, it is limited not only by the sophistication of the technology, but also by the functional literacy of the would-be explorer using it (e.g. Smith, Beale, & Opitz, forthcoming). Visitors who find themselves disembodied in the middle of this spinning spherical panorama are still securely locked down in a particular spot within a very thin slice of time, in limbo, that was initially determined and framed by Reilly, who thereby inadvertently created another set of "social bubble" restrictions in the context of the pandemic.

The unwrapped and flattened compilation of the spherical photogrammetry shown in Figure 2 is suitable for 2D printing, but is at best only a halfway house between the interactive 360° panorama and a conventional flat photograph. The "view" is much more constrained as the viewers' ability to explore it is reduced to panning across, and zooming into, the warped image.

3.1 A Material Incursion

After being digitally dislocated, Reilly once again reengaged physically with the material artefacts there in the cornfield. After millennia of the combined elemental effects of earth, water, wind, and fire, this pick still persisted and had developed a wonderfully lustrous amber-like patina. Form and substance afford different perceptions of an artefact. This object when picked up had none of the warmth and lightness of amber that a

Figure 3: Mesolithic "pick," 140 mm × 65 mm, 300 g, flint (Anonymous, c. 10000–4000 BCE).

superficial haptic gaze might suggest, nor did it offer any olfactory hint of resin. At the first touch it felt hard, cold, and dense. The only smell belonged to the soil that still clung on. Proprioceptors in the hand, wrist, forearm, and elbow pushed to the fore of perception as ocular impressions were recalibrated. This asymmetric, weighty, but well-balanced, lithic artefact "fitted" perfectly into the grasp of Reilly's right hand. More material qualities asserted themselves: the remaining pitted cortex *feels* to be deliberately left in place to provide slightly rough textured gripping pads for fingertip and thumb holds. None of the hard, sharp, and potentially slippery elements need make contact with the grasping hand (Figure 3). When the artefact was measured, it was 140 mm long by 65 mm wide and weighed 300 g. It has a lot more presence than simple bald statements of facts can convey.

Walking to and fro along the path that Friday led to several other lithic objects conventionally dating back to somewhere in the mesolithic period (c.10000–4000 BCE). It soon became apparent that although they are all made from flint nodules and exhibit much in common stylistically, no two are the same. Each member of this scatter assemblage presents a unique, materially specific narrative of making which has been determined as much by the affordances of the materials of the nodules and hammer stones as the hands of the makers. No obvious indications of how any of these lithics came to be scattered across this field are discernable. Unstratified, and adrift in time, their relative order of coming to this place is indeterminate, but there, basking in the sun, they had become contemporaries and to some extent co-located. As mobile network coverage in this part of the world is patchy and unreliable, this spread of lithics was loosely pinned down using the *what3words* location platform. Eerily, the W3W application seems to have noted the crop and assigned a very apt triplet for one group of neighbouring lithics (i.e. https://w3w.co/overruns.cornfield.send).

The next step was to enable and extend the assemblage for collaboration. This involved, initially, washing the lithics and then subjecting each artefact to two standard but complimentary archaeological computer photography practices, both in a somewhat ad hoc manner: Reflectance Transformation Imaging (RTI) and photogrammetric SfM. As with the *Street View* 360° photo spheres, both these techniques rely on the creation of virtual photographic bubbles to enframe the subject. Here too, the hands and eyes of the photographer are hidden behind the lens, and like any other photographic technique, digital or analogue, they carry with them "genealogies of practices of looking and recording" (Jones & Díaz-Guardamino, 2019, p. 211) that are "neither neutral nor objective" (Cochrane, 2018, p. 182) and are applied deliberately for a

purpose. They are "volatile images" (Beale, 2018) being deliberately articulated and repurposed; in this case, in such a way as to facilitate the exploration of novel aspects of the materiality and temporality of this assemblage. Once again, viewers are given semi-autonomous capabilities to interact with the digital artefacts.

Several forms of RTI are commonly used by archaeologists, artists, and curators in museums and galleries, namely dome-, highlight-, multispectral-, micro-, and underwater- RTI (inter alia Back Danielsson & Jones, 2020; Clarricoates & Kotoula, 2019; Earl, Martinez, & Malzbender, 2010; Historic England, 2018; Jones & Díaz-Guardamino, 2019; Malzbender, Gelb, & Wolters, 2001; Mudge et al., 2005; Selmo et al., 2017). They all share in common a basic studio format in which both the camera and the subject are held rigid and multiple photographs are taken, each one with the light source in a different position, but equidistant from the subject; in other words, underneath a virtual hemisphere of lights.

In this half-bubble, the artefacts are completely disconnected and de-territorialised from the contexts from which they originally emerged, and then rearticulated, retemporalised, and fixed within a controlled, synthetic, negative space illuminated by flickering lights that produce meaning-making highlights and shadows. The arrangement is very similar to that described in Plato's allegory of the cave (c.375 BCE) in which he describes prisoners having their heads fixed so that they see only the shadows deliberately cast on the cave wall by the gaolers in order to manipulate their (mis)perception of some external reality. In both cases, the viewpoint is crucial for drawing meaning from what is being revealed (see also Jones, 2020, p. 90). In the case of RTI, however, the flickering lights and shadows are synthesised to produce a digital skeuomorph, using an extremely precise description of the subject's geometry, which can be interactively relit, and its surface properties manipulated. These facilities can dramatically enhance the viewer's perception of the object they are trying to get to know better and perhaps collaborate with, as opposed to creating dystopian illusions. Perhaps Plato might have approved.

With access to institutional imaging equipment impossible, an improvised highlight RTI (H-RTI) rig was put together using equipment and substitutes available to hand: the tripod for the camera is a plant stand with wire supports tied on; the strobe was replaced by a bicycle lamp; the vital reflective sphere, or bubble, without which the subject's geometry cannot be extracted, was a christmas tree bauble; the camera was set up to take 50 photographs at 2 s intervals.

Makeshift H-RTI shoots were performed in a nighttime darkened home office (Figure 4). The images were then ingested into the *RTI Builder* which is available free from Cultural Heritage Imaging (http://culturalheritageimaging.org/Technologies/RTI/) and compiled using the highlight-based PTM (polynomial texture map) fitter option. In practice, this means that the reflective bubble in the images is located by the user, then the software takes over and automatically detects the position of the bubble's highlights for every

Figure 4: Nighttime shoot with improvised H-RTI rig.

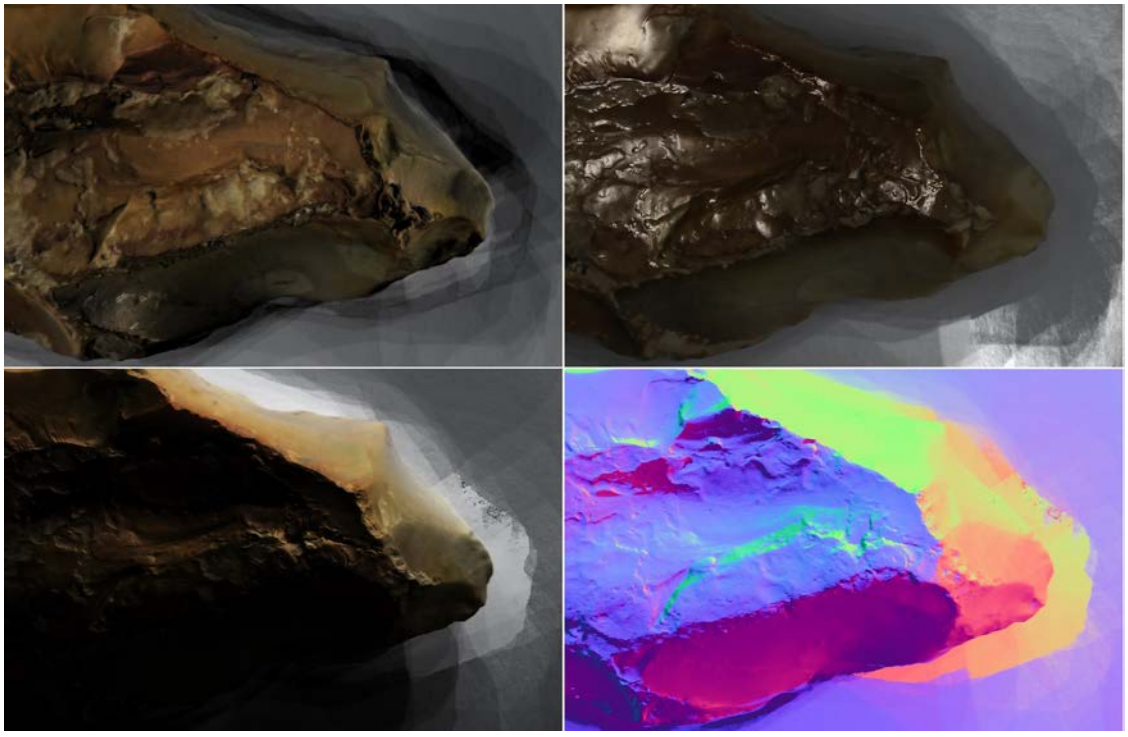

Figure 5: Example render modes of same part of pick.

image. The lighting information from all these images is then synthesised into a mathematical model of the subject's shape and colour properties which are encoded in such a way that each constituent pixel displaying the compiled RTI will accurately model how light behaves at the specific point of the surface it is depicting. Users of the *RTI Viewer* software can interactively re-light, zoom-in, and pan across their models and analyse it, albeit from a fixed viewpoint, in extremely intimate detail. Researchers are also endowed with superficial alchemical powers of transmutation. The material properties of the object's surface can be transformed at the drop of a menu because this application also has adjustable "rendering modes" which enable users to change the displayed surface properties instantaneously to be, for example, more diffuse or more specular (e.g. Figure 5). Some types of marks which would normally be missed, unnoticed by the naked eye on, for example, a bland, rough stone surface can leap out when that speck of geometry they occupy is rendered chiaroscuro-like as a smooth metallic material, enlarged, and dynamically lit from many oblique angles. These functions radically enhance the capabilities of the researcher who, for instance, could unpick much more easily and efficiently the operational sequence of each blow that shaped this artefact's becoming. Eyebrows were raised when RTI analysis of the Folkton drums, already well-known to research, revealed evidence for previously unrecorded motifs, erasure, and reworking. These objects were shown to be palimpsests and not decorated according to a single, preordained scheme, but were successively carved and recarved over time (Jones et al., 2015; Minkin, 2017).

Artist Simon Hitchens has developed a contrasting approach of intraacting with portable lithic objects, light, time, duration, shadows, his pen, and the marks they all engender. He ignores all visual surface details of the silica rock (chert) he is studying and instead records the subtleties of its three-dimensional form using its imprint on time. He does this by tracing the fluid outline of the shadow of the rock due to sunlight as it drifts and morphs at intervals from sunrise to sunset (e.g. Hitchens, 2015). In the finished work, the footprint of the rock in the landscape emerges as a blank silhouette enmeshed by the superimposed, orderly, and penned progression of "shadow lines." The results are surprising, beautiful, and coherent; time, temporal order and duration have been harnessed to help create a new understanding of the rock. In the *RTI Viewer*, however, time does not obey the rules of linear temporal order. Indeed, both may

Figure 6: Temporal diffraction pattern and mesolithic pick in H-RTI frame.

become plastic and pliable and, if handled in certain ways, turn brittle and friable, and time's bubble will burst.

Consider the static frame from a compiled H-RTI of our mesolithic pick using the default settings in the RTI Viewer interface shown in Figure 6. Notice the fringe of interlaced shadows surrounding our lithic subject. This is an example of what physicists call a diffraction or interference pattern. Specifically, it is a temporal diffraction pattern in which "different times bleed through one another" (see Barad, 2017, p. 68). It is created by peaks and troughs of waves of light and shadow overlapping and either reinforcing (brightening or darkening) or cancelling out one another. Light, darkness, and time seem to travel hand in hand. We normally experience these waves of light in linear flows such as those laid out in Hitchen's haunting meditations on duration and transience. In the *RTI Viewer*, however, the ribbon of time has been unpicked, cut into fragments, and can be shaken up like the particles in a snow globe. How can that be, given that the skeuomorphic green bubble provides apparently smooth navigation around the subject? Click the cursor on any point on this bubble and the world is refreshed to show what the subject looked like when the light source was pointed at it from that direction. Skim the cursor across the navigation bubble in any direction and the lighting on the subject is dynamically adjusted to match those lighting points, causing the shadows and highlights to swirl and slide around as this particular hand ballet unfolds. Time, however, is stumbling about this space, hopping to and fro. Its once well-beaten track has become an erratic dotted line, a quantum ellipsis of superpositions.

4 SfM Photogrammetry Bubble

The RTIs were created as the lunar bubble waxed and waned. Photogrammetry followed in the daylight hours in another makeshift studio, this time in the garden to obtain the best lighting conditions. Each artefact was fixed in place to the top of a conveniently high step ladder using bluetack and photographed in the round (i.e. yet another bubble scene of overlapping images). As with the RTI project, these images were shared via the internet in order that Dawson might get a better handle on the assemblage and respond to it creatively. His first response was to process the photogrammetry using Agisoft *Metashape* software and build interactive SfM 3D models (e.g. Figure 7).

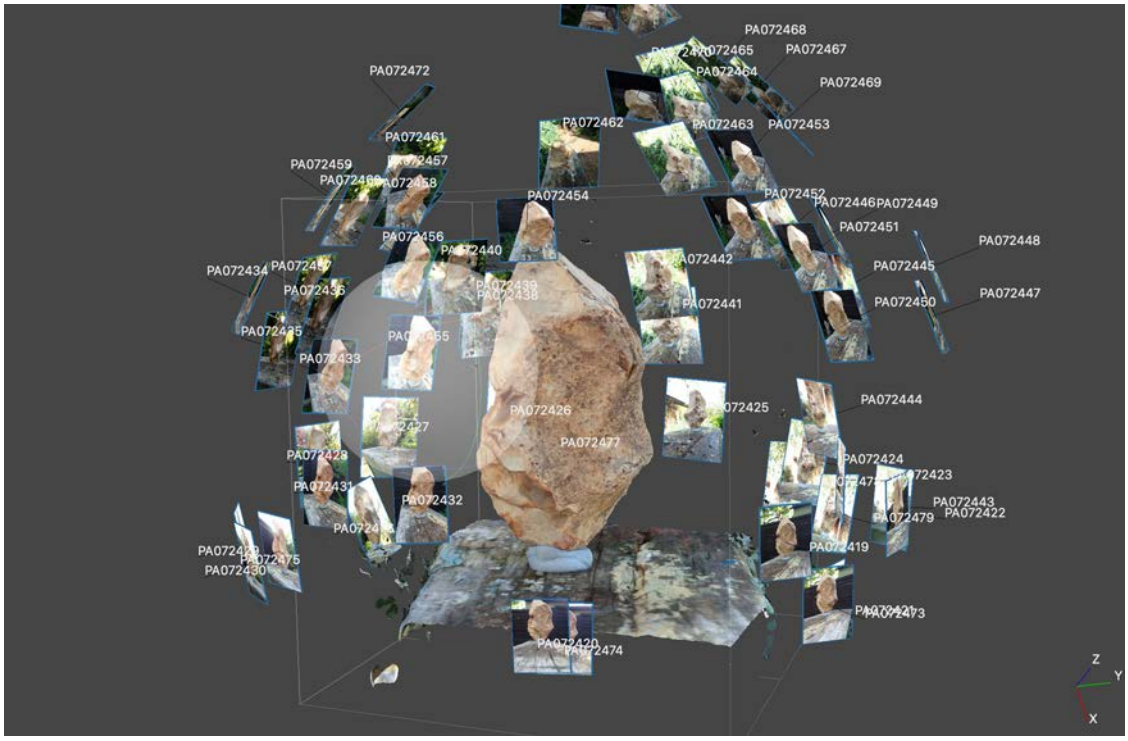

Figure 7: Screenshot of SfM Mesh bubble with axes.

He outputs stereolithographic (STL) files to create experimental 3D prints which are colourful and challenging material reconceptions derived from the digital artefacts and reinscribed with new latent meanings arising from practices of renewal, transformation, and repurposing. The printer refixing fractured moments in its unrelenting linear oozing of duration.

5 Isolated in the Pandemic: Track and Trace

"Bubbles," "isolation," and "track and trace" are three prominent features of the pandemic landscape. A handful of key factors tie these features together, namely location, setting, time, and duration. These very same factors are central to our collaborative explorations of the lithic scatter. How things come together and interact in particular space and time, and for how long, matters. The application of RTI (Historic England, 2018) and the SfM photogrammetry (Historic England, 2017) gave us important insights into the multivalent temporality of the scatter assemblage, the topology of the individual objects, and their superficial materiality.

While Dawson was building out and exploring the plasticity of SfM photogrammetry in plastics, Reilly was fascinated by the temporal diffraction patterns revealed by the RTIs. In parallel, he was increasingly interested in the diffractive possibilities of the popular computer vision technique of image "style transfer" which relies on sophisticated "neural algorithms of artistic style" (Gatys, Ecker, & Bethge, 2016) using a very deep convolved neural network (Simonyan & Zisserman, 2015) to extract the style of one image and transfer it onto the content of another (for a full treatment on style transfer see Miller, 2019, chapters 7–12). In other words, it produces another form of diffractive image that interlaces different styles and different subjects through a machinic way of seeing (e.g. Graham, 2019).

We began to explore how different times, materials, and places could be diffracted through this assemblage, and one another, using this technique. Our point of departure was the mesolithic pick we introduced at the beginning of this paper (Figures 3–6). Our "content image" is a frame from our compiled RTI, in

Figure 8: #FlintFriday – Silica Alchemy IV, 2020.

which the fringe of normally unremarked upon interlaced shadows is also a temporal diffraction pattern. The first material property we wanted to diffract with the RTI of the flint and its accompanying diffraction artefacts was stained glass. Inspired by Dawson's flamboyant 3D-printed confections (see below), an image of a colourful stained glass panel was used to define the style.

One outcome of this experiment is *#FlintFriday – Silica Alchemy IV* (Figure 8), which is quite a departure from standard, but nevertheless very sophisticated, representations of lithic objects (e.g. Lord, 1993 Raczynski-Henk, 2017; van Gijn, 2010). This is one of a series of diffractive digital studies exploring the recursive intra-action of light, shadows, silica, and (artificial)neurons (Reilly, 2020). In this study, the archaeologist's analytical gaze upon the impact scars that shaped the flint tool is radically interrupted

Figure 9: *Trace and Trace I*, 2020 (Diffractive Image – style transfer QR w3w location code and flint RTI).

Figure 10: *Track & Trace II*, 2020 (Diffractive Image – style transfer location setting satellite landscape image and detailed flint RTI).

midway through the process of capturing its RTI portrait, and then subject to the machinic gaze of the *style transfer* deep neural network, before being rendered as another kind of diffractive image in which the RTI multi-lit flint artefact and its compound shadows are seemingly transmuted into backlit stained glass (Figure 8).

The QR-code has become a zeitgeist of the pandemic, capturing as it does those key factors of ontology, time, location, and place. A QR code is a machine readable optical label that can describe to which it is attached. In *Track and Trace I* (Figure 9), the pick's findspot has been rendered as QR code using its unique *what3words* location triplet, which was then style transferred onto the same compiled RTI image used in *Track and Trace I* (Figure 9).

Lastly, for this set of *recursively* diffractive images, a satellite image showing the neighbourhood and setting of our lithic assemblage's findspot was interlaced with our, by now, signature RTI content image (Figure 10). What emerges looks like an island microcosm of the chalk downlands set in a shallow sea, the "pick" once again isolated, set adrift in time, and lapped by temporal ripples. This novel form of diffraction also interlaces dramatically different viewpoints of both the artefact and its setting simultaneously from a *great distance* and in *close detail*. Figure 9 and 10 are examples of what Zylinska (2017) calls "nonhuman photography" in her book of the same name. Nonhuman photographs are not *of*, *by*, or *for* humans (Zylinska, 2017, p. 5 original emphasis). This is not to say that these images are unthought or mindless artefacts, somehow artless, nor that humans have no part in their making. As Zylinska argues, all images will embody both human and nonhuman elements. Figure 9 and 10 are also examples of what Zylinska (2020, pp. 109–111) calls "undigital photographs." They display dramatic artistic changes to the original computational images made after they were originally taken by both human and artificial intelligences.

Perhaps, it was our own sense of isolation during the lockdowns, but we became acutely conscious that this archaeological assemblage had been physically separated from the landscape from which it had emerged. The 360° panoramic bubble photographs and the diffractive style transfer pieces were an attempt to bridge this rift and to place them back, if only virtually, in an appropriate place and moment of re(dis) covery. However, while these images are rich in meaning, perhaps even provocative, and may even imbue a certain sense of their place in the landscape, that landscape was now bereft of the flint scatter. We therefore wanted to physically reconnect the newly inscribed assemblage with the landscape, setting, time, and materials from which it had emerged. Our next experiments involved further (im)material diffractions with time, and then artefacts with place.

6 Diffracting Materials, Scale, Time, and Place

The initial act of discovery of these flint artefacts happened in a cornfield with a track across it, on the chalkland landscape known as the "downs," in Hampshire, UK. Chalk is the progenitor of silica, flint, chert, glass, and so also our lithics and our camera lenses. Chalk is an ostentatious medium in its own right, beloved by builders, geologists, fossil hunters, sculptors, teachers, and mathematicians. This substance calls to be (re)shaped and invites lively movement and thought. It is the didactic material, par excellence, which has encouraged the development of countless ephemeral tracks across blackboards around the world for generations. Mathematicians are particularly indebted to it. As Barany and MacKenzie (2014, p. 115) explain: "The consequences of chalk for mathematics are not just practical but ontological and epistemological [as] arguments are enacted and validated through their performative unfolding – an unfolding as absent from circulable mathematical texts as it is essential to the production and intelligibility of their arguments."

Above the chalk is our field, the corn emerges, heading straight upwards in a hurry, from the crumbley, grey, alkaline soil, pushing aside flint nodules and lithic artefacts on the surface, and is aligned in arrow-straight green dotted lines. The lines of corn form nearly orthogonal axes with the line of beaten track and the chalk bedrock below, and so now something else has to be added to our unfolding assemblage. Corn is central to Dawson's practice. It is the raw material for many of his most recent works which involve experimental 3D-printed components.

For decades, additive manufacturing has enabled fabrication using many different, and multiple combinations of, materials. However, it has only been in the last few years that 3D-printing has become popular in art and archaeology (e.g. Eve, 2018; Reilly, 2015a, 2015b). The 3D-printed works developed in Dawson's *plastic studio* are based on polylactic acid (PLA), a biodegradable polyester derived from corn starch. The base of lactic acid is produced in our bodies during exercise as carbohydrates produce it as a by-product (it's what makes your arms ache if you have been knapping flints vigorously for an extended period, and similarly your legs after a long run). The same fermentation occurs on an industrial scale with homofermentative methods of production. PLA is biocompatible with the human body. It may be implanted as biodegradable support structures inside substitute body parts. It can also be ingested orally, accompanied by a characteristic sour taste, with for example sourdough and homebrews. Externally, the cosmetics industry lathers our skin with it. Without question, PLA is an incredibly vibrant material. Dawson tries to respond intuitively to the material while working from a position of unfamiliarity, the act of discovery still the bedrock of his practice (Dawson, 2012, p. 9). In an increasingly phygital age, he has been extending his methods of creation from the physical and into the digital.

Seeking to address correspondences between materiality, imaging, digital, and physical discussions, even the material properties of plastic should be considered with their long chains of polymers. The material itself is chemically refractive. To be more precise, lactic acid has a particular optical rotation which is birefractive, meaning that a ray of light passing through it will be split into two rays with diverging paths. This is chemically possible because lactic acid has a particular geometric property it has in common with DNA and amino acids: it is a form of chiral molecule, which means that – as with several of our flint artefacts – it has an asymmetric structure that cannot be superimposed on its mirror image by any combination of rotations and translations. Like human hands, such molecules exist in stereo; related to one another by reflection. Each of its left-handed and right-handed molecules will have a single carbon molecule at its stereogenic centre (a molecular fixed point). They are almost the same, but have a different arrangement of atoms in space and are considered optically active on a chemical level. In other words, the material that feeds the 3D printer to draw thousands of superimposed images, in layers upon a print bed, to be worked and reworked within Dawson's studio, and later (re)captured through RTI, can itself be described as optically active, and like some lithic artefacts, it exhibits handedness.

Figures 11 and 12 are frames of a compiled H-RTI of a Dawson sculpture using different rendering modes. In Figure 12, strands of plastic are being explored in the same way as the worked surfaces of flint tools or chalk drums by exploiting RTI capabilities to affect light across a material surface in order to discover layers of plastics, making and meaning. These two images raise a question: what correspondences

Figure 11: RTI of PLA Assemblage.

Figure 12: Detail of PLA Assemblage RTI.

exist between gestures, materialities, and geometry and the images that emerge through their intimate encounters?

Now it was Reilly's turn to watch Dawson handling his reinterpretations of the lithic artefacts from the cornfield in his biodegradable "plastic studio." There had been issues connected with the affordances of the printers and the printing medium, in that they have to be printed in such a way as to assemble correctly and efficiently (both in terms of labour, energy, and material consumption). All of the above could be implicated in Benjamin's (1936 [1968]) famous injunction concerning "mechanical reproduction." Although these objects could have been reproduced as identical 3D-printed facsimiles, in fact, like their lithic prototypes,

Figure 13: Mesolithic pick with dazzle diffraction.

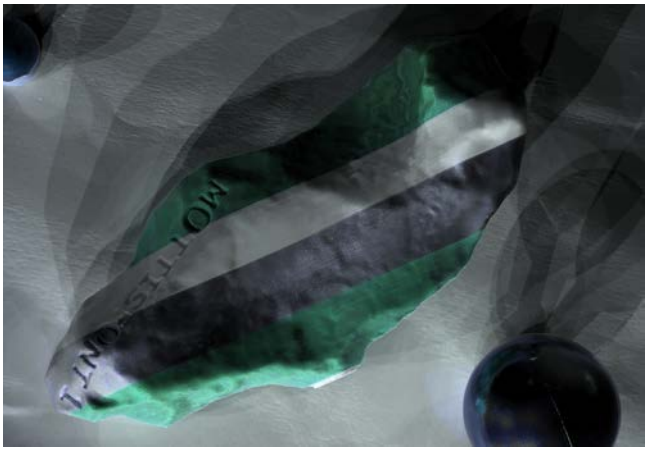

Figure 14: RTI of inscribed PLA pick with oblique green-, white-, and grey-dazzle.

no two are the same. An essential stochastic element is introduced by the maker spontaneously changing the colour of the filament when it is convenient or it just feels right.

Grown from a cornfield, the vibrant, regenerated artefacts that appeared phoenix-like on the screen of our e-meetings were strikingly reinscribed with new meaning. For example, the once familiar lithic topologies and textures that had been extracted so carefully from the SfM photographic surveys to enable the original chaîne opératoire to be determined now reemerged, covered in a profusion of third millennium dazzle that fundamentally redefines the visual encounter. One of the first to steal the stage with its razzmatazz had the duration of its making laid out in stunning pink, white, amber, yellow, black, and grey bands progressing along its entire length, causing the new colourful stratigraphy and the original chaîne opératoire of impact scars to diffract through one another. This particular candy rock like scheme also brought gustatory confusion of *all sorts* (Figure 13). Over a period of several weeks, every individual lithic in the assemblage was generated afresh, each with its own unique colour scheme, laid out in various orientations (e.g. Figure 14) and at more or less random scales.

Several of the PLA works were rendered multiple times at different scales and in different liveries. A colourful, cosmopolitan, and very lightweight collection was packed in a box, handed over to the Royal

Figure 15: Phygital finds tray: Interlaced corn and flint assemblage.

Mail postal service, and tracked online to Hampshire. Once "back home," our itinerant objects were introduced to their sturdy rural cousins (Figure 15). It very soon became apparent that aside from their striking gaudiness, which actually proved very complimentary to the lithics, the biggest difference between the two assemblages revolved around their weight and balance and was how they fitted (or otherwise) into the hand.

In this regard, one rather dowdy PLA artefact stood out (Figure 16). It had been printed using the same technology and processes as the rest but, uniquely, it had then been coated in chalk powder (by being turned over in a revolving bubble for several hours) that was a very close match to the colour of lithic prototype's own patina. The object that emerged from this process was uncanny. It appeared a most convincing lithic artefact, but it felt completely wrong when it was picked out of the delivery parcel. This was because although it looked like the original lithic, its weight, balance, and texture were disconsonant with its appearance, and so it provoked repulsion, especially when it was handled with the flint

Figure 16: Uncanny pandemic object.

Figure 17: Painted pebbles in and around a Test Valley village and along its public rights of way.

prototype held in the opposite hand. Remarkably, once safely installed on a display stand at an arm's distance away, this artefact no longer feels like some kind of uncanny pandemic object.

For the rest, we planned to release them back into the wild under the cover of a diversion. As it happened, school children had over the pandemic taken to placing colourfully decorated pebbles around the village and paths where Reilly lived. A favourite type of spot to deposit these little works of art is on gate posts, the fingers of waymarkers, on stiles and, sometimes, just simply at the side of a footpath. They are also found in various nooks and crannies just off the public footpaths in the woods and fields thereabout (Figure 17). These wonderful objects can be admired and even handled, before being returned to their place of display.

Curiously, the track about which our lithic assemblage was discovered had no decorated pebbles along its course nor at the waymarkers and stiles at its start and finish. Their absence provided cover for our installation. We release our dazzling assemblage of phygitally related artefacts, unannounced, back into the field close to the places the flint lithics were first discovered by the track – the colourful worked corn substitutes replacing their patinated worked flint counterparts. They are (re)introduced when it feels right, when the corn is ripening (Figure 18), or when the corn has been harvested (Figure 19) for example.

7 Summary and Discussion

Bubbles have emerged in this project as potent vehicles for creativity in practice as well places of personal mindful refuge and intellectually positive spaces for free thinking in the time of the pandemic. They serve as both cocoons and incubators, places where metamorphosis can occur. In fact, a single lithic scatter found in

Figure 18: A dazzle in the corn crop just before harvesting.

a cornfield during the pandemic has been transformed through the dramatically different lenses of a veritable "bubblescape." Like the contemporary paintings of Jeffrey Dennis, our art/archaeology bubbles represent intense shifts in micro- and macro-focus (Read, 2017) in relation to how we examine and experience objects within both their places of discovery and their ongoing displacements in time and space.

This paper had its origin within membranes of cortex, stretched around blobs of flint, buried in the chalk floor of an ancient sea. Some of these silica bubbles eventually percolated up into a mesolithic landscape where they were encountered by tool makers who burst them open and discovered that the broken pieces could be fabricated into wonderful objects. Some of these artefacts persisted for millennia and then were (re)discovered and recognised for what they were, by their distinctive technological style, in a cornfield with a path worn across it, in the pandemic of 2020. This assemblage of lithic artefacts now became caught up in a series of new art/archaeology analytical-creative bubbles that interpenetrated one another over many dimensions, including place, setting, time, material, scale, technologies, and cognition. The first of these was the 360° spherical panorama that fixed the "act of discovery" using a mobile device and a credit card photographic scale. While this both inward and outward looking landscape bubble recorded some of the setting of the discovery, its location was also affixed to a named 3 m^2 square mapped onto W3W's meshed bubble representation of the earth. Although viewers could look around the place and setting of the act of discovery, this visual bubble has an element of claustrophobia and conveys a sense of being locked down to a particular moment of time. This led us to several other bubbles that functioned as portals allowing slightly more autonomous and, perhaps more importantly, diffractive exploration of our assemblage via an (im)materially, temporally, and technologically effervescent phygital nexus.

The RTI project invoked a kind of quantum bubble in which time and materialities were pulled out of the shadows to be diffracted through one another in order to unpick not only the chaîne opératoire of the making of an artefact, but also the operational sequence of registering each artefact in an interactive RTI

Figure 19: The cycle of silica and corn continues.

polynomial texture map. As compiled into the RTIViewer, users are able to interactively explore the making and use of these objects (i.e. the artefact and the RTI) by remixing the material surface properties and lighting sequences. However, now fixed in their RTI bubble, our artefacts had somehow come adrift both in time and place. In an effort to return them, creatively, to their silica origins and setting, compiled RTI images encapsulating the temporal diffraction patterns in their making were, in turn, diffracted, using a style transfer algorithm in a cluster of artificial neural bubbles, with meaningful style images: stained glass panel; a QR location code; and a satellite rendering of their find spot. In parallel, a SfM bubble provided a medium to connect Dawson in his plastic studio in London to the geometries and surface details of each individual artefact from the lithic assemblage.

All the art/archaeology artefacts from the 360°, SfM and RTI computer photogrammetry, and image style transfer fall into the category of "simulacra." First described extensively in the work *On the Nature of Things* written by the poet and philosopher Titus Lucretius Carus around 50 BCE, simulacra (called "idols") have the appearance of things from the real world, but are actually just empty films or membranes which have been shed off the real body of the thing they came from, like a snake's skin (see also Minkin, 2016; Lucretius, 2020). They may be considered as empty bubbles without organs. Therefore, feeling that the artefacts in our virtual assemblage had been "deprived of their matter" (Stobiecka, 2019), we decided to (re) materialise the assemblage in such a way as to recall the place, vibrant matter, and form of the original lithic assemblage but with a contemporary art/archaeology twist. The silica artefacts were therefore 3D-printed at very different scales, in dazzling colours, using biodegradable, corn-based, PLA, to create extreme skeuomorphs. The dazzle liveries radically disrupt the visual encounter while indicating the duration of their (re)making as they are diffracted across the traces of the impact scars and chips that shaped the making of the lithics. When touched, the comparative warmth and lightness of the decorated "plastic flints" is a startling contrast to the cold hardness of their silica forebears.

The analytical bubbles we have outlined above share a number of common human and nonhuman elements. Each one includes a group of artefacts, the application of a set of instruments, or tools, an artist, an archaeologist, and a collection of contrasting modes and techniques of observation and analysis. They conform to what Hayles (2017) terms "cognitive assemblages," in which human and nonhuman decision, or choice, making functions are distributed across, and link together, the component parts. Hayles makes a distinction between thinking and cognition. Thinking refers to high-level mental operations she associates with consciousness and unconsciousness, which are grouped together as modes of awareness enabling reasoning, abstraction, and the creation and application of, for example, languages, mathematics, art, and music. By contrast, cognition is a much broader capacity that extends far beyond consciousness into other neurological processes that also feature pervasively in other life forms and complex technical systems, especially in so-called artificial intelligences and scanning devices. Hayles refers to these broader and more widespread cognitive capacities operating below the level of consciousness as unthought or nonconscious cognition. What is perhaps most noteworthy about our art/archaeology artefacts is that they are the products of an intraacting cognitive assemblage in which the cognitive components do not simply interact in parallel or in tandem. Rather, we are consciously diffracting different modes of cognition through one another, human with nonhuman, conscious with nonconscious, artistic with archaeological practice and techniques, with the hopeful intention of producing surprises and unexpected results.

In humans, according to Hayles (2017, p. 27), nonconscious cognition comes online and is inherently much faster than consciousness. Its job is to interpret the constant floods of sensory inputs that would overwhelm consciousness and discern patterns that consciousness cannot detect and draw inferences to anticipate future events. This is perhaps why the chalk-coated 3D-printed "lithic" provokes such a strong negative reaction. The unthought expectation was that the object would have a certain feel and heft which, when it failed to match the anticipated cross-modal sensory pattern, caused a feedback loop to trigger consciousness (a half-second later) to pay attention to it. It caused us to pause and think. Changing the scale, material, colour, setting, or perspective of the artefacts shifts the register of cognition from nonconscious, or unthought, sense-making processes, into conscious attentiveness. One might think of it as deliberately priming a neural trigger for a new act of discovery.

Each individual art/archaeology *exhibit* presented here can speak for itself. We do, however, want to add a few closing remarks about the collection as a whole. Taken together, the bubblescape we have laid out reveals the *effects* of our diffractive art/archaeology practices. In these studies, we have probed into the shadows to discover new productive ways of radically disarticulating, disrupting, and repurposing fundamental features, or attributes, common to both art and archaeology assemblages. Authorship, provenance, temporality, setting, scale, and materiality have all been interlaced through one another. Who or what is the principle maker in these assemblages is now extremely difficult to pin down. Cognition has not so much been de-centred, rather human and nonhuman strands have been spliced together. Place, context, and setting also seep through one another from different perspectives, at simultaneously both macro and micro scales. Chronologies have been interfered with, and the very order of time and the nature of duration are unsettled. Our phygital (im)material exhibits unfold all these attributes and thus rearranged and transformed, they are returned to us for reinspection, recharacterisation, and recognition. These attributes of worlding, or world making, are not simple translations into comparable, or even remotely equivalent, representations. Our apparently simple lithic artefact has *metamophosed* into several previously undocumented "instars" (Ingold, 2020) whose ontological status is currently ambiguous, and whose affordances we are only just beginning to appreciate. Freshly emergent, they call to us for further study and novel phygital acts of discovery.

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