Diffracting Digital Images

Digital imaging techniques have been rapidly adopted within archaeology and cultural heritage practice for the accurate documentation of cultural artefacts. But what is a digital image, and how does it relate to digital photography? The authors of this book take a critical look at the practice and techniques of digital imaging from the stance of digital archaeologists, cultural heritage practitioners and digital artists.

Borrowing from the feminist scholar Karen Barad, the authors ask what happens when we diffract the formal techniques of archaeological digital imaging through a different set of disciplinary concerns and practices. Diffracting exposes the differences between archaeologists, heritage practitioners and artists, and foregrounds how their differing practices and approaches enrich and inform each other. How might the digital imaging techniques used by archaeologists be adopted by digital artists, and what are the potentials associated with this adoption? Under the gaze of fine artists, what happens to the fidelity of the digital images made by archaeologists, and what new questions do we ask of the digital image? How can the critical approaches and practices of fine artists inform the future practice of digital imaging in archaeology and cultural heritage?

Diffracting Digital Images will be of interest to students and scholars in archaeology, cultural heritage studies, anthropology, fine art, digital humanities, and media theory.

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We, the editors of this book, had been working together for several years and decided it would be useful to bring together the insights from these collaborations, as well as from our wider collaborative networks, in a book publication. In particular, we wanted to discuss the way in which archaeological practice and art practice mutually inform each other around the area of the digital image. A book proposal was drafted and sent to Routledge in mid-December 2019, and to our astonishment, the proposal was almost immediately reviewed and accepted, and we were signing book contracts by early January 2020. Immediately, we requested all our contributors to draft a short abstract, which we circulated to everyone for comments and feedback. Two months later, we asked for and received extended abstracts fleshing out the key points our contributors wanted to develop in their chapters. Again, everything was shared across our writing community with a general call for constructive feedback. We had originally planned to hold a symposium for the book contributors in June in Southampton and Winchester. These plans changed dramatically after March 2020 when the Covid-19 pandemic altered life as we knew it.

The pandemic saw a mass migration of life online. During the course of the pandemic, we began to adapt and change our practices. The four editors began meeting, using Teams and Zoom, on a weekly basis, ostensibly, to review the progress of the book. However, the weekly meetings quickly transformed into a way of mentally processing what we (and the rest of humanity) were undergoing; in that sense, the meetings became a form of support network. Under the transformed conditions within which we were working, we experimented with some of the digital techniques we discuss in the book using whatever recording materials were available (replacing the standard RTI sphere with Christmas baubles, children’s toys, etc.) and recording our immediate home environments, particularly flowers in the garden as they changed seasonally in the preternaturally remarkable Spring of 2020. As a result of these meetings, we also developed a new form of RTI – *remote-RTI* using the interface of the Teams or Zoom screen as a data capture device (see glossary and Chapter 7 of this book for more details) – and significantly extended our research libraries (weekly meetings typically saw titles across art practice and theory, anthropology, archaeology, and more being discussed).
Reflecting upon the work we had done together over the past few years and the development of our digital practices, we assembled interstitial chapters to accompany the text (see Dawson and Minkin in Chapter 2 of this book), many of which related to activities that had taken place over the long months of the lockdown during which this book was developed.

Sometime during the course of the pandemic, several of us (Minkin, Dawson, and Jones) received funding from the Arts and Humanities Research Council (AHRC) for the Concepts Have Teeth project, which was intended to facilitate transatlantic exchange between researchers and Indigenous communities in the UK and Canada around the digital recording of Blackfoot artefacts presently housed in UK museums. We adapted to the new online environment and began to craft the project around regular transatlantic exchanges with our collaborators in Alberta, Canada. This led to continued exchanges based on crit sessions between the Indigenous Art programme at the University of Lethbridge, Alberta, Canada, run by Jackson 2Bears and Migueltzinta Solis; and students at Winchester School of Art tutored by Ian Dawson and at Central Saint Martins, London, tutored by Louisa Minkin. The other editors also participated to some degree in these sessions.

In June 2020, the planned physical symposium was replaced by a very successful two-day virtual conference on Teams. This allowed all the contributors to meet, to present draft versions of their papers, and to receive comments from the editors, other contributors, and our two commentators. Armed with these comments, each contributor then revised their papers for publication over the next six months. Our two commentators, Marcus Jack Dostie and Mihaela Brebenel, who each offer different perspectives on digital technologies from their disciplinary standpoints of geography, archaeology, and digital culture, then provided their commentaries. A further meeting was held in March 2021, hosted online as a public event by UAL Research Season to mark the completion of the writing process. This meeting acknowledged the developments that had occurred during the writing process and recognized that the network of collaborators had been extended over the course of the intervening months. As much as marking the end of the writing process, this meeting was also a recognition of the fact that the book was simply a moment in a more extended process of research and engagement; a process in which the network was extended to include new transatlantic collaborators, in which members of the research network highlighted how their practices had changed, and new research emphases became apparent.

The global pandemic has had a profound impact on all of us; we have all seen our lives transformed. This is a period of time in which we have grieved loved ones lost, adapted to the stresses of new online working practices, and seen our social lives severely restricted, curtailed, and attenuated. Alongside this, the pandemic has ushered in new modes of global online connectivity and sharpened our focus on the possibilities and capabilities of digital images and digital imaging; it has also afforded some deeply joyful and comic exchanges, as well as deepening the research links between us.
For the perseverance under the difficult conditions in which this book was compiled, we would like to thank all the contributors and commentators, all of whom have shown remarkable resolve and belief in the project. We would also like to especially thank Jerry Potts, Velma Crowshoe, Kent Ayoungman, Linda Little Chief, John Murray, Carol Murray, Martin Heavy Head, Leroy Little Bear, Amethyst First Rider, Jackson 2Bears, Migueltzinta Solis, and their students Kale Zacharius Fox, Alison Brown, Alison Clark, John Giblin, Jeremy Huggett, and Ing-Marie Back Danielsson. For their help and guidance in bringing the book to publication, we would also like to thank Matthew Gibbons, Manas Roy, and the Routledge Team.
1 What is a diffractive digital image?

Ian Dawson, Andrew Meirion Jones, Louisa Minkin and Paul Reilly

In the video introduction to the Blackfoot Digital Library, the Blackfoot Knowledge Holder, the late Narcisse Blood (Blood 2006), perfectly captures the themes we want to discuss in this introduction. He states, ‘New and changing technologies can work against the people or be harnessed and used in their own worldview’. In a statement powerful in its simplicity, Blood outlines the way in which we cannot assume that digital technologies are innocent tools, and we need to remember that these technologies are shaped by particular outlooks and worldviews (see also Cubitt 2014). We can either use these technologies as standardized methods of documentation, or we can unpack these technologies, harness them, and utilize them under a different guise for other purposes. We view this process of repurposing as *diffraction*.

This book has two aims. First, it examines digital imaging through the divergent lenses of archaeology, art practice, and cultural heritage. Second, it looks at the ethics of the deployment of digital images as a form of data (and conversely, data processed to look like photographic images), particularly how digital imaging is shaped through collaboration with Indigenous communities. From the word go, we should point out that these two aims are related. We argue that ethics do not stand apart from either scientific or art practices (see e.g. Lyons and Supernant 2020 in archaeology); we do not practice first and add ethics to our practices at a later stage. Instead, as Karen Barad (2007, 393) points out, our ethics and our ontologies are intra-actively related: ‘intra-actions effect what’s real and what’s possible, as some things come to matter and others are excluded’. Ethics and responsibility compose the very fabric of our encounters: ‘Intra-acting responsibly as part of the world means taking account of the entangled phenomena that are intrinsic to the world’s vitality and being responsive to the possibilities that might help us and it flourish’ (Barad 2007, 396).

**Diffractive images in the making**

Digital images are produced through the detection and manipulation of light. It therefore seems appropriate to use a term derived from optics and the physics of light to discuss digital images: diffraction. The term *diffraction* has several meanings. In terms of classical optics, it refers to the way light bends around the
edges of an object and produces interference patterns. In feminist theory and, in particular, the theory of Karen Barad (2014), diffraction also refers to the way in which phenomena dynamically intra-act; encounters produce a reconfiguration of what Barad describes as ‘spacetimemattering’ (Barad 2014, 168); and encounters produce a differencing. As Donna Haraway (2014) puts it, ‘to be a one at all you must be a many, and that’s not a metaphor’. This book examines the way digital imaging techniques embody many prior knowledge practices (the many in the one) while, through fresh encounters, helping to foster new and divergent kinds of knowledge (the one in the many).

According to Barad, diffraction ‘involves reading insights through one another in ways that help illuminate differences as they emerge, how different differences get made, what gets excluded, and how those exclusions matter’ (2007, 30). We employ the term here then both to denote the way light may work differently in the production of digital images, while also thinking about how the effects of difference are produced in diffractive encounters.

Why is a diffractive methodology necessary? Rosi Braidotti (2018, 15) alerts us to the humdrum character of much digital humanities research: she pinpoints a dominant narrative about digital humanities as media studies applied to humanities and particularly highlights 3D modelling of archaeological finds as a classic component of this normalizing narrative. We share Braidotti’s discomfort with the rapid and homogenizing rise of digital humanities (a ‘majoritarian meta-pattern’; Braidotti 2018, 15) and wish to argue for the more imaginative intra-active deployment of digital techniques in archaeology through encounters with other disciplines (such as art practice) and other situations (such as in cultural heritage contexts). Hence, our method is a diffractive one.

This book is not, then, a handbook of current methods of digital imaging for archaeologists. Nor is it a guide to digital practice for artists or a reference for those involved in digital applications in cultural heritage. This book instead explores the character and composition of digital images across a suite of related disciplines and practices, and seeks to understand how they creatively differ or converge. We believe that the best research outcomes are the result of diversity and the result of ‘playgroups and collaborative clusters’ (Tsing 2015, 285). Our understanding of the potentials of digital images is benefited by creative interplay and made stronger by differing viewpoints arising from multiple disciplinary positions.

Encounters are key to our discussion. Perhaps the best way of introducing the concept of diffraction in digital imaging is through a brief discussion of the encounters involved in the two projects that led to the making of this book. Andrew Meirion Jones had been working for several decades on projects investigating the mark-making practices of the British and Irish Neolithic (c. 4050–2300 BCE). This fascination began many years ago with his doctoral research looking at the decorated pottery known as Grooved Ware at the Neolithic village of Barnhouse, Orkney. This pottery is inscribed with designs also found at passage tomb sites in Ireland and rock art sites across North Britain. This interest in Neolithic design continued for many years with a long-term project looking at the rock art landscape of Kilmartin, Argyll, Scotland. The final piece of the puzzle of British
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and Irish Neolithic imagery lay in the numerous inscribed artefacts from across Britain and Ireland made of chalk, stone, antler, bone, and wood. To investigate these artefacts, he began the Making a Mark project, which ran between 2013–18. The project enlisted Marta Díaz-Guardamino as research assistant and was run in the company of Ian Dawson and Louisa Minkin. The project used digital imaging techniques (including Reflectance Transformation Imaging (RTI) and Structure from Motion (SfM) photogrammetry) to document a group of portable incised and worked artefacts from the Neolithic of Britain and Ireland. While these techniques have now become part of the standardized methodology of archaeologists (e.g. Historic England 2018a, 2018b), the Making a Mark project used these digital imaging techniques against the grain to reveal, for the first time, practices of erasure and reworking in Neolithic mark making (Jones and Díaz-Guardamino 2019; see also Jones, this volume). The novel use of digital imaging was one of the striking aspects of the project, but just as interesting was collaborating with Ian Dawson and Louisa Minkin. Our method was to meet around a shared image, place, or object. Learning and applying technical imaging processes meant that we spent extended time interacting with objects and exchanging thoughts and disciplinary positions as we did so. Through this project, Ian and Louisa were introduced to RTI and SfM photogrammetry, and began to use them in their own art practices, developing along the way wholly new techniques, including Dirty RTI (Dawson 2020), which subverted, inverted, and bent the standard RTI methodology to new and interesting outcomes. This is one sense in which we discuss diffraction; diffraction as an encounter that produces new and divergent ways of doing. Gradually over time, a fascination that began with the Neolithic transformed into a collective fascination with the ontology of (digital) images and the potential for digital imaging techniques to foster new kinds of knowledge practices. These engagements led us to consider the agency of a digital model both as evidential document and as creative material in formation.

The Making a Mark project was written up as a monograph (Jones and Díaz-Guardamino 2019). It also assembled itself into a discursive event-based exhibition form combining ancient and historic objects with contemporary artworks. Data capture and fabrication were staged in the Lethaby Gallery, Central Saint Martins, London, alongside transdisciplinary speakers and performance events. Students, technical and academic staff, and researchers from a mix of disciplines took the same stage. The project, which took place over six days in 2017, was called Annihilation Event (www.kingscross.co.uk/event/annihilation-event). In particle physics, annihilation is the process that occurs when a subatomic particle collides with its respective antiparticle to produce other particles. A particle collision is a useful metaphor for the unruly and generative process of transdisciplinary exchange – the productive ground of cultural participation. Another kind of diffraction.

One of the outcomes of this event was an invitation from Josephine Mills, director of the University of Lethbridge Art Gallery, Alberta, Canada, to develop a project using digital imaging techniques to document the Blackfoot artefacts in British museum collections. This second project titled Concepts Have
Teeth/Mootookakio’ssin (distant awareness) involves collaboration between members of the Siksikaisitapi (Blackfoot Nation) community in Alberta, Canada, and Montana, USA; artists and web designers from Canada and the UK; and an archaeologist (see Clark et al., this volume; Minkin, Allison, and Jones, this volume). This project adopts an archaeological technology, SfM photogrammetry (see Historic England 2018a), to document Blackfoot artefacts. It involves an intra-action of the properties of these digital technologies with Blackfoot concepts of knowledge transfer and display. Multiple diffractions are involved in this process. Not only is archaeological technology being employed in an art world context, but the art world context is also diffracted by Blackfoot practices. Through this project, we began the initiation of a complex, critical, and committed relation to issues of reconciliation and heritage through digital exchange.

Diffractive knowledges

What is diffraction then? A conversational method of knowledge production enabling generative thinking about the possibilities of democratizing technology and wider debate around decolonisation of knowledge? Encounters produce variants – practices through which we come to know are brought into question. An unfolding or misregistration of cultural lives manifested as vulnerabilities, exploits, blind spots, and exclusions.

Throughout our many engagements with digital images, we thought about digital anatomies, the file types and parts constituting a model, and their pathologies and ontologies. In making a digital model of an object, photographic or scan data is compiled. Conventionally, its anatomical development leads from a point cloud to a mesh of vertices and an image or texture, also called a skin file. The skin in itself may have several components – a normals map and specularity, for instance. These combine to make a surface responsive to different light conditions. An object compiled from data capture has one given materiality and one contiguous surface, though its subject may be made of multiple materials with different qualities (Minkin 2016). The image surface is rendered as one: distinctions in materiality, like shininess or dirtiness, bone or label, are produced through procedurally based rendering. The digital body, once composed, may be given properties: gravity, flexibility, or animation. What is produced is not a representation but a new object: scalable, malleable, and infinitely replicable. These new things sit dormant on drives or, set into motion, spin out iterations into virtual spaces, spawning on new platforms and moving through our human infrastructural spaces like rats in the sewer. Call them digital synanthropes or neophyte familiars.

The partiality of a singular viewpoint is diversified by contemporary imaging technology. Our eyes are opened to other wavelengths. We add more sensory structures to the optic. The technology itself is intrinsically transdisciplinary, built and moulded by experts and fans from an array of disciplines. Tasks here are collective, and information resides in the overlap. Pixel-matching and image-stacking are characteristic assembly techniques of contemporary data capture.
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Information is imbricated like the scales of a fish. Drop a photogrammetric model into the Unity game engine and every constituent image is produced as a camera. Data capture produces new objects – new knowledge. Informatic forms may be made physical in print or animated with game engine physics – given qualities, properties, and scripts. How does the workflow of, for example, physically based rendering author new content and figure new ontologies? In digital spaces, as in Indigenous thinking, object hierarchies are situational, and membership in a given class is ambivalent and unpredictable. Can these new kinds of data objects be useful in parsing the complexities of emotions for feeling out inconsistent realities?

The parsing of archaeological knowledge has recently been discussed by Jeremy Huggett (2020), with particular reference to digital and computer-based methods of data capture. Archaeological knowledge is always partial, and Huggett distinguishes between known unknowns and unknown knowns in his discussion of forms of archaeological ignorance. Most interesting for our purposes here are the series of forms of forgetting he discusses under the rubric of unknown knowns, which include forgetting through effacement, over time and by command, as well as the forgetting that arises from disciplinary divides (Huggett 2020, 7–9). If we view these issues diffractively, we begin to see that there is much more at stake to his discussion. The gaps in knowledge produced by disciplinary divides may in fact be productive of new kinds of knowledge if we consider that – through encounter – differing disciplines may enrich knowledge and produce wholly different kinds of knowledge. Meanwhile, the silences produced by repressive forms of forgetting are precisely the kinds of gaps in knowledge that an emphasis on diffraction is intended to expose. A diffractive methodology pays attention to how such differences in knowledge are made and focuses on what gets excluded and how those exclusions matter (Barad 2007, 30).

The silences apparent in archaeological knowledge are far outweighed by the silences and effacements engendered in colonial encounters (Simpson 2007; Glissant 2010). Here, we consider what is at stake when digital imaging methods confront the legacies of this colonial encounter. How do we go about establishing best practice around digital standards, legal issues around IP, and the hosting of files on platforms with commercial frameworks or transnationally problematic ideas of property? There are questions here of creative online interactions, technical innovation in regard to non-instrumental worldviews, shapeshifting, possession and dispossession, animacy, and material cultures (for an example of animacy in Blackfoot medicine bundles, see Zedeño 2008). There is both creative engagement and philosophical inquiry at work that must figure the ontology (or hauntology) of a digital model. The spectre of the ancestor and the return or coming back of the ghost destabilizes history and time, and puts them out of joint. Artist and Six Nations cultural theorist Jackson 2Bears (Leween 2012) glosses it like this:

... for Derrida, the sign of the specter becomes a way to re-envision the tenuous relationship between the past and the present, such that history is re-imagined to be a living, or better yet un-dead “Thing” that occupies,
inhabits and haunts the present moment. And so, Derrida says, that while specters do not belong properly to the ‘living now’ they also do not necessarily belong to the past or to the future.

. . . the ‘undead’ apparitions of history (re)appear to haunt the lives of the living, which they do by means of (spirit) possession wherein they internalize themselves in the body of a host. . .

Rather than emphasizing the revenants of history, we instead wish to consider how older traditions embodied in newer ways of doing may instead help to revitalize and renew (Wemigwans 2018, 105; Smith 1999). Can computational photography provide the conditions for revitalisation and renewal? The digital file is instantiated somewhere between Indigenous and museum protocols in encountering and approaching objects, making both positions visible and multistable. There are technical challenges in finding and developing platforms for reciprocity and sharing, as well as larger questions around memory, translation, community, and living cultural inheritance. We emphasize the need for these technical challenges to be met. Following writers on Indigenous knowledge, such as Jennifer Wemigwans (2018, 55) on online Indigenous knowledges, and Leanne Betasamosake Simpson (2011) and Linda Tuhwi Smith (1999, 161–2) on Indigenous knowledges more generally, we recognize the need for digital objects to be created within a framework of respectful sharing of knowledge and perspectives. We also echo Natasha Lyons’ and Kisha Supernant’s (2020, 1) call for an archaeology that places emotion, love, and connectedness centre stage, while continuing to practice with rigour and care.

Visual and conceptual frames can be ways of building and destroying populations as objects of knowledge and targets of war (Butler 2010). Ariella Azoulay (2019) is explicit about the violence of the camera shutter, cutting like a blade and separating us from them, here from then and art from life – a technology of separation and alienation that naturalizes the division of rights. She goes on to speak about reversing the shutters’ work, overcoming dissociation between people and objects, and forming new alliances. Unlearning imperialism, she says, involves decompressing, decoding, reversing, rewinding, and redistributing.

You can think of photogrammetry as a form of refitting or re-assembly of multiple digital images. Every compiled object is in fact a new object and a new instantiation of the data. The same data will be compiled differently by different people at different times. Cleaning up a file and modelling requires a series of interpretative decisions (see also Minkin and Jones, this volume), shared creative interactions between the object, the collected data, and the community working with it to make a co-authored surrogate (or many iterations of such) often over extended periods of time. This is a process of slowing down. We would argue that this kind of co-production is not so much about values of authenticity as it is about duties of care and not so much about owning as about manifesting a relational tool for seeing and feeling.

**Diffractive images**

In the previous sections, we have discussed the ontological strangeness of digital images. We argue that the strange anatomy of digital images is rooted in a much