THINGS IN FLUX:

Understanding the ontological dynamics of digital heritage objects

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DECLARATION

I declare that this thesis is my own unaided work. It is submitted for the degree of Doctor of Philosophy (History of Art) in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination in any other university.

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ABSTRACT

Processes of digitisation, particularly within heritage-related fields, are frequently rendered as being infinitely thin and consequently mechanically objective. The lack of engagement with their complexity results in what Latour calls "black boxing" of the processes, technology, and practices.

In this work I examine techniques and practices of 3D photogrammetric recording of archaeological, ethnographic and art objects and collections. Using two exemplars in the form of a late 19th century "curio" in the KwaZulu-Natal Museum collection, and a San rock art site near Van Reenen, I unpack and attempt to understand what is contained within these black boxes.

I offer digitisation as a thoughtful, object-centric practice rather than data-driven process, drawing on ideas from Caraher's "slow archaeology" and Stobiecka's "prosthetic archaeology".

Objects are decontextualised and unanchored in the process of excavation or procurement, and on accession into collections they are inducted into organisational and taxonomic schemas designed to afford them value as epistemological objects. These schemata are both biased and flawed, being natural heirs of colonial knowledge systems, and are thus lacking in awareness of multiple ontological viewpoints. By reframing the original *thing* and the resultant digital object in an ontological sense, I attempt to characterise these systems and their constructions of authenticity.

I look to past practices of three-dimensional recording and copying, namely plaster casting of specimens and sculpture, and their role in not just practices of duplication, but also in furthering the colonial project and its epistemological flows. Collection, casting and digitisation — as acts of physical and material translation — perpetrate violences involving

removal of things from their context, remaining adrift until re-anchored within schemata and rules. Understanding and challenging the nature of these rules is critical in avoiding the risk of reinscribing procrustean colonial approaches to recording and documentation. Furthermore, as metadata and data become inextricably entangled, it becomes more difficult to recreate compelling narrative and "human-readable" context from these structures. However, these shortcomings might rather offer potential, building on Lev Manovich's ideas of database trajectories and Ruth Tringham's "recombinant histories", allowing new and unforeseen paths through the data.

I suggest that by eschewing neoliberal metric-driven approaches to "mass digitisation" in favour of small-scale, thoughtful practices, we foreground the opportunity to learn from and with the thing during digitisation. Opening up the "black boxes" and exposing and recording craft practices helps reconnect the digital object with the original thing, and offers a reconfigured view on digital authenticity. By formally recording these acts and decisions we can also contribute to the communities of practice which have grown around many of the arcane skills of digitisation.

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INTRODUCTION

Studying material culture necessitates handling, manipulating, looking and otherwise closely engaging with objects and assemblages. These objects *invite* us to do so. The fundamental nature of an artefact is embodied and physical, and our interaction with it allows us to deploy other senses — we can *feel it*, *smell* it, and even *taste* it. We traditionally then record and document our discoveries in the form of photographs, drawings and texts, which reductively flatten this rich sensorium into line diagrams, pixels and prose. Such practices within epistemic discourse are well established, from Robert Hooke's 1665 *Micrographia*, showcasing his illustrations of barely visible space; through Linnaeus' literary descriptions of plants; to Pitt-Rivers' detailed 19th century illustrations of his archaeological finds.

However, these practices of representation are not merely recording — they involve complex operations of interpretation, knowledge production and communication. The shift towards mechanical means of recording — first with photography, and now with their transmigration into the digital domain has obfuscated not just the act, but the *practitioner* and *craft* threaded throughout their enactment. This movement evolves across orthogonal axes; one axis involving a shift from flat, two-dimensional representations on paper or a screen towards three-dimensional digital models, the other axis tracking the concurrent usage and development of technical tools of observation, offering new extra-sensorial views such as multispectral imaging, LiDAR, and other modes of engagement with the recording.

Moreover, these forms of recording reassure us of their true verisimilitude by obscuring the human factor, and thus are *mechanically objective* (Daston and Galison 2007, p. 121). As Opgenhaffen notes, tools and vocabularies for figuring the nature of these digital and technical artefacts has not yet caught up with the technology itself (Opgenhaffen 2021, p. 1698); the material culture which we study has remained the same, but these new digital

objects have a "dubious ontology" — we cannot use the same criteria in dealing with them that we do with physical things (Allison et al. 2005, p. 364; Ekbia 2009, p. 2553).

My personal practice lies in digitising and creating digital three-dimensional models of museum artefacts, sites, and other heritage using Structure-From-Motion photogrammetry. This has made me aware that the dominant attitude — both in the wider public view *and* in academic projects — is that the processes of digitisation are seen as purely technical processes which are *infinitely thin*, with the internal mechanics — and the practices involved — being invisible. It is now almost mandatory to have some form of 3D model content attached to an archaeological or historic project or institution, whether it be the latest season of *Time Team*, or the British Museum's *Sketchfab* account showcasing their collection. There exists an unwritten promise of the digitised object being emancipated from the tyranny of flatness; that it will escape the constraints of the two-dimensional drawing or photograph into three-dimensional space. However, it is becoming apparent that to a large extent the manner in which this may happen is not understood — the actual *purpose* of the digital model is indeterminate or has not been afforded sufficient consideration, the model often being nothing more than a "sexy technological endeavour with little or no scholarly application" (E. Gruber 2015, p. 63).

Justification for digitisation of artefacts and other heritage follows several consistent motifs. Firstly, the idea that digitisation affords unprecedented access and *democratises* access to collections and sites, allowing anyone, anywhere (as long as they have broadband Internet, that is) to view them. Secondly, is that of *preservation* in an increasingly uncertain setting of global unrest, climate change and cultural intolerance; that the digital copy will suffice as a stand-in for the original when it is (according to this discourse) inevitably destroyed or damaged. And finally, the idea that this will allow new and novel forms of *research* to take place on objects, sites, and collections. These tropes provide a convenient lens through which to examine the nature of the digital model, and with which to disambiguate the factors behind the drive to digitise, and the attempts to productively use these models.

The nature of the embodied, material encounters with physical artefacts — as I discussed earlier — lies in stark contrast to responses to the awkward immateriality and somewhat

embarrassed circumstances of the 3D model and "virtual museums" — or even 3D displays within the museum space. These displays offer, usually, a limited scope and in fact a limited reason for engagement with their flat, Cartesian representations on a screen. I have considered these aspects in the context of Walter Benjamin's somewhat nebulous concept of *aura*. This, a product of Benjamin's writings, notably his 1939[1] work "Art in the age of its technological reproducibility" (Benjamin 2008), might succinctly be summarised as the nature of one's *affective engagement* with a thing. It has also variously been referred to as the "contemplative experience" of an object, and the networks and accretions defining the "life of the thing" (Shanks 1998, p. 20; Duttlinger 2008, p. 80).

Entwined with the idea of aura is that of *authenticity*, which in an art-historic, antiquities or archaeological sense orients with general concepts of provenance. However, within the neoliberal climate of thinning budgets for heritage and humanities, the notion of authenticity is increasingly being used as metric for the *value* of an artefact or site, a marker of what is "worth keeping, displaying, discarding" (Ouzman 2006, p. 274). Authenticity becomes ever more hazy when consider the current age of near-instant, infinite and intricate modes of digital and mechanical reproduction, such as 3D scanning, 3D printing and CNC machining, and the impenetrable "black boxes" which these technologies present. Boellstorff writes that the tendency to place the digital and the "real" in opposition, means that "authenticity, value and meaning" increase or decrease as we move closer to one end or the other (Boellstorff et al. 2016, p. 387).

As I mentioned earlier, with the unknowability of these processes, and their perceived thinness, comes the implication that they are also *objective* and *neutral* (Younan and Treadaway 2015, p. 240). This is however, unlikely and impractical. The practitioner performing these processes is a multivalent actor, and so there are many nodal points within the creation of digital objects inflected with the practitioner's input, skills, craft, belief and bias. For instance, within my personal practices of 3D photogrammetry, I occupy many roles; simultaneously photographer, illustrator, software operator, artist and archivist. Recent technologies such

1 Second, revised version, and basis for most English translations. The essay was first published in 1935.

as so-called "AI"[2], with the ability to generate images or 3D models from a textual description are even more unknowable; they have been trained on massive, undocumented and unknown corporae of data (extant images or 3D models) harvested off the Internet. They provide no attribution or acknowledgement of source, with there being no indication of the source and provenance of the digital *spolia* they assemble into their output, further clouding the landscape of digital authenticity.

Museum objects are decontextualised through the processes of collection and acquisition, and intentionally recontextualised to fit within a desired reading or schematic. In order for them to be considered as objects of knowledge or *epistemic objects*, they have to be cast within a classification schema or taxonomy. The digital model itself is also embedded within the same networks of epistemological systems as the original physical thing, and which is shifted — or rather mapped into the digital domain through the use of metadata or formal ontologies. Despite this shift, these digital schemata still carry with them the impedimenta of the colonial project under which the original systems — and the disciplines which they served, were created. As these systems evolve, complexify and shift into other media, they inherit the "inertia of the installed base of systems that have come before" (Bowker and Star 1999, p. 33). Moreover, systems and archives are by no means neutral, and so there is an urgent need to both interrogate these systems, and challenge them so as not to re-inscribe the problematic practices of the past. As Risam observes:

> The promise of digital archives is far from guaranteed, since traces of colonial violence appear within them. In the context of the digital cultural record, digital archives hold both the risk of reaffirming colonial discourse and the promise of challenging it through the development of new archives and design practices (Risam 2019, p. 47).

The complex entanglements of the thing, the practitioner, and the technologies of digitisation have suggested the basis for my research, beginning with three main questions. Firstly: in order to become an epistemic thing, what are the processes of decontextualisation and

2 For example *Magic3D* (Lin et al. 2023).

recontextualisation which a thing needs to endure, and what is the nature of the systems and epistemological frameworks within which this happens? Secondly: how do these processes continue when we digitise an object; what forms of translation happen within the process of digitisation, and what does this tell us of the ontological status of the subsequent digital object? Thirdly: how do we make the digital object itself a usable epistemic object, and are we entirely dependent on (or a victim of) extant epistemological assumptions and assertions?

My overall aim for this research is to reframe and refigure our approaches to the digitised 3D object, and unpack the processes of 3D photogrammetric digitisation. By shedding light on the manifold links and translations occurring between the physical object and the digital copy, I will attempt to figure something of the ontological status of the digital object. These links and translations occur not just in the digitisation process itself, but, as I mentioned earlier, in the systems within which the physical object and the digital model find themselves classified, ordered and theorised, and so I will look at the epistemologies which informed these systems, their translation into the digital milieu, and how we might consider challenging them so as not to reinscribe past biases and assumptions.

The digital object presents itself as a sort of ontological triptych — made up of multiple segments, each of which contributes to the whole. It is a *geometric translation* of the physical thing — a translation from the immersive Euclidean space of materiality into the flat, Cartesian space of the digital domain. Concurrently, it is also (ideally) an *epistemic object*, an object of knowledge and scholarly research, and as such continues and extends the networks within which the original, physical object is situated. And finally, it is also a *phenomenological* — or *affective* object, for display and consideration. This form depends to a greater or lesser extent on the other two forms, but itself is not fully realised until it is rendered or visualised on screen.

Further to this, I will look at the craft practices — the hand of the practitioner — made visible within the processes and practices of digitisation, and consider how they are obscured, and how they might be recorded and foregrounded in order to reimagine digitisation as creative. I argue here for the need to shift our view from the final product to the process itself, by positioning the act of digitisation as craft, which offers unprecedented opportunity

for learning from and with the original object. I will also consider how observing and acknowledging the hand of the practitioner will allow us to interpolate the chain of provenance across the digitisation process and its re-mediations, and reconsider the importance of "authenticity" in the context of digital models.

THEORETICAL APPROACH

As current engagement with 3D digital recording happens across multiple fields — archaeology, art history, heritage, and museology, my approach to both theory and engagement with my case studies is informed by this disciplinary range. My key theoretical focus anchored within archaeology, as this field has a long history of both theoretical and practical engagement with digital technologies. This is evidenced by the existence of journals, working groups and organisations such as *Archeologia e Calcolatori* and the *CAA* (Computer Applications and Quantitative Methods in Archaeology) who held their first conference in 1973. Initial engagements with computing in archaeology focused on quantitative research, mainly in the areas of cataloguing and seriation, and subsequent statistical analysis (Whallon 1972).

By 1978, though, there was already experimentation taking place in using three-dimensional computer graphics in mapping spatial distribution of materials on a site (Reilly and Shennant 1978). Amongst the first usage of 3D scanning of any sort was performed by the French School of Athens in 1995, scanning architectural details and excavated material at the site of Marmaria, in Delphi (Bommelaer and Albouy 1997). Photogrammetry for the purposes of creating 3D models of sites and artefacts for documentation was being tested by 1997 (Pollefeys et al. 1999; Hanke 2000). At the same time, the practice of creating 3D models manually from measurements and observations made with both digital and analogue tools was taking place at various sites (Koistinen 2000; Ioannidis et al. 2000).

Furthermore, alongside this *practical* engagement with digital technology, archaeology has a competent record of *critical analysis* of both the technology and the practices associated with it (Lock 1995; Huggett 2004; T. L. Evans and Daly 2006) as the field's focus on the tools has expanded from quantitative to qualitative and back again (and continues to oscillate to some

extent). Archaeological practice has been constructed as craft (Shanks and McGuire 1996; Jones and Yarrow 2013; Alberti 2018), and this is critical to my examination of digitisation processes; they may not involve a trowel, but involve similar decisions and interpretations throughout the processes of knowledge production.

I have not eschewed other heritage-aligned disciplines in favour of archaeology exclusively; my approach is, as Olsen writes, somewhat of a process of *bricolage* (Olsen 2010, p. 13), wherein I look across disciplinary boundaries in order to reframe and reconsider attitudes to digitisation practices. Looking across the heritage field, we see early adoption of digital technologies — for instance Ben Kacyra, the engineer who created and marketed the first practical time-of-flight laser scanner in 1995, used his scanners to record numerous heritage buildings and sites, and later went on to found the non-profit *CyArk* foundation, for digital cultural heritage preservation (Underhill 2018; Spring 2020). There is, however, a notable lacuna of work theorising the enmeshing of practitioners, practices and the technology itself. Similarly, within art history, there is a history of praxis, involving tools such as multispectral imaging and advanced sensing techniques, but primary deployments of digital technology, as Miriam Posner observes, have been in the context of the *digital slide library* or, more recently, *big data* for "distant readings" of trends within large corporae (in Kienle 2017). Likewise, museology, until fairly recently, has concentrated mainly on digital cataloguing practices, migrating extant card-based catalogues into digital databases (F. Cameron 2003; Parry 2007).

Chapter 1: Objects and Ontologies

I begin by considering appropriate terminology for the objects and artefacts we're working with, settling on the *thing*, the artefact as not just object, but also as meeting place which gathers together affordances and agents, as both a part of the world, and a tool of engagement with that world. I then offer an overview of collections and collecting as entanglement of Empire, colonialism and the formalisation of archaeology and similar disciplines. These practices focused on *thing* over *process*, as meaning was seen to be intrinsic to a thing, requiring just appropriate classifications and taxonomies to reveal this meaning. These practices

meant that within certain types of collection there was little to no context available for much of the constituting material, as it had been thoroughly decontextualised in processes of collection, trading or theft.

I then examine the processes of recontextualisation: how things are made into epistemic objects — objects of knowledge — through their initiation into a classification or taxonomy. The practices and systems within museums, and their internal terminologies and ontologies selectively erased much original context. Furthermore, these systems were both a product of the colonial project, and an important tool of colonial processes of control and exploitation. I locate these systems within the model provided by Foucault's principle of *epistemes*, and how they have informed museum collections and disciplines. Finally, I engage with one of the principle problems of these systems — that of their tendency to universality — and consider a counterpoint in the form of an *ontological* approach. I advocate for an alignment of the *anthropological* conception of ontology as espoused by De Castro and Daston, with that from the field of *knowledge organisation* in order to shape alternative ways to approach both the *thing* and the *digital object* produced from it's digitisation.

Chapter 2: Methodologies and Exemplars

In the second chapter, I outline my methodologies, and introduce my case studies, which I will treat as *exemplars*, which serve as sites of encounter with the theory, rather than examples or *proofs of concept*. I utilise Igor Kopytoff's principle of *object biographies* in conjunction with Joyce's *object itineraries* as a tool with which to locate the thing — pre digitisation — in space and time across its lifespan, and consider its subsequent manifold ontological states. These ontological states inform the epistemologies within which the object has existed and been used or studied, and shape the networks of knowledge within which it is imbricated, both as physical thing and subsequent digital object.

Following this, I approach the act of digitisation itself, positioning it as being *black-boxed*, or so complex that it is effectively unknowable, and offer the idea of the *chaîne opératoire* as a means of looking inside this black-box. The *chaîne opératoire* approach has long been used

in describing the sequences of actions and decisions in the production of material culture — primarily lithics and ceramics — but has also been used in studies of modern technological processes. I have adapted the stages of production described by Sorin Hermon in order to align them more closely with my methods of construction of 3D photogrammetric models.

Finally, I present my case studies, these being a set of cattle horns from the Natal Museum, engraved and painted with scenes from the Anglo-Zulu wars of 1879, and a rock art site from Van Reenen in Natal, once richly adorned with San imagery, but since completely obscured with 20th century graffiti. I offer a biography/itinerary of each of these cases, and discuss their ontological ambiguity by suggesting an appropriate framing for each visible point of inflection throughout their lifespans.

Chapter 3: Process, Practice and the Model

As with the *thing*, I begin this chapter by considering the prevalent terminology, arguing for the digitised object as *model*, being simultaneously *maquette*, *subject*, and *predictive tool*. I then suggest that in order to understand current practices in 3D recording and modelling, we need to look at prior practices, with precedent being set by plaster casts, being one of the longest-standing[3], pre-digital means of copying physical artefacts, sculpture and architectural detail. At the height of their use, around the mid nineteenth century, casts occupied a position of ontological multivalence, being instruments of teaching, research, and public consumption. Furthermore, as copies of classical sculpture, palaeontological specimens and archaeological artefacts, they were an important factor in the circulations of knowledge between Europe and the colonies in the 18th and 19th centuries. As such, they were also implicated in the *racial science* of the period, with castings of indigenous peoples being collected and circulated. Casting also provides us with a view into the practices and processes through markers left by the techniques and the practitioners on the finished cast.

3 The Louvre opened their casting workshop, or *atelier de moulage* in 1794, and it is still in operation, having embraced 3D printing and other digital techniques in the interim.

Having looked at similarities between casting and digitisation, I then unpack the processes of digitisation, both generically and then specifically referencing 3D photogrammetry, after which I describe the 3D model as a technical construct, and how we might see it as analogous to the cast. I look at Lacan's *point de capiton* — or "quilting point" — as a further connection with the idea of casting. I then move on to orienting the 3D model ontologically, looking towards Latour's idea of circulating references, and the idea that that *translations* happen at each stage of digitisation, rather than acts of copying or mimesis. Digitisation then takes the form of an overall translation, with the link to the original being *algorithmic* rather than *indexical*.

I then describe the technical processes of 3D photogrammetry, and its basis in pre-digital surveying and mapmaking, after which I relate the *chaîne opératoire* of the digitisation of one of my exemplars, and discuss the nature of the resultant object and the craft practices involved. I argue, based on these results, that current frameworks are inadequate for documenting digitisation as practice, as they focus on technical configurations and settings, providing no acknowledgement of craft and practitioner involvement. The creation of the 3D model is a site of learning *with* and *from* the physical thing, and current frameworks obscure this in favour of the didactic digital model.

Chapter 4: The Nascent Digital Object

In this chapter I examine the nature of the digital object as more than just a spectacular visualisation, or "virtual object", and focus on three commonly observed aims for digitisation and their respective audiences. These are, loosely: *access to collections*, the potential for *new and novel research methods*, and *preservation* from decay or destruction. I unpack these in detail, considering commonalities and differences, and how they inform the subsequent digital object and its continued existence. Having outlined common motivations for digitising collections, I discuss the idea of *mass digitisation*, or quantitatively-driven digitisation, and parallel tropes of technological fetishism within discourses of digitisation.

Following this, I explore the problem of some form of recontextualisation of the digital model in order to produce a coherent epistemic digital object, without which it may remain marooned on a storage device somewhere. This involves establishing the object within a metadata schema, which, much as the case of a physical artefact in a collection, involves classification, naming and schematising. These schemata act to "concretise" the digital object, and owe their existence to existing classification systems, and thus tend to reinscribe misalignments and violences first constructed in colonial science, museology and archiving practices.

Within material culture studies in general, we look to build narratives involving things. In order to do so, we need rich metadata, descriptions and documentation as part of the digital object. I take some key passages from biographies of my exemplars, and illustrate the ontological shifts and misalignments which happen when reinscribing them as metadata. I debate the philosophical and technical structures of a commonly-used schema in heritage and archaeology, this being the CIDOC-CRM ontology. I look to my examples and their representation in metadata form to illustrate the inherent problems of describing ambiguity, uncertainty, interpretations and other non-technical discourse using formal schemata. This underlines the need to consider, firstly, alternative approaches for constructing narratives from atomised metadata, and, secondly, if we are to understand the processes which created the digital object, and afford it epistemic value, a means of recording the practitioner's involvement. I discuss this in concluding the chapter.

Chapter 5: Aura, Authority and Authenticity

Within this chapter I examine the ontological states of the thing itself, and for this I return to Benjamin's ideas of aura and authenticity. Given that authenticity is an important concept within heritage discourse, I discuss two different approaches, firstly, the essentialist approach, which takes authenticity as being inherent to the fabric of the thing itself. This approach was common in the 19th century, being a foundation of Morris' and Ruskin's approach to historic buildings. The second approach is that which presents authenticity as culturally constructed, through discourse and habitus. I then argue that it is productive to reconcile

both approaches, as they offer insights across the multiplicity of ontological states held by a thing throughout its lifespan, including its instantiation as digital object.

Following this, I note that Benjamin's ideas of authenticity and aura cannot easily be disentangled, but for the purposes of this chapter I will disambiguate them both as forms of authenticity, namely "provenential"[4], or forensic authenticity, and "affective" authenticity, describing the nature of our material and emotional engagement with a thing. Having these tools at hand, I proceed to argue that things take different pathways over their lifespans, and the balance between various forms of authenticity shifts with the thing along these pathways. Provenance may reinforce legitimacy within a collection, while lack thereof may actively destabilise extant knowledge — I discuss the provenential authenticity of my NM176a case study with these ideas in mind, as it moved along pathways of becoming an ethnographic artefact and epistemic object. Alternatively, a thing may move along pathways within the art and antiquities market, where provenance takes different forms, and in fact may be actively obfuscated or outright invented. I then shift my focus to affective authenticity, and think about this in terms of ontologies and alterities, which inform how people may have engaged with the thing in different contexts. I then look towards my Scotston rock art site exemplar, and discuss how we and others may have seen it within its ontological plurality.

Finally, I consider the shift of these engagements into digital space, and note that conventions within visualisations and display of 3D digital objects often fracture anthropocentric norms and views, neutralising any affective response. I discuss the status of the digital copy, and, rather than it being inferior, as copies are often seen, I present it as generative — as the mould from which more can be made, rather than inferior mimesis. I end the chapter with an acknowledgment of recent developments in generative machine learning ("AI") and the potential for generation of artwork and 3D models to undermine many aspects of authenticity and continue reinforcing systemic bias.

My position as a white male scholar in a post-colonial society – that of South Africa – provides a further complication in the context of my own *habitus*, experience and bias.

4 Relating to provenance; see (Dewdney 2019, p. 75) .

Being both aware of and firmly imbricated within the colonial epistemologies which formed, and continue to form the foundation of the fields within which I am working, these being archaeology, anthropology, museology and knowledge organisation, makes it impossible – and rightly so – to claim any sort of neutrality.

However, given the awareness within these fields of this problem, I position this work not as an objective study, but as an observation from within, and ensuing problematisation of various aspects of the practice of digitsation as it currently stands. As we are all aware, the time, personnel and most importantly – funding – to effect far-reaching change in these fields is lacking, and so I attempt to understand and offer some small acts of resistance and challenge to the spectre of mass-digitisation.

1

OBJECTS AND ONTOLOGIES

> Our museums are ghastly charnel-houses of murdered evidence ; the dry bones of objects are there, bare of all the facts of grouping, locality, and dating which would give them historical life and value.
>
> Flinders Petrie, 1904, *Method & Aims in Archaeology* p.48

> Objects in museums might well be thought of as facts without their clothes on.
>
> Julie Marcus, 2012, *Towards an erotics of the museum* p. 189

1.1 THE EPISTEMIC THING

Inducting an object into an organisational schema inscribes it with an epistemic value it did not have before. Hannah Turner characterises this as the transformation of a *mundane* object into an *object of knowledge* (Turner 2020, p. 66). As Turner states, the objects "become 'specimens' as fully accounted for and legible in a specific, pervasive discourse" (2020, p. 66). Objects may have some form of documentation accompanying them, such as field notes or other traces: in the context of archeaology, Lucas calls this small mobile assemblage an *archive* (Lucas 2012, p. 230). These traces (or archival assemblages) need to be concretised and made *durable* in order for the object to fulfil its commitments as an object of knowledge (Rheinberger 2011; Brusius 2017, p. 267).

Hans-Jörg Rheinberger calls these *epistemic things*, which he defines as

> Material entities or processes—physical structures, chemical reactions, biological functions—that constitute the objects of inquiry. As epistemic objects, they present themselves in a characteristic, irreducible vagueness. This vagueness is inevitable because, paradoxically, epistemic things embody what one does not yet know (Rheinberger 1997, p. 28).

These things may not just be objects, but also instruments of observation, techniques, models or other representations. They actualise the deep entanglements between the physical world and theory, and the tools and systems we use to understand them (Tybjerg 2017, p. 269).

For things to become "objects of knowledge" or "epistemic things", we need information about them. One form in which this manifests is that of metadata, which owes its origins to some of the key formative processes of the scientific revolution — classification systems, taxonomies and ontologies. I will discuss the structure and nature of metadata and how it may be mapped onto (and from) the physical world, in chapter 4, and so here I will focus on key points in the evolution of these schemata and their origins in early practices of collection. Furthermore, these systems embody the issue of the divide between "the soil, bones and stone tools" as subjects of archaeology and our placement and representations of them as found in archives and collections (Lucas 2012, p. 237). Quine called this *semantic ascent*, which he describes as "the shift from talking in certain terms to talking about them" (Quine 2013, p. 250).

These practices created a need for formal structures and repositories in order to locate them "within the world". Moreover, the classification systems and taxonomies in widespread current use, being derivative of those that came before them, are firmly rooted in 18th and 19th-century practices of colonialism, othering and exploitation. I unpack and highlight the importance of both being aware of this burden of history and the need to consider and possibly construct alternative systems in an attempt to mitigate the biases and problematic assumptions on which they were constructed.

I will then engage with the idea of *ontologies*, popular for some time in anthropology, and more recently archaeology, and consider the deployment of these concepts within the

field of *knowledge organisation* (as this provides some frameworks for working with digital objects as epistemic things), and how these two derivations of the original philosophical construct may be brought into alignment in order to later discover something of the nature of the digital copy.

The reliance on legacy systems of ordering and classification highlights two primary issues which I will consider in this chapter. Firstly, their colonial underpinnings eschew any engagement with non-Western epistemologies, and secondly, they begin to collapse when confronted with non-physical things. This latter factor is also apparent in discourses related to *intangible heritage*, characterised by Logan as "heritage that is embodied in people rather than in inanimate objects" (Su 2018, p. 922), in other words art, performance, culture and memory. While the digital objects I discuss are re-mediations of physical material culture, they exhibit the same instability, with notably different behaviour to physical objects as knowledge-carriers.

1.1.1 *On things…*

The first question which came to mind when starting this research, was, "what do I call the *stuff* I'm working with?". Object, artefact, *thing*, or something else? Given that I'm looking at both physical objects and their digital counterparts, each with varying levels of materiality and physicality (or manifesting these in different ways), this was more complicated than it seemed at first glance. The physical object within a museum collection at that moment occupies a known ontological space, whereas the digital object's ontological status is uncertain at best.

Yuk Hui, in attempting to describe the existence of digital objects uses Aristotle's term of *eidos*, referring to "form", rather than *morphe*, roughly corresponding with "matter" (Hui 2016, p. 6). This subscribes to the pernicious construction of a "physical/digital" binary, or a "real/virtual" divide (Boellstorff et al. 2016, p. 387). This approach seems unproductive when working with an *object of knowledge*, as regardless of the form this object takes —

whether physical or virtual — it is still potentially an object of knowledge within the same epistemic networks.

Archaeologist Ian Hodder suggests that we are more likely to use the word *object* for something that is stable in form, for instance a pot (Hodder 2012, p. 7). He continues, saying that "the term 'object' is very tied up in a long history which opposes subject and object, mind over matter, self and other. It connotes an objectifying approach in which material matter is analyzed, codified and caught in disciplinary discourse" (2012, p. 8).

My research looks at objects which — before digitisation — are ontologically mobile yet physically stable. They manifest different states of being at points through their life, their creation, usage, discarding, collection, study, and so on. However, they may also occupy different states simultaneously, or the indeterminate ontological state of the intangible, digital form. Furthermore, despite being mobilised from within different heritage-aligned fields, the digital objects themselves seem to originate from within an ontological and disciplinary void. They are however agents located within a network of relationships and circulating references; they accrete knowledge and information around them, and — as objects within an epistemological framework — are a product of processes and decisions.

In their work *Thinking Through Things*, Henare *et al*, building on work by anthropologist Marilyn Strathern, propose that "The advantage of *things* as a term is that, unlike *objects*, *artefacts* and *materiality*, they carry minimal theoretical baggage". They suggest that starting with this term, evacuated of theoretical weight, allows one to rethink its status:

> Rather than going into the field armed with a set of pre-determined theoretical criteria against which to measure the 'things' one already anticipates might be encountered, it is proposed that the 'things' that present themselves be allowed to serve as a heuristic with which a particular field of phenomena can be identified, which only then engender theory (Henare, Holbraad and Wastell 2007, p. 5).

Both Henare, and Hodder (quoting Heidegger) employ the concept of the *þing* , denoting (in this case in Old Norse and modern Icelandic), the *thing*, or a "gathering place, a space

for discussion and negotiation" (Henare, Holbraad and Wastell 2007, p. 6), a thing gathers together affordances and agents, it is both a part of the world and a tool of engagement with the world.

Thing allows us to avoid the implication of a binary distinction between subject and object, and an associated real/virtual dualism. It emphasises that things are not passive objects, that they have agency and potential to shape experience and knowledge.

1.2 COLLECTING THINGS

1.2.1 *Collection and context*

When discussing collections, museums and classification in this section, I will be working mostly within the context of the late 18th to early 20th centuries, as this marks a key epoch in the entanglement of Empire, colonialism, classification, and the formalisation of academic disciplines such as geology, palaeontology, evolutionary study and archaeology. I will be referring to significant collections of the period, including the British Museum, the Smithsonian Institute, the Pitt-Rivers Museum, and locally, the Iziko Museums of Cape Town. One of my case studies also resides in the KwaZulu-Natal Museum, which was founded in this era.

The late 18th century saw personal collections having significant influence in the development of early scientific thought. Collectors of this era tended to have either private collections in their homes - "personal museums", for which they would often charge admission, or belonged to clubs or societies frequented by like-minded "learned" collectors or amateurs. While most collectors tended to acquire objects for the sake of curiosity and for aesthetic appeal and often had little academic interest in the objects they collected, there were notable exceptions — for instance evolutionist, early archaeologist and collector General Pitt-Rivers.[1] A military man, his interest began with the collection of small firearms,

1 Whose interest in antiquities and archaeology stemmed from his military career and tenure on the board of the RUSI (Royal United Services Institute) museum, with its haphazard collection of weaponry (C. Evans 2020, p. 96)

leading to his attempts to describe technological evolution through typological organisation.[2] His later involvement in field archaeology was in service of his desire to extend these evolutionary sequences of tools and weapons (Bowden 1991, p. 55; C. Evans 2020), and his collection later formed the basis for the Pitt-Rivers Museum in Oxford.

Meanwhile these collectors — and their collections — formed the core around which learned societies accreted and gravitated. The Royal Society, for instance, being amongst the first of these. Founded in 1660, its members were initially involved with a broad array of interests in natural philosophy, but by the late 1700s they were almost exclusively concerned with "antiquarian" matters (S. M. Pearce 1995, p. 118; Henare 2005). The collections amassed by their members frequently formed the basis of other large museums; for instance Sir Hans Sloane's personal collection formed the basis for the British Museum, which opened in 1759 (Delbourgo 2017, p. 320). Similarly, Elias Ashmole's collection led to the creation of the Ashmolean Museum in 1683 in Oxford (2017, p. 306). Locally, the collection built by members of the Natal Society became the basis for the new Natal Museum in 1903 (S. Brooks 1988; Pridmore 1999).

The act of collection, by definition, removes an object from its original context, and through both intentional and unintentional processes frequently results in the object being stripped of much of its meaning and affect. Collections accumulate space and time, and flatten both to the point of invisibility. Susan Stewart notes that time is made "synchronous" within the scope of a collection, while Foucault constructs museums, collections and libraries as *heterotopias*, suggesting that they are representative of the idea of

> Accumulating everything, of establishing a sort of general archive, the will to enclose in one place all times, all epochs, all forms, all tastes, the idea of constituting a place of all times that is itself outside of time and inaccessible to its ravages, the project of organising in this way a sort of perpetual and indefinite accumulation of time in an immobile place… (Foucault and Miskowiec 1986, p. 26).

2 Pitt-Rivers in fact seems to have invented the term *typology* (Piggott 1959, p. 48)

Foucault continues, stating that the heterotopia is capable of "juxtaposing in a single place several spaces, several sites that are in themselves incompatible". This heterotopia manifests as a constructed and curated spatiotemporal volume, offering visitors concurrent access to things disarticulated from both place and time. The 19th century museum heterotopia was about completeness and the creation of a "general archive" of all things from all times designed to preserve things in perpetuity (Hooper-Greenhill 1990, p. 58). Additionally, there was a drive toward completeness, as an incomplete collection meant an incomplete model of the world (Pomian 1990, p. 57).

Curators, scientists and natural philosophers were working under the conception that meaning was *intrinsic* to an object, and lay dormant until exposed through observation. By categorising, cataloguing and arranging things the "substance inherent in things" could be animated and thus contribute to understanding of the world (Henare 2005, p. 64). The act of categorising, planning and displaying itself enabled the construction not just of exhibits but theories as well, as Sharon Macdonald suggests, the museum is "a theory: a suggested way of seeing the world" (Macdonald 1996, p. 14). This arrangement of things happened in both a theoretical manner — through the use of taxonomies and systems, and a physical manner, in cabinets and vitrines in collections and museums. The aspiration of these practices within the 19th century museum, according to Eugenio Donato, was to "give by the ordered display of selected artefacts a total representation of human reality and history" (Donato 1980, p. 221). European museums of the period positioned themselves predominantly as locations of public education and enlightenment and instruction, with curators casting themselves "in the role of benevolent educators, dispensing rational and more particularly 'scientific' knowledge about the colonies and their indigenous peoples" (Coombes 1994, p. 43).

Colonial museums, despite being on the periphery, had similar aims, albeit with local focus. The Natal Society Museum (later to be the Natal Museum and currently the KwaZulu-Natal Museum) had as its primary function education of European settlers to the region, providing information about local resources and practical knowledge for settling and farming (S. Brooks 1988, p. 59), its function being not just to educate, but also to facilitate exploitation of the resources of the colony.

Museums also accreted and bound together specialists with common interests, providing nucleation points for their research. As Olsen notes

> These institutions, likewise, did more than order artifacts. They also regulated entry to the discipline, controlled titles, and facilitated interactions with colleagues by hosting visiting scholars, conferences, and invited lectures. Moreover, they sought to perpetuate their existence (Olsen 2012, ch 3).

The institutes were greenhouses for the growth of significant disciplines, such as palaeontology, geology and archaeology. The interaction of multiple institutions and actors resulted in these disciplines coalescing into coherent fields, and marked the shift of what might be termed "leisure"[3] activities into legitimate, formal fields of study (Whitehead 2009, p. 63).

1.2.2 *Acts of decontextualisation*

Museologist Tomaslov Šola writes that "The process of decontextualizing exhibits in museums is just a misdeed against the object as the abduction into slavery is a crime against people" (Šola 1985, p. 82). Early practices of collecting and exhibiting suggested — or even demanded — that any residual context be stripped from objects, effectively neutralising any voice they themselves may have had in order to encode a new "preferred" context. Helmut Groschwitz characterises collecting as "nullifying functional relationships and fragmenting the cultural integration" of objects (Groschwitz 2019, p. 15), while Susan Stewart highlights the intentional nature of decontextualisation as *forgetting*, and concludes that this allows the collector to "start again" (Stewart 1993, p. 152).

These processes are constant and dynamic, as objects are accessioned, conserved, exchanged, deaccessioned, and possibly even curated into a display.[4] Also, the nature of the initial act of decontextualisation may vary, dependent on the object's original context — one might for instance consider the violence involved in the theft of the Benin Bronzes (Hicks 2020),

3 For instance "antiquarianism" evolved into archaeology.
4 Groschwitz places the percentage of any museum's collections on active display as between 2 and 5%.

or conversely, the commissioning of a piece from an indigenous artist — as illustrated by my NM176a case study and its companion pieces. In the case of ethnographic objects, curator and archaeologist Christopher Wingfield reiterates that the degree and mode of decontextualisation needs to be considered, and the oft-deployed discourse of how objects are "detached and carried away by ethnographers" needs to be critically assessed (Wingfield 2011, p. 121). While some objects may have been valued ceremonial objects which were stolen or gifted under duress, others may have already "reached a stage of becoming outmoded and being discarded" (Groschwitz 2019, p. 14).

Furthermore, the *nature* of the decontextualisation varies according to discipline. Prior to formalised archaeological and ethnographic field practices, antiquaries and *dilletanti* concerned themselves with collection, and *thing* rather than *process*, and so context (possibly beyond a culture or region) was paid little attention (I discuss this further later in this chapter). Even within later, formalised archaeology, inadvertent loss of notes or lack of adherence to documentation requirements can result in the loss of context of things. Alison Wylie, following archaeologists working with 19th century records, comments that

> …they find not only that the empirical legacy of 150 years of archaeological work is rife with gaps and inconsistencies, a reflection of evolving retrieval and recording practices, but also that it has been badly compromised by poor storage conditions, sometimes lost altogether, or dispersed among institutions in ways that greatly complicate any systematic use of existing records and collections (Wylie 2008, p. 198).

Objects circulating on the international market, destined for private collectors, galleries or museums often have little context or the context is intentionally obfuscated or fabricated. Muscarella describes the case of looted antiquities on the market — and as subjects of research in museum collections — all with doubtful, probably entirely fabricated provenances (Muscarella 2013, p. 955). Objects can be legitimised through their involvement in a high-profile personal collection, or by passing through a "transit market" (Kersel 2006, p. 193), where their provenential status is "reset" and they receive a "clean bill of sale" — Price describes this as the object being "issued a new passport" (Price 1989b, p. 102). Brodie

notes how auction catalogues are known for their cliches in describing provenance, such as "property of a European gentleman" or "bought on the London market" (Brodie 2014a, p. 63). They might also not necessarily have been looted, but exported from countries after the implementation of various international conventions and treaties on trafficking and movement of antiquities (Renfrew 2006, p. 246).

Wingfield suggests the field collector as the principle "agent of detachment" through which an object is removed from its authentic context (Wingfield 2011, p. 122). However, the term "field collector" carries much weight here, with little indication, for one, on *how* the objects were collected or acquired. For instance, Alison Petch relates Pitt Rivers was not the field collector for much of his collection, and he did not know many details of the objects. Furthermore, he did not attempt to obtain any of this information from the collector (Petch 2021, p. 101). On the other hand, however, Turner notes that 19th century "relic hunters" in the American Southwest produced detailed catalogues with comprehensive locality information in order to sell material — although it is important to note that their primary market was directly to museums, not collectors (Turner 2020, p. 59).

1.3 DOCUMENTING THINGS

1.3.1 *Accessioning things*

The first order of induction into a collection or system is inscribing the object's details in the accession register, and assigning an accession number; Alison Petch describes this as "the basic information building block of the museum" (Petch 2021, p. 98). Systems of cataloguing and classification used in museums and collections have generally (until fairly recently) been primarily *internal* systems, serving registrars and curators (F. Cameron 2013, p. 83). Despite their primary mission being outward-facing, that is towards the public and researchers, the systems are for internal use in the service of *collections management*. This lies in direct contrast to libraries and to some extent, archives — where these schemata are designed as standardised in order to facilitate interoperability between disparate systems (Bowker and Star 1999; Olson 2011). Furthermore, library and archival systems have the primary task of aiding the *finding* of materials and providing access points for the archive,

whereas museum systems — in addition to this function — are also designed to facilitate the *classification and study* of materials. These systems were primarily descriptive, favouring measurements, typologies and taxonomies, and much of how these were captured also depended on the individual who was cataloguing them, as different collectors or curators used different terms for similar objects (Turner 2020, p. 150). The systems are not static, and change over time, as Bowker and Star observe:

> When we ask historical questions about the deeply and heterogeneously structured space of classification systems and standards, we are dealing with a four-dimensional archaeology. The systems move in space, time , and process. Some of the archaeological structures we uncover are stable, some in motion, some evolving, some decaying. They are not consistent (Bowker and Star 1999, p. 42).

An object's existence as "object of knowledge" is entirely dependent on documentation — description, provenance, and standardisation within these practices; there was little of any of these in early collections (Turner 2020, p. 85). For example, in both Pitt Rivers' collections, and that of the Smithsonian Museum of Natural History (which true to form for the period, was also collecting ethnographic material), the accession registers had little regard for either ethnographic origin or field collector of the object (Wingfield 2011; Petch 2021). Otis Mason, curator of ethnology at the Smithsonian museum of Natural History, stated that curators were to describe "the full history of the object in as few words as possible" (Turner 2020, p. 50).

They were however, extremely rigorous in maintaining the link with the collector or donor who provided the object to the collection, as they were invariably the final arbiter of origin and authenticity (Turner 2020, p. 50). Laura Kate Gibson observes similar behaviour in colonial era South African museums, noting similar practices in recording provenance: "The 'who,' for example, was concerned with who collected or donated the item, rather than who made it, and the museum was more interested in capturing where and when it was collected, than where and when it was made" (Gibson 2020, p. 90).

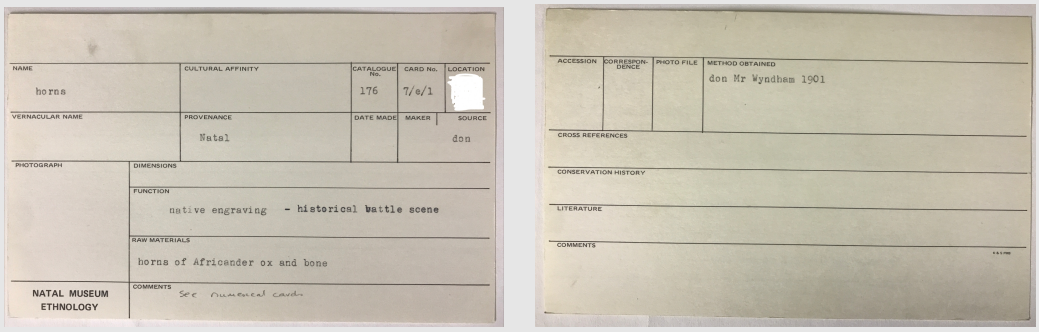
Similarly, much of Pitt Rivers' collection was not collected by him, and so much detail of the objects remained unknown; the information accompanying the objects was often "crude and undetailed", in fact to such a degree that Petch (while cataloguing and digitising the Pitt Rivers founding collection) states that the collection provides many examples of "how not to" provide information about artefacts (Petch 2021, p. 100). For example, one randomly selected item has the record

> 466, 467. Plain and round cylindrical clubs. Fiji Islands. Fig 53

Wingfield also notes that, similarly to the Smithsonian, over 99% of objects in the Pitt Rivers collection have a documented *PRM Source* — the donor, collector or institution from which they obtained the object, while fewer than 20% of the objects have a known *maker*. Wingfield further relates the gaps in stating that "The further one travels away from their arrival at the Museum, the more obscure the human and transactional history of its objects becomes." (Wingfield 2011, p. 120). Practices at the KwaZulu-Natal museum appear to have followed a similar course; the catalogue entry for my NM176 case study reads as follows:

> 176A. "Native engraving on horns of Africander Ox, Natal." Source "Mr Wyndham 1901". (Maggs 1990, p. 144).

The associated card is shown in figure 1.1. Maggs agrees that, true to practices of the period, more attention is given to the donors (prominent colonial officials) than to the artists, who remain anonymous (Maggs 1990, p. 144).



Front *Reverse*

Figure 1.1: NM176a catalogue card, circa 1980. *photographs: Dr. Justine Wintjes*

It is worth noting that generally, the combination of accession register entry and index card do not form the totality of documentation of the object, being primarily indexical. However, in the case of these early collections, this *was* more often than not the case. The act of accessioning an object, as curator Stephen Williams notes, is an *institutional level* process involving one or more objects (S. L. Williams 2004, p. 43). This entails the assumption of legal ownership of the objects, and to "qualify and quantify" the objects, and provide an auditable and traceable record of their status within the museum.

1.3.2 *Documenting things*

In addition, the museum was at the time part of the Natal Society, without premises or staff, and was run by amateur naturalists rather than professionals. As a result, documentation practices were somewhat informal. Ernest Warren was appointed director of the museum in 1903. An academic zoologist with a PhD from University College, London, his aim was to professionalise the museum, and make it into a model institute for the Empire (S. Brooks 2005, p. 8). In an interview with the colony's leading newspaper, he is recorded as saying that "the present classification … is naturally very defective. The labelling is simply done on pieces of dirty card" (2005, p. 9). [5]

Further to the problem of fragmentary documentation, is the difficulty of standardisation of terminology. Chenhall and Homulos observe that it was only curators who generally had contact with things and records, but with the increase in museum outreach and education, administrative transparency, and collaboration, a need became apparent for some sort of systematic standardisation (Chenhall and Homulos 1978, p. 205). As late as the 1970s, trial projects intent on computerising the catalogues of various American art museums showed an alarming lack of standardisation and documentation of cataloguing practices even *within* each individual museum. As David Vance records, there was even lack of agreement amongst

5 The accession register was started in 1904 and the card system dates to the early 1980s, leaving a significant gap between a thing being captured and further documented.

museum staff on the usage of terminology and fields on their cards and labels. He recounts that

> Examining these museums' files, one invariably found printed cards with labelled 'fields'. Nowhere was there a written definition of even one field label. Often the same label (notably 'provenience') was used by different museums for radically different content. The only way to learn what a label meant was to interrogate the staff, who often disagreed among themselves (Vance 1986, p. 41).

The disharmony in terminology seems to be a result of two problems. Firstly, the process of standardisation fixes the nature of a thing within the system, flattening its potential polysemy. Cameron writes that

> By naming objects according to prescribed and standardized descriptive fields, object documentation systems record the induction of objects into the museum contexts and thereby reduce their array of potential meanings down to one notion of significance (F. Cameron 2004, p. 248).

This results in the solidification into a single ontological pigeonhole of something which may be complex, uncertain or otherwise fluid, and exclude it from other possibilities of interpretation and understanding (Rengman 2008; Lucas 2018, p. 90). Secondly, on a more pragmatic note, the administrative load of retroactively altering terminologies is prohibitive, and was near impossible until the computerisation of records began to reach critical mass (Parry 2007, p. 54; Turner 2020, p. 137).

Further to the problem of lack of agreement and shared terminology, and lacunae in information, is that of supplemental information added later to accession registers or objects' documentation. These annotations are a form of abstract index to arcane institutional, personal or professional knowledge, which is itself frequently neither catalogued, recorded or attributed. Some of these may be corrections to fields already present on the entry, but there are often also uncontexted or cryptic annotations by unknown researchers or curators. There is rarely any place within formal documentation systems for these, particularly when

information is moved between systems or digitised, and as a result they are frequently relegated to catch-all fields such as "comments" or "notes", which quite effectively removes them from systemic flows of knowledge.

Turner characterises these annotations as "marginalia", with reference to the practice of adding notes and drawings within the margins of manuscripts or books, and argues that they are "key indicators that show how actors constantly disrupt the discursive stability or form of the ledger through time" (Turner 2020, p. 75). Often, there may be occult knowledge on the objects still resident in personal notes or diaries of the collector or archaeologist which remains unpublished and unindexed.

1.3.3 *Systems of the World: ordering, classification and discipline*

This section will historicise practices of classification and ordering in collections, being an inherent part of knowledge production within archaeology, anthropology and museology. As I discussed earlier in this chapter, the museum has long been a site of knowledge production (Hooper-Greenhill 1992; Bennett 1995; Whitehead 2009). This has manifest in various philosophical and epistemological variants through their evolution from personal collection to *wunderkammer*, early colonial-era and late-colonial[6] through the modern museum familiar to us. These shifts have each been marked by the formation and subsequent supersedence of epochs, or *epistemes* (Hooper-Greenhill 1992; Foucault 2012).

The *Renaissance episteme*, informing early natural philosophy and subsequent collections, was based on "interpretation and similitude, with things being read for their hidden relationships with each other" (Hooper-Greenhill 1992, p. 12). The meaning and knowledge inherent in all things would be revealed if their inscriptions and signs could be understood and related. Foucault quotes 16th century philosopher and alchemist Oswald Croll as saying "Is it not true that all herbs, plants, trees and other things issuing from the bowels of the earth

6 I specifically note these with reference to Bennett's observation of the "reordering of museum scripts" post the 1851 Great Exhibition, marking a shift towards reinforcing a "capitalist and industrial economic and social order" (Bennett 2012, p. 147).

are so many magic books and signs?" (Foucault 2012, p. 30), and offers that "a knowledge of similitudes is founded upon the unearthing and decipherment of these signatures. It is useless to go no further than the skin or bark of plants if you wish to know their nature; you must go the prose of the world" (Foucault 2012, p. 29).

These self-referential circular logics were ruptured through the late 17th century by the structure of the *classical episteme*, based on order, measurement and the creation of classificatory tables as the basic structure of knowledge (Hooper-Greenhill 1992, p. 15; Foucault 2012, p. 81). This heralded an age of taxonomies and classification where collation of an object's physical properties and associated classification was enough for an interpretation to be considered objective truth (F. Cameron 2013). Formerly dispersed knowledges and specialities coagulated in the form of learned societies and emergent fields such as geology and palaeontology. This episteme was foundational in the formation of ecologies of classification and knowledge production, and the emergence of natural historians and the Linnaean system.

This was again ruptured by the *modern episteme*, from the late 18th century, with the imperative to look beyond the object, and at how "things came to look as they do" (Foucault 2012, p. 17). The key to this episteme is the animation of relationships and links between things. Things were "inserted in the flow of time", and positioned within evolutionary series (Bennett 1990, p. 42). Bennet suggests that the advent of the modern public (and disciplinary) museum coincided with (and in fact required) the emergence of new fields, as he states,

> … the emergence of a new set of knowledges - geology, biology, archaeology, anthropology, history and art history - each of which, in its museological deployment, arranged objects as parts of evolutionary sequences (the history of the earth, of life, of man, and of civilisation) which, in their interrelations, formed a totalising order of things and peoples that was historicised through and through (Bennett 1990, p. 42).

Most museum collections were at this point ordered geographically - by region of origin, including the massive collections of the British Museum (Chapman 1985, p. 23). Augustus Pitt-Rivers was inspired by Natural Historians (and early geologists, as the Geological Society at this point was discovering "deep time", with the fossil as its focus), and their ongoing project of developing an evolutionary tree for animals. However, he was intent on using a different temporal marker — archaeology, rather than geology (Wingfield 2017, p. 601). He wrote at the time that the current systems were inadequate, stating that the collections of the British Museum were all but "useless" as tool of education or research. Owing partly to his interest in race — and how contemporary races could inform ancient ones, he arranged his collections typologically to illustrate his theories of evolutionary progression, outlining his approach as follows:

> For this purpose ordinary and typical specimens, rather than rare objects, have been selected and arranged in sequence, so as to trace, as far as practicable, the succession of ideas by which the minds of men in a primitive condition of culture have progressed from the simple to the complex, and from the homogeneous to the heterogeneous (Pitt-Rivers 1875, pp. 293–4).

Much of this resulted from Pitt Rivers' early typological classification work focused on weapons, and constructed *his* narrative of an uninterrupted evolution from the aboriginal throwing stick to the mediaeval musket (Bennett 2017, p. 10).

Similarly, but more sweepingly generalising, Christian Thomsen published his now universal *three-age* system in 1836, dividing human history into Stone, Bronze, and Iron ages. Schnapp writes that "Thomsen's system was not a theoretical model spontaneously thrown together on its author's intuition, but the product of minute descriptions of assemblages, systematically compared one with the other" (Schnapp 1996, p. 300). Thomsen's classification was not directly based on evolutionary ideas, but function and seriation, and was informed by ideas common at the time — as was Pitt Rivers — that "less developed" contemporary cultures illustrated the earlier ages of European culture (Heizer 1962). This was a long held and persistent view, already having been set down by writers such as Thomas Hobbes in his 1651 work *Leviathan*, and John Locke in 1690 (1962, p. 261).

Within South African archaeology the San formed the foundation of this discourse in the late 19th and early 20th centuries. They were considered the "authors of prehistory", with their material culture in the form of artefacts, art, and their bodily remains being written as proxies for archaeological artefacts and rock art in general (Shepherd 2003, p. 829). The technological capacity of contemporary peoples being synonymous with progress, social complexity and perceptions of worth was (and still is) pernicious. Meskell problematises this fact that cultures are "correlated back into prehistoric time", and that this reinforces the idea that "impoverished material culture equals impoverished culture in general" (Meskell 2008, p. 11). Breaking with this tradition of the period, Franz Boas was instead looking to display the diversity of humanity (Livingstone 2003, p. 34), insisting that things should be seen within context of their original cultures, and that "civilisation is not something absolute, but that it is relative, and that our ideas and conceptions are true only so far as our civilisation goes" (Jacknis 1985, p. 83).

While these epistemes are quite reductive in their mechanical repetition of disruption, they offer a useful heuristic device for understanding collection and classification, as they orient conveniently with similar shifts in knowledge production through collections. Hooper Greenhill notes that

> In many ways, Foucault's three epistemes appear remarkably improbable. They certainly raise issues and approaches that have not been used to explore any history of museums. And yet, there are resonances here that are tantalising (Hooper-Greenhill 1992, p. 18).

Current classification schemata — which owe their existence to the classical episteme — still bear traces of its classification tables and their construction through hierarchy, difference and othering. Bowker and Star consider these systems themselves as historical and political artefacts (Bowker and Star 1999, p. 285), and as such, they too record the shifts and ruptures in their own definition and redefinition through time (Von Oswald 2020, p. 110).

1.3.4 *Standards and the shaping of power*

These systems emerged within the epoch of European colonial expansion, and record keeping was a central tool within the colonial apparatus. Records were essential for "describing, itemising and controlling the colonised" (Cunneen 2005, p. 68). An intricate knowledge of the colonised and their resources was crucial to the ability to control — one should remember that in its original sense, colonialism referred to the "use of state power to (attempt to) secure monopolies for national companies" (Bastian 2006, p. 272).

The colonial project took custody of lands and peoples through their ability to classify, name and describe things in the interests of science – replacing what it considered irrational, superstition-based indigenous power with the sheer force of "rational knowledge" (T. Richards 1993; Pratt 1992, p. 7; McNiven and Russell 2005, p. 181). Naming in this case provided the ability to impose order on the world, by renaming people and things, and reclassifying people as subjects or as "not-people" (Olson 2002; Duarte and Belarde-Lewis 2015), thus facilitating and justifying its violent and genocidal methods. Māori scholar Linda Tuhiwai Smith writes that

> Imperialism provided the means through which concepts of what counts as human could be applied systematically as forms of classification (S. M. Smith 2021, p. 25).

As I discussed earlier regarding Thomsen's three-age system and the correlation of contemporary cultures back into (pre-) historic time, these hierarchies and schemata determined where the colonised lay on the evolutionary scale. Through these abilities of classificatory conquest, European colonisers shaped the nature of their relationship with indigenous cultures, and conspired to construct and normalise the ranking of the colonised in a specific manner (Montenegro 2019, p. 736; Gibson 2020, p. 82), and informed rules and norms which determined the manner of interaction with colonised indigenous peoples.

1.3.5 *Standards and universality*

Anthropologist Mary Douglas argued that Classification systems are fundamental to human cognition and social organisation, and essential in trying to make sense of complex or ambiguous phenomena (Douglas 2002). These systems — and all knowledge production systems — are situated socially, culturally and historically. This was further argued by Donna Haraway, emphasising the need to acknowledge and embrace the diversity of perspectives and experiences shaping knowledge production, while being aware of the illusion of the unbiased, objective viewpoint (Haraway 1988; Montenegro 2019, p. 735). Castro-Gómez characterises this as a point-of-view which denies *being* a point-of-view, and claims universalism, producing knowledge from the "Western man 'point-zero' god-eye view" (Grosfoguel 2010, p. 69).

Given the inconsistency of earlier systems, efforts were made to prescribe terms, fields and categories, and limit vocabularies in order to control the profusion of synonyms used by curators or collectors for object types. For instance, Turner records that the American Museum of Natural History — at the time their ethnographic records were being computerised in the late 1980s — was using almost 10 000 unique terms in describing objects. In comparison, the Pitt-Rivers Museum was using fewer than 1000 terms (Turner 2020, p. 152). The attempts at standardisation and minimisation of disparate terminologies tended to normalise and reinforce extant discourses. As Ruth Philips states, objects were sorted "according to criteria of homogeneity determined not by historical sensibility, but by abstract typologies derived from nineteenth century discourses of natural history, history, and art history" (R. B. Phillips 2011, p. 99).

The need for standardisation has been well acknowledged, particularly starting in the late 1970s with the advent of computerised cataloguing systems in museums (Gautier 1978; Parry 2007, p. 37). Bearman notes that:

> A standards-based information management strategy should help individual museums acquire information less expensively and with greater functionality

> but its real pay-off is for the cultural heritage community as a whole. There it promises to make our information collectively useful (Bearman 2010, p. 49).

Standardisation, however, imposes an artificial rigidity on the thing and reduces the many networks and relationships within which a thing is situated to a handful of keywords and vigorously argued terminologies. As mentioned earlier, the application of these is often even disputed amongst curators working on the same collections, leading to misclassification based on individual opinion or subjectivity, or *lumping* of things into convenient reductive categories. For instance, Keletso Setlhabi recounts systems at the Botswana National Museum, with the primary categories being *art*, *ethnology*, *archaeology* and *natural history*, and the criterion for initial classification rests with the acquiring curator — such that if an object has "strong visual components to showcase creativity and design" it may be accessioned as *art* (Setlhabi 2012, p. 157). Similarly, Gibson, looking at schemata at Iziko Museums in Cape Town, uses the example of an assemblage of ceramics accessioned simply as "pots" (Gibson 2020, p. 85). The objects have been identified — based on function — by Zulu community members as *izinkhamba*, *imbiza* or *umancishana*, yet these terminologies are "erased by the blanket classification *pot*" (2020, p. 87).

Standardisation of vocabularies and terminology, for instance with the advent of Chenhall's 1978 *Nomenclature for Museum Cataloging*[7] (Chenhall 1978) resulted in this narrowing of categories in the interests of aligning internal systems and collections with each other. The subsequent computerisation of records exacerbated this trend, as noted by Srinivasan *et al*:

> In effect, the informational core of the museum, namely, the representations and classifications of objects in the museum's catalog, is being stripped of the multiple meanings and ontological perspectives in this rush to digitize and enable "universal access" and interoperability between museums (Srinivasan et al. 2009, p. 266).

7 Still actively maintained and updated as an ongoing standard (Gouvernement du Canada 2018).

Baines and Brophy note with concern the diffusion of this trend into archaeology, writing that it has the potential to "restrict archaeological discourse to a vocabulary that can only be used to describe the past and its material traces as a collection of non-relational, objective facts" (Baines and Brophy 2006, p. 211).

Within this section I have looked at classification systems, and the epistemological frameworks within which they were constructed, and how they have evolved since then. Furthermore, understanding their limits and shortsightedness in dealing with complex things from colonised cultures — and within post-colonial contexts — equips us with necessary knowledge and tools if we are to attempt to challenge and overhaul them. Additionally, they are ill-equipped when encountering non-physical things, for instance the digital objects which are part of this research.

1.4 BEYOND ORDER: ONTOLOGIES AND OTHER WORLDS.

1.4.1 *Why an ontological approach?*

One of the aims of this research is to attempt to determine the nature of the digital object, and consider its relationship to the physical thing from which it was translated. Networks of ownership and usage, collection, study and archiving have left their traces on the thing, and the digital object inherits these. Things move through different states of being throughout their lives, as do digital objects, from their inception, and travel across machines, systems, platforms and within milieux.

As I have frequently mentioned, I am looking at things within collections — ordered and classified within a system — and as such, they might occupy similar states as part of the collection, but they may have arrived there through a multitude of different routes. An archaeological thing may have followed a pathway from creation, through usage, discard or destruction, site formation, excavation, classification and study. In its abandoned context its status and relationship to people and other things within its origin culture are unknown, and have to be retroactively reconstructed. An ethnographic thing began life as a material object with its own specific function within its living indigenous context. It was acquired

in some form of transaction involving trade, purchase or outright theft, and on accession into a collection may have brought some knowledge along with its material self.

Things are existentially multimodal, occupying differing ontological spaces at different points in their lives; at some points even being multivalent. Jody Joy writes that

> In reality as an object is living out its life it is not restricted to a single life path. Many historically or anthropologically situated studies have shown that the life trajectories of objects can often alter dramatically. They can also be re-interpreted a number of different times throughout their life, undergoing successive 'reincarnations' (Joy 2009, p. 543) .

Their identities shift and mutate, and depend on "the articulations of the epistemological framework, the field of use, the gaze, technologies and power practices" (Enqvist 2021, p. 31). Lacking cultural context and intervention, their narratives and meanings may be lost, ignored or subsumed into Western systems and schemata; for example the case of the "pots" in the Iziko museums, quoted above. These schemata eschew an understanding of an object's polysemic nature in favour of standardisation and interoperability. Thomas Richards casts this subsumption as *comprehensive knowledge*, the sense that

> knowledge was singular and not plural, complete and not partial, global and not local, that all knowledges would ultimately turn out to be concordant in one great system of knowledge (T. Richards 1993, p. 7).

This indicates the need for consideration of the overlaps between epistemology and, as Daston states, the "ultimate reality" in which things exist — the worldviews within which they were created and used; not just the worldview of their creators, but also of those subsequent users. Particularly, as Daston writes, "under conditions highly mediated by instruments and ingenious setups" (Daston 2008, p. 98) — in this case, the tools and machinery of classification and archiving. In their groundbreaking work *Thinking Through Things*, re-imagining the ontological turn and arguing against fragmentation of disciplines, Amiria Henare *et al* argue that all alternative ontologies could be considered as inherently different *epistemological* positions (Henare, Holbraad and Wastell 2007, p. 9). That is, our

ontological assumptions shape our epistemological approach; we should avoid the danger of assuming that only our own perspective is valid, and remain open to other possibilities.

Cameron and Robinson observe that

> The challenge is to revisit the current epistemological foundations on which documentation is formulated and to consider how diverse cultural and theoretical ideas, for example polysemic interpretive models (ones that recognize the inherent pluralistic meanings of objects), might revise documentation, taking account of these technological potentialities (F. Cameron and Robinson 2007, p. 169).

My case studies exhibit complex entanglements with colonial epistemological practices, and as such I felt that a more expansive approach to different epistemic frameworks might be useful to explore at this stage. As I discussed earlier, formal classification and documentation systems reinscribe many of the epistemological biases and shortcomings inherent in their predecessors (Turner 2020, p. 65). It is incumbent on us to reconsider reliance on these systems for a number of reasons.

Firstly, they are firmly anchored within the European colonial mindset and so deny the validity of other epistemologies. Secondly, they were constructed around physical objects — things — which behave very differently to intangible constructs — such as cultural concepts or digital objects — as carriers of knowledge. To this end, Lorraine Daston describes working with physical objects as "common-sense thing-ontology", which is "chunky and discrete", which does not translate comfortably to digital objects. Similarly, Geismar observes that we have trouble describing digital objects using "the language of museum collections" (Geismar 2018, p. xvii).

Materialist discourse frequently positions the *real* and the *digital/virtual* in binary opposition (Ekbia 2009, p. 2554; Boellstorff et al. 2016, p. 388), and so we tend to try to understand digital objects only in relation to physical objects, again using the language of difference.

Finally, as justification for this turn towards a more expansive, ontology-based approach to understanding things, is De Castro's observation on the current popularity of the ontological approach:

> But perhaps above all, it expresses the growing feeling that our own modern ontology (singular), such as laid down by the scientific revolution of the seventeenth century, not only was made largely obsolete by the scientific revolutions of the early twentieth century, but that it also turned out to have disastrous consequences when considered from its business end, i.e., as an imperialist, colonialist, ethnocidal and ecocidal 'mode of production'." (De Castro 2015, p. 8).

De Castro's resultant approach of *perspectivism* challenges our Western understanding of a singular ontology, considering that all actors, whether human or not, have their own subjectivities and perspectives on the world.

Similarly, within the field of digital archaeology, Eva Mol suggests we make space for both past – and non-human – ontologies and experiences, as the framework within which much of this work is performed considers "human" in the context of the Western, white male (Mol 2020, p. 66). Furthermore, she writes that

> We can attempt to dissolve boundaries between human and non-human, between the inner and the outer world, but also between analogue and digital (68).

By acknowledging the existence of multiple distinct ontological frameworks, we can attempt to shift our eurocentric approaches to epistemology.

1.4.2 *The ontological turn(s)*

Philosopher Ian Hacking writes that an ontology refers to "what comes into existence with the historical dynamics of naming" (Hacking 2002, p. 26). Ann Stoler, in *Along the archival grain*, extends this to cover "the categories of things that are thought to exist or can exist

in any specific domain, and the specific attributes assigned to them" (Stoler 2009, p. 4). While this approach may be indistinguishable from that employed within cataloguing and organisational systems as discussed earlier, these systems are singular in their worldview. Furthermore, these systems impose an artificial order which ignores the polysemic nature of objects, and their origins *elsewhere* and *elsewhen*, neglecting contexts such as *thing in community* or *thing in circulation* (F. Cameron 2013, p. 84; Greene 2016, p. 148).

The concept of an *ontology* might be more useful as a larger-scale means to describe the world or "alterity" in which a schema exists. This allows us to step back from the minutiae and critically approach the forces shaping classification and knowledge systems within particular periods and disciplines. Briefly, in an archaeological and anthropological setting, the concept of an ontology can be considered a *theory of realities*, the somewhat ethereal notion of a worldview or "mode of existence" (Alberti, Fowles et al. 2011, p. 897). Alberti suggests that "not all physical and conceptual worlds are alike" (2011, p. 900), and Boellstorff positions the ontological approach to this assertion as the acceptance of alternative (non-western) modes and models of being (in Boellstorff et al. 2016).

The various ontological turns can loosely be grouped into four approaches (Cipolla 2020a, p. 155). Firstly we have the *worldview-centered* approach, suggested by Cipolla as the most familiar within archaeology and anthropology. The focus here is on attempting to reconstruct non-western worldviews, and suggests that we "carefully consider Indigenous knowledge and, in doing so, allow[s] researchers the unique opportunity to see the cracks and arbitrary defaults in their own worldviews and disciplinary lenses" (Cipolla 2020a, p. 156).

Secondly, is the *relations-centred* approach focusing on relationality. This is a broad framework encompassing the idea that objects themselves have agency, and form networks of relations between themselves, people, and their environment. Humans and their environments are interdependent and co-constituted (Gell 1998; Latour 2005). This is further applied by Ian Hodder in his idea of *entanglement*, in which humans and their material environments are intertwined and co-constitutive, and shape each other (Hodder 2012). It also forms the basis for the Christopher Witmore's concept of *symmetrical archaeology*

(Witmore 2007), which, again, declares not just the importance of the relationships between humans and non-humans, including both objects and landscapes, but also recognises that these relationships are not necessarily contemporary with the object's instantiation, and may have significant temporal span. Shanks notes that

> The past becomes what it is through a trajectory of connections that take it far from its temporal origin in the chronometric past of dated location. The past is not to be seen as a datum under this symmetrical attitude, but as a network of relationships that continually reconstitute the past itself (Shanks 2007, p. 593).

Thirdly, is the *worlds-focused* ontological turn, in which the existence of multiple worlds is considered valid. Based on the work of anthropologist Eduardo Viveiros de Castro, this requires the acceptance of Indigenous ontological propositions as truth and attempts to move beyond Western propositions, which effectively judge and contradict their existence (De Castro 2015; Cipolla 2020a, p. 159). In applying this in archaeology, Benjamin Alberti and Yvonne Marshall emphasised the importance of local knowledge in engaging with material culture (Alberti and Y. Marshall 2009; Cipolla 2020a, p. 159).

Finally, *object-centred* approaches build on the work of philosopher Graham Harman who himself builds upon the work of Latour (Harman 2018). Where Latour concentrates on explicitly *decentering* the object to concentrate of networks of relationships, Harman argues that Latour's networks draw attention *away* from the object *qua* object. Whereas other approaches accept that certain indigenous knowledge systems merge *knowing* and *being*, object-oriented approaches tend to reinforce a concrete distinction between epistemology and ontology (Cipolla 2020a, p. 159).

The concept of ontology broadly has its roots in philosophy, where, according to Smith, it is "the science of what is, of the kinds and structures of objects, properties, events, processes, and relations in every area of reality" (B. Smith 2012, p. 155). This formed the foundation for Phillipe Descola's work on ontologies in anthropology (Descola and Lloyd 2013), also considered by De Castro and others (De Castro 2015). Alberti covers the uptake of the

principle within archaeology in great detail, through the work of Olsen, Witmore and others in his article *Archaeologies of Ontology* (Alberti 2016).

Shifting briefly to focus on the exploration of ontological approaches to digitised objects (which I will discuss in much greater detail in chapter 3 onwards), I will look at practices within the field of *knowledge organisation* (KO) — which refers to formal practices of organisation of knowledge through classification, cataloguing, indexing, and development of taxonomies. In the early 1990s, practitioners in this field began to experiment with concepts and specifications to assist in the sharing of knowledge across dissimilar digital classification and archival systems. Computer scientist Thomas Gruber's 1991 paper *The Role of Common Ontology in Achieving Shareable, Reusable Knowledge Bases* (Thomas R Gruber 1991) positions his work as presenting "… a strategy for building libraries of shareable, reusable knowledge in which common ontologies play a central role as a knowledge coupling construct". He introduced the term "ontology" within the field of KO, and defined the concept as "… coherent sets of representational terms, together with textual and formal definitions, that embody a set of representational design choices".]

These systems (as I will discuss in much greater detail later) form the basis for the existence of digital objects as things, in that they cannot exist as epistemic, semantically individualised digital objects until they have been formalised and concretised within one of these schemata. Both the KO and anthropological and archaeological interpretations of ontologies, despite having diverged significantly, still have common roots in the original philosophical arguments constructing an ontology as a "systemic account of existence" (Thomas R Gruber 1993, p. 199; Cipolla 2020a, p. 151).

Gruber's imagining of the ontology within KO played a crucial role in the shaping of current classification schemata, most notably the need to tailor systems to specific domains.[8] The ontological turn within archaeology, anthropology and to a lesser extent, museology, has been thoroughly discussed and litigated, and so I am not attempting to add anything to that argument. Rather, I am rather using the idea as a heuristic, and a tool for comparison

8 As opposed to earlier systems which attempted to standardise terms across *all* domains.

between the milieux in which physical, museum and archaeological objects find themselves, and the state of ontological polyvalence in which digital objects exist. To this end, I will momentarily lever Gruber's domain-aware concept of ontology into some sort of alignment with the worlds-aware concept of ontology from within anthropology and archaeology. My aim in doing this is to establish a means of identifying the situations occupied by things — both physical things and immaterial digital things — at various points in their existence, by considering their status, locations, and relationships with us and other things.

1.5 DISCUSSION

While we can *recognise* the existence of a differing ontology, it has been argued that it is fundamentally impossible to *understand* such an ontology from an external viewpoint (De Castro 2015, p. 11; Mol 2021, p. 87). De Castro wonders how we can "create the conditions of the ontological self determination of the other when all we have at our disposal are our own ontological presuppositions" (De Castro 2015, p. 11). As such I am not attempting to understand or reconstruct the ontological space occupied by a thing at a given point within its life; merely acknowledging that it *occupies* this space, and that it is subsequently anchored within a specific set of epistemological affordances and obligations.

Things are objects that data clings to. These data consist of many types, and remain unstable, polysemic and potentially inaccessible until informed by a schema or ontology. One means through which this happens is the act of classification; the translation of an object from one ontological domain into another (in the case of a thing in a museum, this is also, literally, a geometric translation — the movement from one place to another). Frequently the original ontological context of the thing is unknown or unrecorded, and this is perceived as unproblematic — the thing is then *forced* into the new ontological situation, either flattening diversity into controlled vocabularies or ignoring it altogether.

Understanding something of the nature of a digital thing requires figuring its epistemological affordances. Some are of the system into which it is inducted — its classificatory ontology — some are due to the nature of its own epistemic situation. Taking the above enumerated

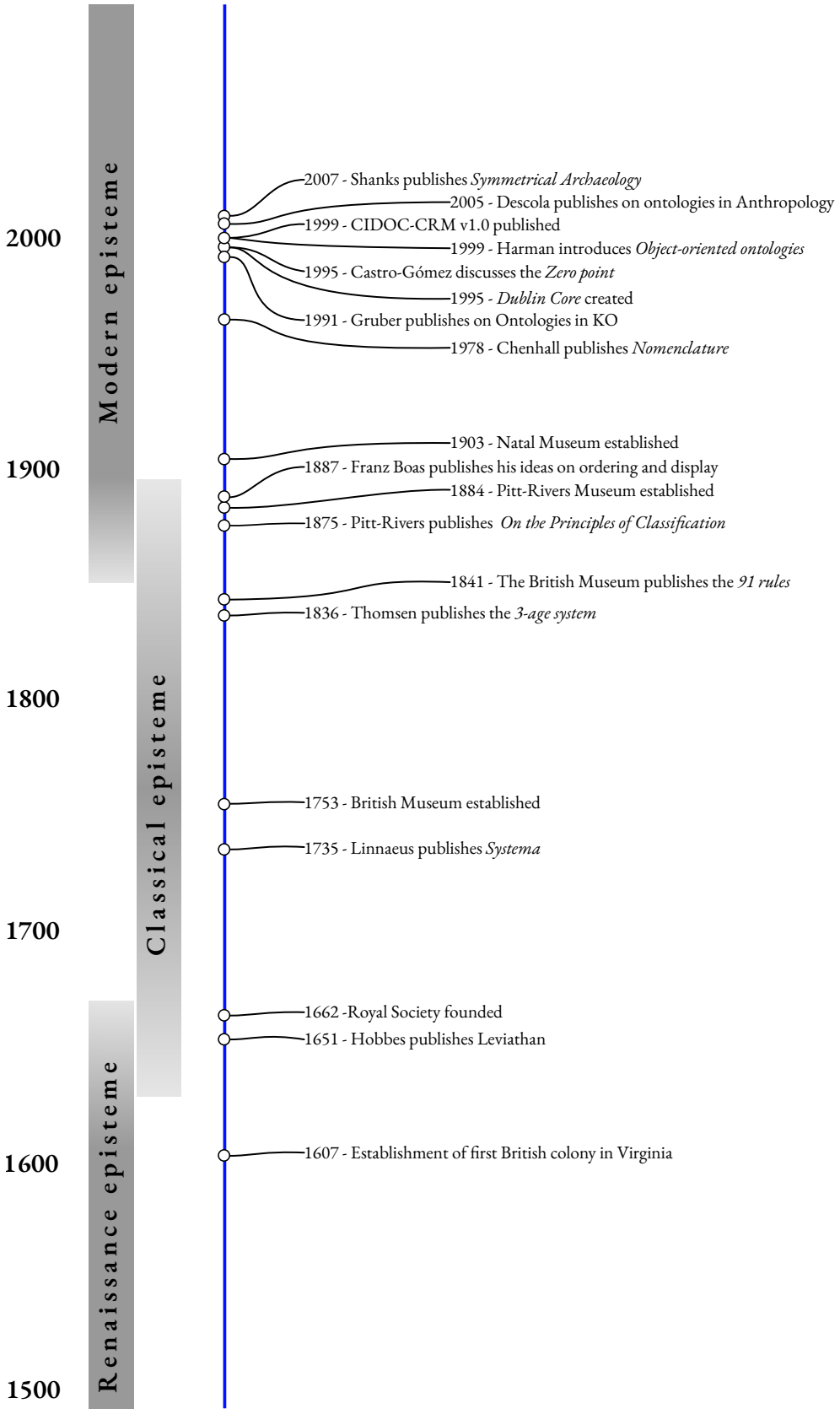


Figure 1.2: Historicisation of the epistemic regimes discussed in this chapter

ontological turns, one could group these together and call them, for want of a better term, *natural ontologies*.

Things are inducted into ontologies through the act of classification. These ontologies — for instance a museum classification, a taxonomy or an archaeological typology — are explicitly constructed. They are negotiated by groups of specialists or academics, and are simultaneously reflections in their own ontological mirror. We could call these *artificial ontologies*, and might include such systems as the *Dublin Core* metadata schemata or Chenhall's *Nomenclature*; they approximate Hui's "prosthetic schemata" (Hui 2016, p. 8). They are explicitly situated, in that they are the product of intent and negotiation, and as Bowker and Star observe, "someone, somewhere, must decide and argue over the minutiae of classifying and standardizing. The negotiations themselves form the basis for a fascinating practical ontology" (Bowker and Star 1999, p. 45). Furthermore, these negotiations and intentions frequently remain invisible, whether they are undocumented, unavailable, or just "black-boxed" into things, systems, or software. The shift towards computerisation of classification in the late 1970s involved a deliberate, verbatim duplication of existing manual card-based systems and these schemata, with no attempts to interrogate or mitigate their foundations within Victorian mechanisms of colonialism and power.

The question remains on how to approach the problem of gathering information about the multiple ontological states of a thing, both in physical and digital form. In its pre-digital form, that is, before it has been digitised, we can look at notions of the *object biography* and *object itinerary* in order to locate it in time, space and epistemic situation. In digital form, or rather, within the process of digitisation, we can look inside the *black box*, and attempt to unpack the inner workings of the otherwise obfuscated machinery, and determine both the acts and forms of translation it undergoes, and try to understand the negotiations and intentions built into the mechanisms. As such, in the next chapter, I will explore the use of object biographies and *chaîne opératoire* in understanding the ontological plurality of a digital thing.

2

METHODOLOGIES AND EXEMPLARS

The aim of this research is to survey the ontological landscape of the digital artefact, or *thing*, using two case studies to illustrate and theorise my ideas. In order to consider the ontological state of a thing or site we need to gather information about the multiple ontological states occupied by this both in physical form and as digital copy. Pre-digitisation, I will look at how we might historicise the thing, and locate it within time, space and epistemic situation, loosely shaped by Kopytoff's idea of the *object biography* and Joyce's *object itinerary* (Kopytoff 1986; R. A. Joyce 2012). Then, I will look inside the *black box* of digitisation and attempt to situate the complex and arcane processes within, the practices which surround this machinery, and its inbuilt intentions and predispositions. For this, I will use the concept of *chaîne opératoire* to examine both the translations which happen at each step, and the ontologies and epistemologies which inform the processes.

Object biographies and itineraries and *chaîne opératoire* share similarities when considered across different scales. They both accept that knowledge is situated; that things have a life-cycle across which they are transformed through human and non-human engagements; and they are aware of the importance of social and cultural context in the understanding of a *thing* or process.

2.1 OBJECT BIOGRAPHIES

Donna Haraway, in her formative work on the American Museum of Natural History, *Teddy Bear Patriarchy*, writes that "Behind every mounted animal, bronze sculpture, or photograph lies a profusion of objects and social interactions among people and other animals, which in the end can be recomposed to tell a biography" (Haraway 1984, p. 21).

Anthropologist Igor Kopytoff discussed this idea as the *biography* — or life story — of an object (Kopytoff 1986). His pivotal work was published in 1986 in Arjun Appadurai's *The Social life of things : commodities in cultural perspective* (Appadurai 1986). Kopytoff's emphasis is on the recontextualisation of an object in various situations and usages throughout its lifespan, suggesting that one can ask questions of a thing, much as one would do with a person. He asks of an object:

> What, sociologically, are the biographical possibilities inherent in its "status" and in the period and culture, and how are these possibilities realized? Where does the thing come from and who made it? What has been its career so far, and what do people consider to be an ideal career for such things? What are the recognized "ages" or periods in the thing's "life" and what are the cultural markers for them? How does the thing's use change with its age and what happens when it reaches the end of its usefulness? (Kopytoff 1986, p. 66).

Jody Joy provides an exhaustive review of the concept (Joy 2009), but I will highlight significant points and turns as the idea has enjoyed significant exploration and expansion across the disciplines of anthropology, archaeology and art history (Holtorf 2002; Edwards, Gosden and R. B. Phillips 2006; Tilley 2010; Geismar 2018).

There has been criticism of the idea, most notably by Dan Hicks, who argues that it has served to "fix the boundaries of things rather too firmly by tending to overestimate physical constancy in the face of movement between shifting human contexts" (Hicks et al. 2021, p. 3). Further to this, he suggests that it is implicated in the suppression (or at least minimisation) of the problematic histories of museum collections, and acquisition of much of their materials. As such, he argues, it is invalidated as a tool of decolonisation and restitution. While much of this is undeniably true, I look to Geismar's response to Hicks, in which she offers that it enables the "surfacing of alternative narratives, counter-histories, and and histories from below" (Hicks et al. 2021, p. 9), and that

> the methodology emerged in relation to understanding the complex global values of objects as they moved from place to place; and has been used with great

> effect to delegitimize narratives of national superiority and imperial conquest in museums (2021, p. 9).

In response, I propose that object biographies still provide a constructive entry-point towards locating the ontological states of a thing over time — offering the potential, as Geismar says, to reveal diverse narratives and consolidate potential alternative epistemologies within the museum space. In this case I argue that the object biography is not the entirety of our investigation, but that we rather position it as a higher-level construct or heuristic in order to anchor deeper incursive investigations into the ontological spaces of a thing across time and space.

Janet Hoskins notes that two primary forms of Object Biography dominate: firstly, we see the production of narratives of objects' use and perception within the cultures that made them, based upon ethnographic research. The second form is an attempt to interrogate the objects *themselves*, allowing them to "speak", and to recontextualise them with linkages to other sources, such as documents, other objects, photographs, and so on. This form has gained traction mainly in art history and archaeology (Hoskins 2010, p. 78). The use of object biographies tends to be biased towards museums and what may once have been termed *anthropological objects* — things from non-Western ontologies, mostly as these remain woefully under-provenanced in any meaningful sense. Christopher Wingfield observes the shortcomings in formal documentation of these things, and writes that

> While ethnographic museum databases may aspire to present information about the 'original context' from which an object has come, this is removed from the museum in both space and time, and can probably only be reached by attempting to trace the network through which the collection has passed (Wingfield 2011, p. 124).

Moreover, the concept of the object biography is not merely about considering the path an object has followed from birth towards ageing and ultimate death, but considering its role and meaning within each of these unique ontological spaces (Moreland 1999, p. 198). Hicks notes that

> for conservators, archaeologists, curators, and others who work with physical things, it is always clear that any object is at least as unstable as its context; that any life-history is always a life course, with ageing, decay, maintenance, death, rather than just serial recontextualisation (Hicks et al. 2021, p. 3).

However, object biographies as such can run the risk of offering a reductive model of the object lives and their manifold entanglements with actors of all sorts, both human and non-human. They suggest a single linear path from life to death, and little beyond death or discard. Holtorf writes that

> Things are made somewhere; they often do something, and some move from place to place; their meanings and functions can change in different contexts, and, as time goes on, they age; eventually most things die, and whatever is left of them is discarded in a final resting place where it gradually disintegrates" (Holtorf 1998, p. 23).

Furthermore, they often end with the thing in a storeroom or box somewhere, as in Holtorf's classic *Notes on the Life History of a Pot Sherd*, where the biography of the aforementioned sherd ends with it coming to rest in a museum storeroom along with thousands of similar undiagnostic sherds (Holtorf 2002, p. 62). This holds true for an excavated, undiagnostic potsherd in this case, but may be radically different in other cases. Hicks writes — specifically referencing assemblages such as the Benin bronzes and the Parthenon marbles — that object biographies silence the violence, loss or death involved in their extraction from their original cultural contexts (Hicks et al. 2021, p. 5).

2.1.1 *Object Itineraries*

In chapter 1 I quoted Hodder and the idea of the *thing* as gathering place, or a nexus of interconnections and entanglements. Hodder considers this in the form of "entanglement", based on Latour's "actor-network theory", both of which I discussed in chapter 1 under the section of "relations-centred" ontologies. Ingold repaints this as a *web*, across which humans

and things move, intersect, influence each other and live their lives and are "ontologically interlinked" (Ingold 2007; Bauer 2019, p. 342). Likewise, Jody Joy recognises this non-linear, punctuated shape of a biography:

> Object biographies therefore can also be seen as non-linear, consisting of a series of connected jumps as the object becomes alive within certain clusters of social relationships and is inactive at other points in time and space, undergoing a series of different lives and deaths (Joy 2009, p. 544).

As a means of addressing the complexity of this dynamic web, Rosemary Joyce introduces the *object itinerary*, usefully complicating Kopytoff's original *object biography* with its convenient linearity of life-use-death. This offers the means with which to follow the complex, highly non-linear journeys of *things*. She notes that traditional biographies have a distinct beginning and end (R. A. Joyce 2012, p. 124), whereas itineraries are

> Open-ended and multidirectional, and they include elements, fragments, transformations, and intersections with other itineraries and lines. They "extend backward to incorporate the sources from which materials came and forward to incorporate the conversion of wholes into fragments or assemblages" (Bauer 2019, p. 29; R. A. Joyce 2015, p. 343).

Joyce emphasises that when referencing distinctive things, terminology within archaeology (and related fields) frequently indexes geographic locations (2012, p. 124), and so some biographies are better considered as itineraries as things move from place to place — for instance my NM176a exemplar. This approach advocates for consideration of nodal points in the life of a thing not as isolated points of inflection on a timeline, but as comprising complex intersections of trajectories of things, places, and actors across space and time. Bauer notes that this might include the object's entanglement with scientific and technical inquiry, and furthermore, it might also afford exposition of the scholarly trajectories taken by things across their lifespan (Bauer 2019, p. 344). These methods provide useful viewpoints from which to observe the convergence of pathways followed by a thing, including its entanglement with technologies and practices of digitisation and archiving.

2.2 THE BLACK-BOX

Shifting focus — for now — from the thing to the process of digitisation, we find that many technological processes have become — or been constructed as — what Bruno Latour would call *black-boxed*. Latour defines the term as being used by "cyberneticians whenever a piece of machinery or a set of commands is too complex. In its place they draw a little box about which they need to know nothing but its input and output" (Latour 1987, p. 3). Latour was primarily dealing with scientific instruments and processes, however Bjørnar Olsen extends this into digital media practices in the service of archaeological documentation. He suggests that

> Digital media would seem to completely obscure their sources, giving the appearance of the perfect black box, inscrutable to all but the most computer science–savvy users. By truncating transformation to the key step of mathematization and hiding any traces behind circuitry boards the intermediary steps of translation are not disclosed. (Olsen 2012, ch 6)

As Olsen states, the algorithmic (and electronic) processes in digital media are fundamentally unknowable as far as the "average" user is concerned. The output of the black box is no longer linearly and predictably coupled with the input, as for instance, the case of film photography, which follows a linear progression of chemical reactions from input to output — all of which are known and visible to the practitioner. Latour reiterates this, noting the complete de-emphasis of the process:

> That is, no matter how controversial their history, how complex their inner workings, how large the commercial or academic networks that hold them in place, only their input and output count (Latour 1987, p. 3).

Also the black box is not unique to computation, as the classification systems described in chapter 1 are themselves also scientific instruments, or instruments of observation, order and control, and are subject to the same obfuscation of the work, politics, and *habitus* behind their creation.

2.2.1 *Peering inside the black box: the* Chaîne opératoire

The concept of *chaîne opératoire* was introduced in 1964 by anthropologist André Leroi-Gourhan as a tool for explaining technical processes and the social acts and decisions involved (Rösch 2021, p. 1514). It is used primarily in exploring the production of material culture, particularly lithic technology, and the techniques, transformations, and decisions involved in its production. Lithic specialist Peter Bleed presents it as "a way of relating formally diverse materials to a single process" (Bleed 2000, p. 117). Hacıgüzeller *et al* summarise this in stating that "Observing someone digging a hole, or carving a sculpture, is fundamentally different from analysing the digging-stick, the hole, its width and depth" (Hacıgüzeller, Poblome et al. 2019, p. 180).

While research involving the *chaîne opératoire* tends to focus on the steps involved in the production of material culture — lithics, ceramics, or food preparation — the methodology itself offers potential for mapping any sort of technological act of production. Despite limited applications of chaîne opératoire to modern technical processes in the literature, I decided that it affords a suitable organisational principle for closely examining each step in the process of 3D digitisation with an expanded view of the mechanics inside the "black box", particularly the epistemic frameworks in which the technical processes, hardware and software are implicated. Digitisation as a process is itself the intersection of many different technologies, concepts, algorithms, devices, practitioners and acts, and so does not in itself occupy a stable ontological space and concrete epistemological framework, and so I will attempt to triangulate this while discussing the practices and tools in chapter 3.

Sorin Hermon outlines the key stages of the *chaîne opératoire* as:

- Acquisition - Raw materials, and their procurement.
- Production - How they were modified and adapted to produce the product.
- Shaping - What kind of things were produced and how.
- Utilization - How they were used.
- Discard - What happened to them after use and why; taphonomic or preservation processes (Hermon 2016, p. 20).

Hermon proposes that the two primary mechanisms which shape an operative chain are *connaissance*, which he describes as the "mental representation of ideal forms", or outcomes, and *savoir faire*, memorisation of operational modes; Opgenhaffen conveniently reduces these terms to "knowledge" and "technical know-how" (Opgenhaffen 2021, p. 1688).

While there is a definite lacuna in the literature here, there is some published work skirting this idea. While not specifically discussing the use of chaîne opératoire *in* the 3D modelling process, Hermon discusses the function of this modelling as a *link* in the overall chain of interpretation of other sources, and how it might relate conceptual knowledge to procedural knowledge, thereby giving our "assumptions a visual meaning" (Hermon 2016, p. 13). In this case the modelling or digitisation process could be thought of as a complement to the more usual modes and methods of interpretation and knowledge production.

Similarly, in an exploration of a 3D reconstruction of the neolithic/chalcolithic site Çatalhöyük constructed in the online platform *Second Life*.[1] Angela Piccini considers life-cycles of digital objects in the context of decisions made by their designers and creators (Piccini 2015). In their provocation for archaeologists to be prepared for what computer scientist John Aycock has termed the "coming tsunami of digital objects" (Aycock 2021), Sarah and Eric Kansa consider the use of chaîne opératoire for discovering and documenting the life-cycle of born-digital data and software applications (S. W. Kansa and E. Kansa 2021).

While these studies are principally involved with completely "born-digital" objects, Loes Opgenhaffen examines processes of digitisation and archiving of material (mostly potsherds), employing a "layered approach of reflexivity and chaîne opératoire" (Opgenhaffen 2021). Also dealing with the digitisation of extant material, Felix Rösch examines historic archaeological excavation data and how knowledge is produced — initially from paper archives — reports, maps and sketches, and then through their digitisation, using techniques based on chaîne opératoire (and acknowledging Latour's Actor-Network theory). These techniques, he writes, "disclosed the workflow, enabling the reader to follow every single interpretive

1 This reconstruction in *Second Life* is discussed by Tringham and Morgan (Tringham 2013; C. L. Morgan 2012).

step", tools, decisions, and how the data were transformed at each step. Another advantage, he suggests, is that it "empowers the reader to draw their own conclusions", and one can "add one's own or other sources of knowledge" (Rösch 2021).

I have loosely adapted Hermon's stages to align with the digitisation process, viz.

- Setup - Choice of physical thing and factors informing its choice; equipment and site choice and setup.
- Production - The various stages of the digitisation process and how they each perform acts of translation and inscription.
- Refinement - Refining the form of the model according to *connaissance*.
- Utilisation - How the thing becomes an *epistemic thing*; How it is used as a phenomenological thing.
- Preservation - Accession into a system; How it is stored, archived, or forgotten.

Anthropologist Tim Ingold observes that as "the form emerging from technological processes arises from the active material itself, the form of a digital artifact arises from the digital material from which it is produced" (in Garstki 2017, p. 745). In short, similarly to the way in which a scraper may emerge from a chunk of flint, the digital thing arises from the raw materials of equipment, code, electronics, and binary digits and their entanglement with the technician.

Hermon		**Modified**	
Stage	Activities	Stage	Activities
Acquisition	Raw materials, and their procurement	Setup	Choice of physical thing and factors informing its choice. Equipment and site choice and setup
Production	How the raw materials were modified and adapted to produce the product	Production	The various stages of the digitisation process and how they each perform acts of translation and inscription
Shaping	What kind of things were produced and how	Refinement	Refining the form of the model according to *connaissance*
Utilization	How the products were used	Utilisation	How the thing becomes an *epistemic thing*. How it is used as a phenomenological thing
Discard	What happened to the objects after use and why. Taphonomic or preservation processes	Preservation	Accession into an archive. How it is stored, archived, or forgotten

Figure 2.1: Comparison of Hermon's *chaîne opératoire* and my modified approach

2.3 EXEMPLAR: NM176A - ENGRAVED AND PAINTED HORNS

This case study deals with one pair of a series (probably at least 10 housed across different collections) of engraved and painted cattle horns by the same, unnamed artist in 1880s Natal. Patricia Davison describes this set as such:

> Archival records confirmed that the engravings on the horns were indeed visual narratives of encounters between British and Zulu regiments in the Anglo-Zulu war of 1879 and surrounding events. The finely-incised line drawings include details of Zulu warriors, British infantry and cavalry, military uniforms,

> weapons, horse-drawn gun carriages, battlefield confrontations, as well as scenes of military marching-bands, equestrian displays and, in some cases, vegetation and wild animals (Davison 2016, p. 82).

The full pair of horns and surface detail is shown in figures 2.2 and 2.3.



Figure 2.2: Detail view of NM176a artwork *photo: author*





In makeshift photo studio *Closeup detail*

Figure 2.3: NM176a *photos: author*

2.3.1 *Ontological ambiguity*

NM176a was one of a number of similar items produced contemporaneously by the same artist, with many of its siblings coming to rest in museum collections, private collections, and some in motion on the international art and antiquities market. In this section, I will use NM176a as the exemplar for a sort of "composite thing" encompassing it and its kin, in order to briefly illustrate their potential trajectories and ontological situations across time and space.

This *thing* has passed through many contexts throughout its life – many of these have been documented – at the time and in retrospect by historians, archaeologists and art historians. However, many no doubt remain elusive, particularly those relating to its original creators. As this object currently resides in a museum collection, the contexts I consider of particular interest here involve those which define its path towards the museum (and within the museum). Each of these contexts is framed within a particular historic and epistemological

situation, and lacking the space to unpack these in their infinite complexity, I name the potential status of the object itself *within* each larger context as a starting point for discussion.

NM176a as autochthonous

There is little information available on the artist and their context. Around 1884 a call went out to the extents of the British Empire for ethnographic artefacts for the "Colonial and Indian Exhibition", to be held in London in 1886, and the task of collecting objects and art from the colony of Natal was taken up by the Secretary of Native Affairs. The secretary, aware of the need for proper representation of the colony circulated a request to the magistrates of Natal asking their assistance in obtaining "from the Natives such specimens and Samples of their Manufactures and Products as may be procurable" . A response from the magistrate of Newcastle reads:

> There is a native here who makes very pretty walking sticks, whips and chowries, mounted in horn…, at 10/- each; and there is the native who carves the ox-horns at £1. per pair. Would you like me to get any of these, and if so, how many? (Dell 1994, p. 144)

As Davison writes, the carver was probably not living as a traditionalist within the Zulu community around Newcastle, but was probably incorporated in some way into the colonial economy as a carver of curios (Davison 2016, p. 84). Kasfir observes that this situation marks the advent of a cash economy (in a colonial context), and patronage from missionaries, colonial administrators (and later tourists) (Kasfir 1992, p. 41). Newcastle at the time had a large British military presence, and from the carvings on the horns, the artist was a keen observer of not just detail such as uniforms and military formations, but also individual mannerisms. Davison observes that the artists was not just depicting encounters with colonial powers, but also commenting on colonial practices and intrusion (Davison 2016, p. 97).

As noted above, a number of sets of horns were commissioned from the unrecorded artist in Newcastle, and three sets appear in the catalogue for the Colonial and Indian Exhibition:

- No. 952 - Izimpondo Ezibaziweyo: Carved horns, the carving supposed to represent the Zulu war of 1879; the English and Zulu soldiers confront each other, and the English artillery and bandsmen are represented.
- No. 1098 - Set of carved horns.
- No. 1100 - Eight pairs of ox-horns with carvings.

The first public appearance of these (or similar works) was at the 1884 "Natal Agricultural, Horticultural, Industrial and Art Exhibition" held in Durban. Dell quotes:

> Perhaps the most remarkable exhibit in the whole collection is the huge pair of ox-horns upstairs, completely covered with figures, descriptive, no doubt of the field of Isandhlwana, the work of a native living near Newcastle. These drawings are precisely similar in the profile treatment to the ancient Egyptians and other artistic representations of by-gone ages… (Dell 1994, p. 144).[2]

After the London exhibition ended, some of the objects were returned to Natal, at which point they were redistributed - gifted to collections, auctioned or sold. One of the people responsible for this disposition was Mr A.S. Windham, a former colonial official, who was also on the Museum Committee of the Natal Society (Davison 2016, p. 84). The original tag on NM176a states "Mr Wyndham[3], 1901".

NM176a as trophy

A number of sets of these horns (it is unknown whether or not it was *all* of them) were mounted on small wooden shields, reminiscent of how trophy hunters mounted their kills. Dell suggests that the horns themselves already held this association, and that they could be "mounted in European homes as souvenirs" (Dell 1994, p. 144). Furthemore, Coombes notes the prevalence of the term "trophy" in descriptions of displays from period museums,

2 Official Minutes and Report of the Natal Agricultural Horticultural, Industrial and Art Exhibition, in Durban, January 1884, p 84.
3 Maggs notes that this is a mis-spelling of "Windham" (Maggs 1990, p. 145)

such as the Horniman (Coombes 1994, p. 26) and catalogues from exhibitions such as the 1890 *Stanley and Africa Exhibition* (1994, p. 116). Davison reiterates this, further noting that the scenes of battle may have acted as reminders of the battles that irreversibly altered the nature of British/Zulu relations, and that their mounting evokes "the well-established colonial genre of mounted trophies of the hunt for proud display in the home territories" (Davison 2016, p. 85). Likewise, their presentation as trophies may have appealed to the middle-class white male and the evocation of him as "great white hunter" (Coombes 1994, p. 198).



Figure 2.4: One set of the series, on original mounting *photo: Jacaranda Tribal*

NM176a as curio

It is notable that these and similar objects were all listed close to the end of the "Natal" section under the heading "Native manufactures". Art and craft material provided by the white settler population came earlier under the heading "Arts and manufactures" (*Colonial and Indian Exhibition* 1886, p. 313). This underlines the ambiguity with which similar things have long been treated within the art world (Kasfir 1992; Nettleton 1993; Shiner 1994), and so I will not relitigate the issues here. Suffice to say that many of the early arguments could be summarised by French art dealer Henri Kamer, arguing that in Africa

> there are no individual creative artists.. .(The African artist) produces masks and fetishes according to the needs of the moment, always by order of tribal elders and never on impulse as would any conventional artist (Kamer 1974; Price 1989a, p. 67).

The situation of NM176a and its kin is an edge case in this argument, as they were explicitly created for the curio market, rather than being items made for use within the society that created them, which were then traded, sold or appropriated (Kasfir 1992, p. 41). Their imagery, as Davison observes, was designed to appeal to buyers – any sort of ethnographic detail being secondary (Davison 2016, 85ss).

The artist remains unknown, despite efforts by Val Ward in 2005 to discover any archival sources which may have revealed their identity (Davison 2016, p. 98), but they were known to have worked in the Newcastle region of Natal. However, as Davison notes, they were "incorporated in some way into the colonial economy" (2016, p. 84), and their work was held in "high enough esteem" to be considered for inclusion in the Colonial exhibition in London.

NM176a as Art

It is unknown whether NM176a itself was on the international art or antiquities market — and if so, for how long. Many sets and individual horns now reside in museum collections,

however a number of sets of these horns have recently been in such circulation. One set was sold for at least USD 60 000 in 2015 by an art and antiquities dealer in New York (*Jacaranda - Engraved Cow Horns* 2022), and another single horn was still on the market for USD 150 000 as of mid 2023 (*19th Century Engraved Zulu Cow Horn 1879 Anglo-Zulu War* 2022).

The abovementioned single horn is advertised by the dealer under the classification of "Tribal art", while the dealer involved with the recently sold pair, called *Jacaranda Tribal*, deals in "Traditional arts". In comparison, a pair held by the British Museum — having been thoroughly inducted into colonial epistemologies of ethnography — bears the *object type* of "Animal remains".[4] Kasfir writes that canonisation of ethnographic objects and what is often termed "primitive art" into these realms of fine art involves distinct languages of classification, which is "powerful, one-sided, and usually final" (Kasfir 1992, p. 45). Price observes further that the Western buyer or connoisseur is the one who not just declares these objects as art, but is the first one to actually *see* the potential for the thing *as* art (Price 1989b, p. 104).

The assertion of agency by the expert in determining this reclassification also serves to reinforce the need for the artist to remain anonymous within a Western, art-market ontology. Price records that common arguments for this anonymity include both the lack of attention *within* cultures to naming artists, but also the "insouciance of early collectors" (Price 1989b, p. 104). However, Price recalls the words of a Parisian collector:

> I am completely enchanted by the artist's anonymity. Not knowing the artist is something that causes me enormous pleasure. Once you learn who made an object, it ceases to be primitive art (1989b, p. 103).

Naming — and thus ascribing agency to — the original artist negates the mystery and cachet of the work, and as such also "resets" its value to the collector (as I discussed in chapter 1

4 Af1979,01.5234.a-b

regarding decontextualisation), allowing one to consume it within known, domestic context (Price 1989b, p. 106; Kasfir 1992, p. 46).

While NM176a remains in an anthropological collection, and has done so since 1901 as part of the Natal Society Museum, many pieces from the same body of work of still occupy the flows of the international art and antiquities market. Their current context is far removed from that of NM176a itself, having accrued a different kind of value, in the form of financial rather than epistemic worth. We might consider that the extraction of the object from its original ontological situation *creates* its value in another.

NM176a as digital copy

In 2018 I photographed NM176a extensively in order to create a 3D photogrammetric model for study and archival purposes. This involved shooting approximately 350 high resolution (24 Megapixel) digital images, and processing them using a pipeline involving various software tools in order to produce a 3D model. Further to this, I then produced a number of "unwrappings" of the engraved and painted horn surface in order to more closely examine the imagery. This is a relatively new technique used primarily in work with ceramic wares (Houska et al. 2021) and clay cylinder seals from the ancient Near East (Dahl et al. 2018, p. 53). The process is straightforward with consistently cylindrical objects such as the aforementioned seals, but quickly gets quite complex when used on objects with non-uniform curvature such as NM176a. The process involved remeshing the model with a lower face count in order to simplify the surface (as the topography was not important), reconstructing the UV texture map in contiguous form, and reprojecting the texture. The process is effective however does tend to produce an arbitrary reframing of the surface detail depending on the position of the "seam".

Figure 2.5 outlines selected points in the life of NM176a and the other horns from the series. I have arranged these points on a timeline, and highighted their ontological contexts as discussed in this section.

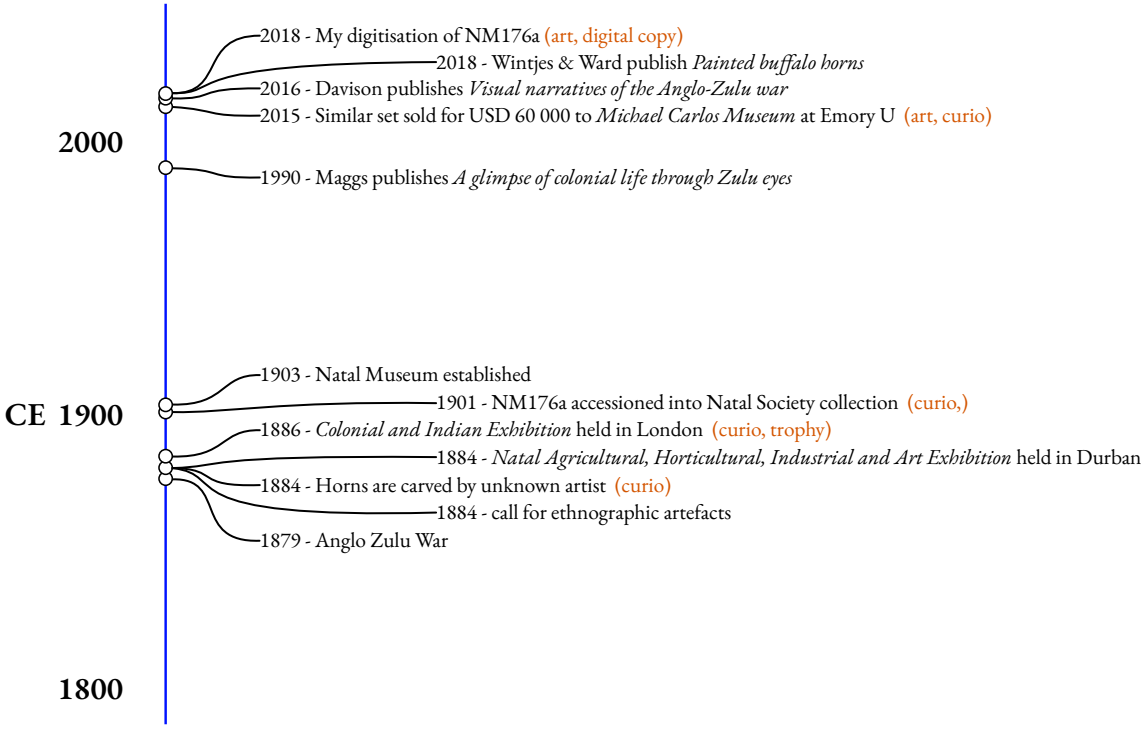


Figure 2.5: Key events and shifts within my NM176a case study's biography

My digital model of this case study may be found online at the following URL: `https://www.metsemegologolo.org.za/anton/NM176a.html`

2.4 EXEMPLAR: SCOTSTON 4128

As I have done regarding all cases of contentious or unclear nomenclature in this work, I will proceed to explicitly outline my choices here. I note that the site I describe was painted by hunter-gatherers – their own names for themselves are unknown, but they formed part of the broader San or Bushman community. Much of the history I write of the site has taken place in times of colonial activity and flux, and in the context of Scotston as a site on multiple geographic and ontological frontiers — Boer and English, settler and San, farmer and raider — I follow Rachel King's lead and use the term "Bushman" where it is in historic context, and "San" in a current context (King 2019, p. 22).

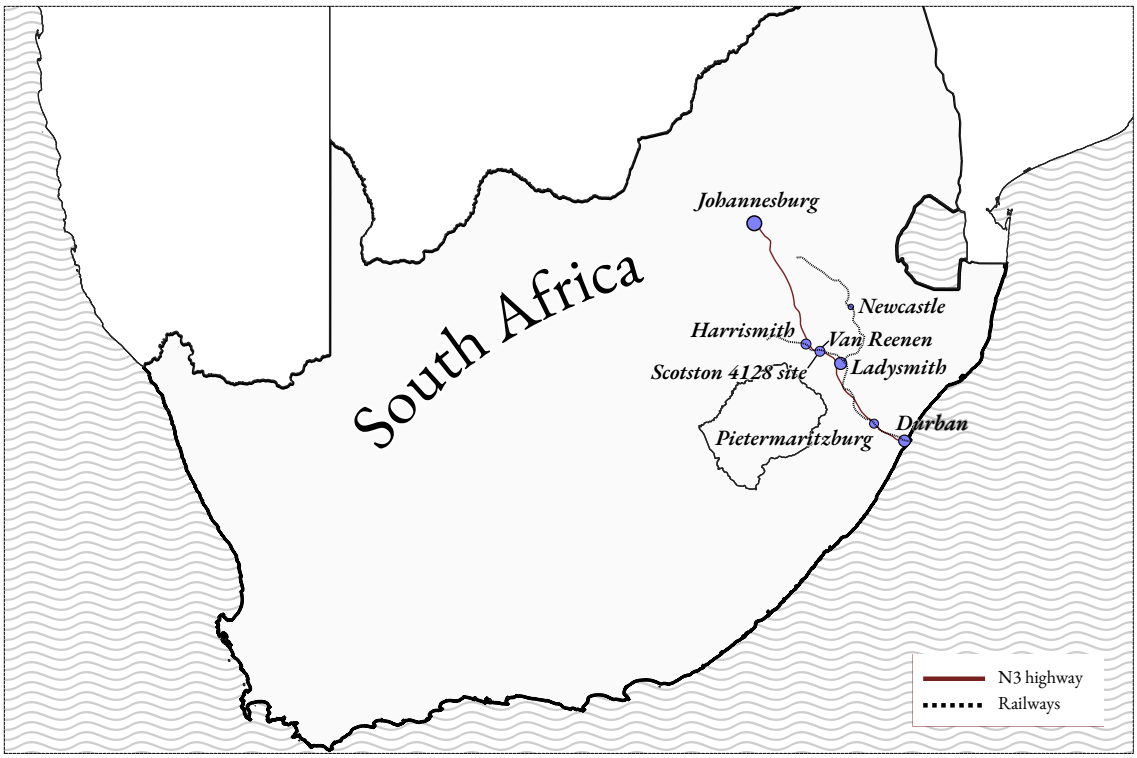


Figure 2.6: Map showing places mentioned in these case studies.

This "object" is a recorded archaeological site and painted rock shelter. It might not be physically present in a museum collection, but it is present in collections in other ways, for instance as a digital recording. It has been documented and subject to the same process of classification and violences of being forced into an ontological framework as any museum object. As above with my NM176a exemplar, I have considered this site's circumstances throughout its (recent) life. The site itself has not moved, but cultures, contexts and landscapes around it have shifted, and so I have framed the site by considering the role it may have played within each of these ontological situations. Unlike NM176a, this site has undergone little study, and so I have reconstructed much of its history through a sort of triangulation, from anecdotes, notes and in some cases photography and graffiti of those passing through and observing the site through different lenses (and in some cases altering it).

This particular site has occupied a multitude of ontological spaces through its life. It currently exists within numerous databases, that being "RSA SCS1" in the SARADA[5] database where it exists as a rock art site, "2829AD 006" in the SAHRIS[6] database, where it exists as a heritage site, and also exists in the KwaZulu-Natal Museum internal database.[7] It has also variously been referred to as *Bushman's Cave* and *Nolan's Kloof*. I will henceforth refer to this case study as *Scotston*, derived from the name of the farm — Scotston 4128 — on which the site is situated.

Before that however, it occupied an indigenous ontology, that of the *uKhahlamba* San, where its first phase was probably painted at some point in the last few hundred or even thousand years, as interpretations of dating vary.[8]Since then it has occupied many spaces; the farm itself was demarcated by the Surveyor General of Natal in 1875 (*Surveyor General's Map of Farm "Scotson 4128"* 1875), and recorded within colonial systems of land classification and control. This particular site is formally classified within the ontological space of both SARADA (The South African Rock Art Digital Archive) as a rock art site, and that of SAHRIS (South African Heritage Resource Agency database) where it exists as a heritage site. It also occupies the position (for the area) of "[Natal] Site No. 1" in Leo Frobenius' records of his recording work in uKhahlamba.

The pass, the highway and the railway through Van Reenen are faultlines across both time and space, imbricating the site within different ontologies (and distancing it from others). At times collisions between these ontologies left traces, both at the site and around it.

5 South African Rock Art Digital Archive.
6 South African Heritage Resources Information System .
7 Both SARADA and SAHRIS obtained their information from the KZN Museum database. Their records exist in digital form only, in contrast with the museum with the original card catalogue and documentation.
8 Lewis-Williams (in Thackeray 1983) considered it unlikely that any paintings in the area were more than 2-300 years old. However new AMS dating by Mazel and Watchman in 2003 suggested the tradition was much older, possibly predating 50 BCE (Mazel and Watchman 2003), and Bonneau *et al* push dating in the region back to 300 BCE or so (Bonneau et al. 2017).

2.4.1 *The place*

Scotston is located in the uKhahlamba (Drakensberg) Mountains of South Africa, at the top of a major mountain pass, and straddling the border between two provinces, the Free State and KwaZulu-Natal. The route known as "Van Reenen's pass" was built around 1856 by Frans van Reenen who owned the farm "Sandspruit" at the foot of the pass. Van Reenen knew suitable routes up the mountains from driving his cattle back and forth in search of grazing, and so, at the behest of transport riders [9] he laid out the route for a pass, allowing (relatively) faster travel to Harrismith. Many of these routes — as did van Reenen's — follow wildlife migration routes; Barter notes one of the early "Drakenberg" [sic] passes slightly North of this area was known to the local Boers as "Quagga Pad (zebra path) (Barter 1852, p. 69).

In the latter stages of the 19th century much of this oxwagon traffic involved goods destined for the goldfields of Pilgrim's rest (this went North from Ladysmith), or the goldfields of the Reef, later Johannesburg — this made up most of the traffic on this section (Heydenrych 1991; Bizley 2004). About 9km downhill from the current town of Van Reenen, a border post and small town were located on the farm "Wyford", including customs officials, a dipping station for cattle, a police station, boarding house, two blacksmith shops and the "Good Hope Hotel". Diarist Catherine Portsmouth, married to the owner of the farm, noted at one point in the late 1880s that nearly 3000 wagons per month moved through Wyford (Spencer 1997). When the railway line opened in 1891, these services were moved to the top of the pass, forming what is now the town of Van Reenen. This provided a convenient location for a station and associated services on this branch railway[10] line between Ladysmith and Harrismith (the main line at the time ran Northwards towards Charlestown). The site and its situation are shown in figure 2.7.

9 These being professionals or farmers supplementing their income by transporting goods to and from the coast via oxwagon.

10 At this time run by Natal Government Railways.



Figure 2.7: The Van Reenen area, showing the site *image: SA National Geospatial Portal, 25cm imagery*

Van Reenen was also a key point in the Anglo-Boer war, being the frontier between the Natal colony and the Orange Free State Republic, which was aligned against the British (and thus Natal) with the South African Republic. In the current era, a national artery - the N3 highway - passes through Van Reenen, bringing with it somewhere in the region of 9000 vehicles per day, few of whom stop in this town, preferring to push on to the filling stations and fast food of Harrismith, some 35km Eastwards.

2.4.2 *Ontological ambiguity*

Scotston as archaeological

The only formal site recording I was able to find was made in April 1982 by archaeologist Tim Maggs. His comments on the paintings are as follows:

> The shelter is 22 metres long, maximum width of 5 metres, has a stony floor, with no deposits or artefacts. The site is a well known place for signatures painted and carved in the rock. A few paintings survive 1 bichrome red and white eland . Well to the right, a panel with a running man holding a stick. Eland torso, ? Small antelope. ? Seated human figure, covered by name Preggy in green paint (Maggs 1982).

Maggs photographed the site, but makes no further mention of the locations of these individual elements. The seated figure, partially obscured by the name "Preggy" is still visible on the ceiling of the shelter (see figure 2.8, and the bichrome eland may be situated on the large, mostly graffiti-covered wall external to the shelter proper. The site seems to have been frequently visited, but remains largely unrecorded by 20th century rock art researchers. Traveller Robert Huchard, passing through the area in 1904 describes a (somewhat disappointing) trip to what is probably this site:

> Nothing very particular surprises us, to tell the truth. It is one of the most banal cave, similar to all those I have already seen in France, to all those undoubtedly that you can see in the world. If some interesting objects were there once, they are long gone. All that we can notice on one of the rock walls is an ocher and vague tint, which must once have been an inscription or a drawing (Huchard 1904, p. 244).[11]

11 "Rien de bien particulier ne nous y étonne, à vrai dire. C'est une grotte des plus banales, semblable à toutes celles que j'ai déjà vues en France, à toutes celles sans doute que l'on peut voir dans le monde. Si quelques objets intéressants s'y trouvaient autre- fois, ils ont depuis longtemps disparu. Tout ce que nous pouvons remarquer sur l'une des parois de roche est une teinte ocreuse et vague, qui dut être jadis une inscription ou un dessin."



"Preggie" as noted by Maggs *Enhanced, showing original art*

Main panel *Enhanced, showing traces of original art*

Figure 2.8: "Scotston" detail *photos and enhancements: author*

German anthropologist[12] Felix von Luschan mentions a site at Van Reenen in his 1908 *Über Buschmann-Malereien in den Drakensbergen*,[13] and that in October 1906, "in Van Reenen

12 Also doctor, archaeologist, ethnographer and explorer.
13 *About Bushman paintings in the Drakensberg*.

four Bushman paintings were copied on a trial basis" (by his assistant, Mr. Terno), one of which he identified as "an ox" (von Luschan 1908, p. 684). Cambridge archaeologist M.C. Burkitt toured South Africa in the late 1920s, at the invitation of notable archaeologist A.J.H. Goodwin (formerly Burkitt's student). He refers to this site as "Nolan's Kloof", and comments on "polychrome paintings" similar to those at Modderpoort (near Ladybrand, in the Eastern Free State) (Burkitt 1928, p. 135).

The next mention of this site is in journals by members of Leo Frobenius's 1929 exhibition to Southern Africa (Wintjes 2012) where their movements are listed as:

- Thursday 17/01/1929: Mannsfeld, Schulz and Weyersberg depart for Natal by train to Van Reenen (Frobenius and others head for Southern Rhodesia)
- Friday 18/01/1929: Visit to a site near the Hotel (N.1), traditional houses in the area, and local Zulu inhabitants.

Elisabeth Mannsfeld, Agnes Susanne Schulz, and Maria Weyersberg were among the illustrators and painters on the 1929 Frobenius expedition, and frequently travelled independently to record sites, According to the above notes, they visited this site, referring to it as "[Natal] Site No. 1", but did not record anything here, suggesting that by this point the art was already well faded and covered by travellers' inscriptions, and therefore — probably (by their reckoning) not worth recording when the promise of unspoiled work lay further into the Drakensberg. Due to both complete obscuration of the art by graffiti layered atop it over the last 100 or so years, and the fact that the main panel is exposed to weather and bush fires, it has effectively been ignored, and relegated to the status of a *sacrificial* site, there ostensibly being nothing worth preserving there. Its value as epistemic object has been overshadowed by others within the systems and schemata of knowledge. The site as it appears today is depicted in figure 2.10.

Scotston as touristic

At some point in 1873 a traveller named Gibson carved his name into the ceiling of the rock shelter itself. This may or may not have been Robert Gibson, notable citizen and town

board member of Harrismith. Gibson was not the first, nor the last to make their mark here - the site is covered with people's names — however his was the oldest dated mark I could see. Somewhere underneath all these layers of painted names surely lies a rich collection of San rock art, little of which is now visible to the naked eye. Any proof of habitation in the form of lithics or deposits is long gone, either worn away by the scuffing of visitors' feet, washed away, or collected by the same visitors. Most of the dated graffiti falls within the heydays of "mountain tourism" (J. B. Wright and Mazel 2007)— travellers, mostly from Europe, visiting the Drakensberg/uKhahlamba mountains for sightseeing, hunting in the region, or other recreational activities, using the nearby hamlets of Van Reenen or Harrismith as base.

This shelter — *Bushman's cave* as a 1913 postcard published in Johannesburg by the "South African Photo and Stereo Company" refers (figure 2.10) — is "less than 10 minutes' easy walk from Van Reenan (sic) station" (Burkitt 1928, p. 135) and was clearly a favourite stop for anyone visiting or passing through by train. The abovementioned postcard photograph shows the area around the shelter as having been cleared, and highly visible from the above promontory, with many of the travellers' inscriptions quite apparent from a distance (it is currently overgrown and almost invisible). One has to wonder how much of the rock art itself was at all visible to the casual visitor of the period. South African Railways employee David Preller, who was stationed at Van Reenen between 1923 and 1925, photographed the site in 1924 (figure 2.11), and his photograph clearly shows large areas of visible graffiti (various 1924, p. 898). Preller was then to carve his name (away from the main panel, fortunately) that same year, where it is still quite visible (figure 2.9).

Currently the site lies just below a small chapel - the Llandaff Oratory, and a coffee shop catering to inquisitive travellers alongside the great temporal and spatial rent in the landscape of the N3 highway, which runs constantly, being the primary road corridor between the Natal coast (and Durban) and Johannesburg.

Scotston as Art

English art critic Roger Fry, reviewing Helen Tongue's book containing copies of San rock art, wrote (grudgingly) of his admiration for their fine skills of "visual transcription" (Fry 1910, p. 337). Similarly, anthropologist George Bertin paints the San has having a "great talent of imitation", apparent in their painting (Bertin 1886, p. 56), affording them little intent or agency in the process. San art *qua* art was denounced as crude and primitive, for instance Victorian novelist Bertram Mitford described the art as "repulsive, grotesque, obscene, the handiwork in bygone ages of the most primitive race in the world" (in Street 2016, p. 86).

Scotston and similar sites have been extensively recorded and examined by researchers, and have invariably fallen victim to these epistemological presuppositions. Scholars were convinced that the San were an inferior race and thus were an "evolutionary hold-over" and rendered as the "authors of prehistory" (Shepherd 2003, p. 829). Within popular culture of the 18th and 19th centuries the "Bushman" was presented as subhuman and savage, with little to offer in the way of intangible or material culture (Barnard 2007, p. 23; Street 2016, p. 87). They were frequently represented in natural history museums, along with their art and material culture, alongside animals, insects and other specimens (Davison 2001, p. 9). They were, according to Meskell, being "correlated back into prehistoric time" (Meskell 2008, p. 11).

Reinforcing this was the theory held by notable archaeologists such as Henri Breuil, aligning San art with that found in the Iberian peninsula, despite there being an age difference of up to 35 000 years (Breuil 1930).[14] He was explicitly attempting to find or construct parallels between these two temporally and geographically distinct cultures in order to further

14 Considering that the Bushman art being discussed falls within the range of 1900 CE to around 4000 BCE, and in many localities was being produced into the early 20th century. The European art it was being compared with dates to around 20 000 - 40 000BCE (Thackeray 1983; Pike et al. 2012). This comparison is further complicated by the existence of the Apollo XI *art mobilier* from Namibia, dating to approximately 27 000 years (Masson 2006), and the fact that much of the Upper-Palaeolithic art known to Breuil *et al* is very well-preserved in deep, relatively environmentally stable caves (Ontañón-Peredo and Rodríguez-Asensio 2014).

cement the San as a truly primitive people, effectively still living in a continuation of the Upper Palaeolithic (Breuil 1930; Shepherd 2003, p. 828; Díaz-Andreu García 2007, p. 300; Geroulanos 2018, p. 142). He and other scientists were "scratching hopefully in harsh local soils for signs that could be linked back to a cave in France" (Shepherd 2003, p. 829).

However, despite clear local connections both stylistically and geographically, many scholars attributed the work to foreign cultures, particularly those in the Mediterranean. Breuil, commented on the "academic perfection" of the infamous "White Lady"[15] in Namibia, while suggesting it "belonged to a Cretan/Phoenician/Egyptian archaeological milieu from which it was manifestly geographically removed" (Geroulanos 2018, p. 147). Raymond Dart loosely identified the various disciplinary lenses through which they have been observed at these points in time. These lenses inform the epistemologies and ontologies within which I have examined them was later to recapitulate this belief, offering the opinion (based on recordings by Brother Otto Mäeder of Marianhill Monastery) that the Phoenicians, Egyptians and Chinese were not only represented in San art, but also influenced its evolution (Dart 1925).[16]

Counter to attitudes of the period, the first curator of the Pitt-Rivers, Henry Balfour, considered San paintings as *true* art (Coombes 1994, p. 52), writing in his preface to Helen Tongue's 1909 book *Bushman Paintings* that "the artists of the Bushmen have had to take their place in the category of 'Old Masters' " (Tongue 1909, p. 10). Similarly, traveller Sir John Barrow wrote in 1797, after having seen a San shelter near Graaff-Reinet, that "the force and spirit of drawings, given to them by bold touches judiciously applied, and by the effect of light and shadow, could not be expected from savages" (Barrow 1801, p. 239).

The early years of the twentieth century saw a shift taking place (in Europe, at least) in attitudes to Africa within the art world. Picasso, Rousseau and Cézanne spearheaded the

15 Site NAM TRE1 in SARADA.
16 However, on publication, this was immediately succinctly and solidly rebuffed by Flinders Petrie (F. Petrie 1925).

Primitivist[17] movement, inspired by visits to the Trocadéro.[18] Their interest, Steiner writes, was only in the art *qua* art; it had to remain devoid of cultural context and symbolism (Steiner 1994, p. 109), as they were interested in their aesthetic aspects rather than ethnographic or historic (E. Williams 1985, p. 162). A similar influence took hold in South Africa, albeit slightly later as Erich Mayer, Walter Battiss and J.H. Pierneef all looked to San rock art as inspiration at some point, though this was not explicitly constructed as part of the Primitivist movement (Ouzman 1995; Duffey 2006; D. G. Pearce, Mallen and Namono 2017).

Battiss continued to reference San art throughout his career, and also spent copious time copying art from various sites, some of which he had discovered (D. G. Pearce, Mallen and Namono 2017).[19] He also copied art from a number of Upper Palaeolithic sites in Europe while visiting Breuil in the late 1930s (1963, p. 31). However as noted by Barnard, he categorised bushman art as having moved from "reverence" — in the service of ritual and religion — to mere "illustration", reflecting Fry's categorisation of San art as "visual transcription" or mere mimicry (Barnard 2007, p. 88).

There was little further art or art-historical engagement with rock art in South Africa until the late 1970s when Alex Willcox argued for an "art for art's sake" approach to the work, and that "no further purpose need be sought than that of the pleasure of the artist in his work and in receiving the admiration of his community for his skill" (Willcox 1978, p. 60). Much of this was in response to the fact that many researchers of the period, such as Neil Lee and Bert Woodhouse (and including Willcox himself) were still working within Western ontologies, and so their approaches to rock art were framed by this (Jenkins 2019, p. 56). Genres, styles and chronologies formed the basis of their analyses — as they would when

17 The descriptor *primitive* in this case, referring to "original" or "primal", rather than the pejorative (Duffey 2006, p. 22).

18 The *Musée d'Ethnographie du Trocadéro* in Paris. Later to become the *Musée de l'Homme*, and now forms part of the *Musée du Quai Branly*. to admire the ethnographic objects in its collection (Clifford 1988, p. 228)

19 He later became protégé of Henri Breuil, at the time along with the poet Mary Boyle and archaeologist M.C. Burkitt, and worked alongside him recording and excavating notable sites such as Rose Cottage Cave (Scully 1963, p. 62).

working with European art — and so this informed their descriptions and interpretations of the art.

More recent work on South African rock art concentrates on cognitive and shamanistic approaches (Lewis-Williams and Dowson 1990; Guenther 2015), and so its value as *art* is frequently ignored (Skotnes 1991, p. 16). Skotnes argues that this precludes us from being able to see rock art as "anything more than a kind of anthropological cartography" (1991, p. 16), while Dowson suggests that rock art had become "a handmaiden to evolutionary perspectives on human cognition" (Dowson 1998, p. 67).

It was not until the 1990s that South African artists and art historians such as Skotnes began to acknowledge the artistic aspects of rock art (Ouzman 1995, p. 24; Duffey 2006). These acknowledgements of its value as art were not new, merely a revival and reframing after a long post-primitivist dormancy.

Scotston as digital copy

As mentioned earlier, and as is apparent in the accompanying figures, the main panel of the site is completely filled with painted and engraved graffiti, spanning the visible range of 1873 to 1970 or so. At first glance little of the original content is visible, save the unmistakable outlines of some large polychrome eland. On closer examination though, it becomes apparent that this was once a rich site, with the main external panel covering an area of approximately 3m by 5m, with dense superposition of figures. I decided on two approaches — one being to record the site for photogrammetry — that is photographing the site and creating a digital 3D model, which may be viewed and manipulated in many different ways.

The second approach was to then use both the raw images and finished "mosaiced" and orthorectified images from the 3D output to enhance the artwork itself. This uses a tool called "D-Stretch", developed by American rock art researcher Jon Harman (*DStretch.Com Home Page* n.d.; Le Quellec et al. 2013). This is based on a mathematical technique known as *decorrelation stretching*, which was originally developed at the *Jet Propulsion Laboratory*

in the early 1990s for enhancing satellite imagery (Alley 1996), and later incorporated into a plugin for the *ImageJ* image processing package, originally developed by the American *National Institutes for Health* for processing medical imagery (Schneider, Rasband and Eliceiri 2012).

My digital models of the Scotston site (main panel) may be found online at the following URLS:

normal view: `https://www.metsemegologolo.org.za/anton/Scotston.html`

enhanced: `https://www.metsemegologolo.org.za/anton/Scotston_dstretch.html`

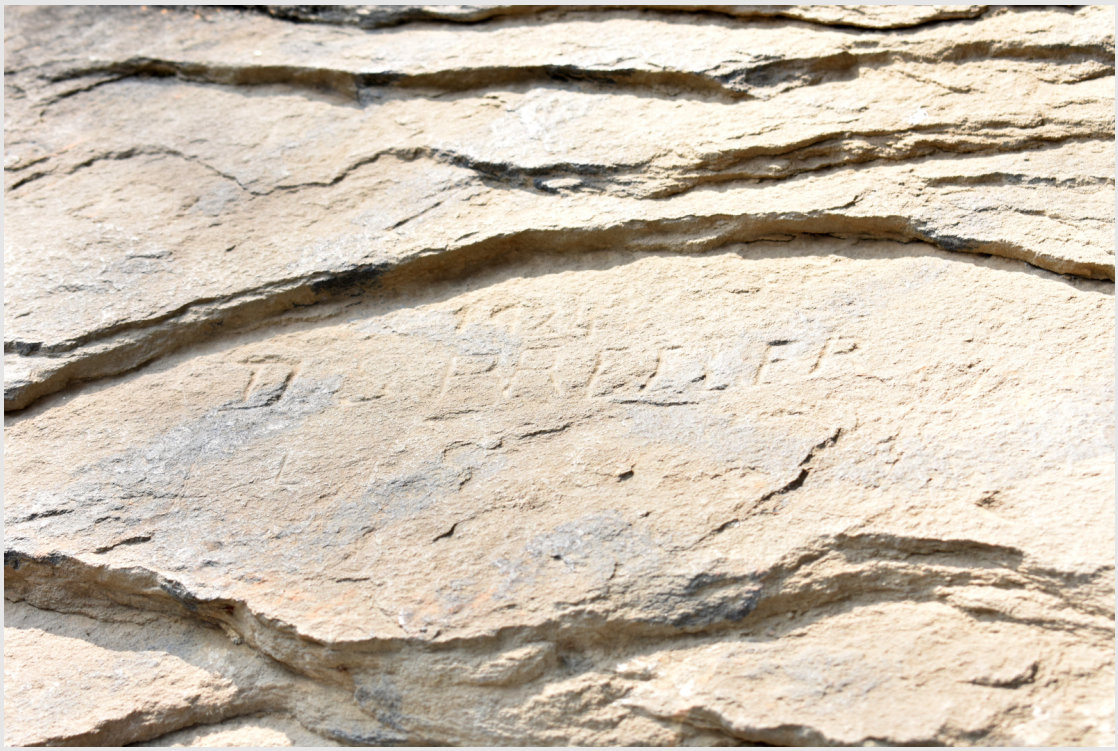
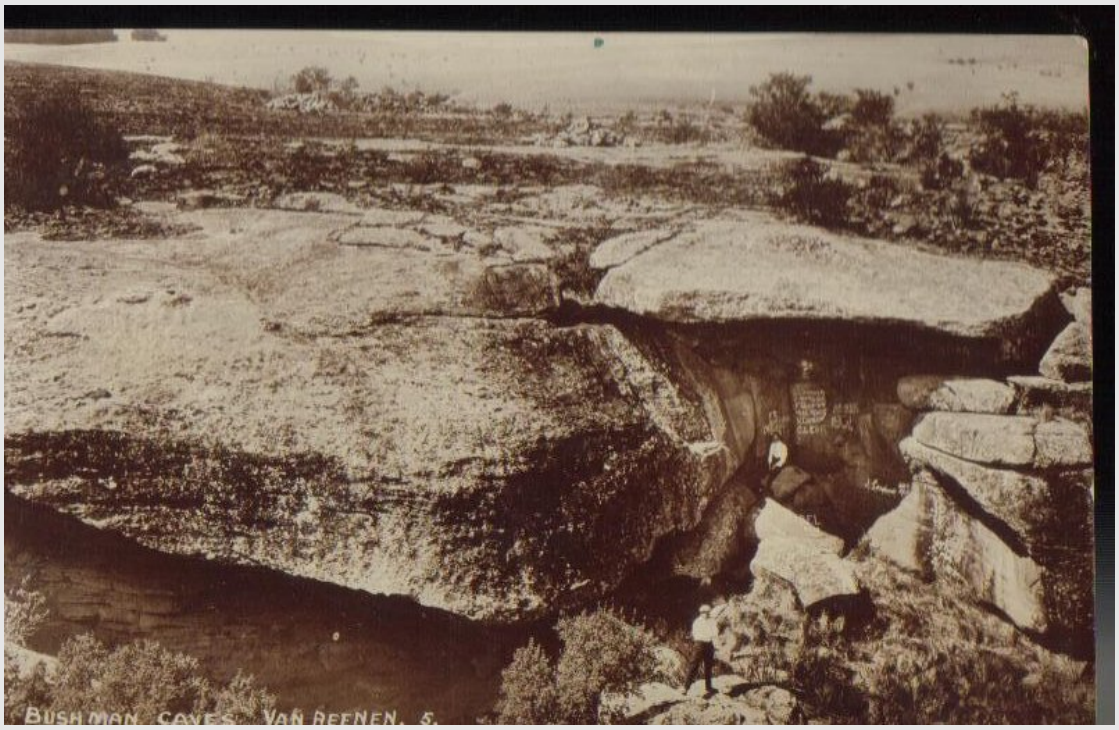


Figure 2.9: David Preller's engraving at Scotston.*S.A. Railways and Harbours Magazine, Sep 1924.*

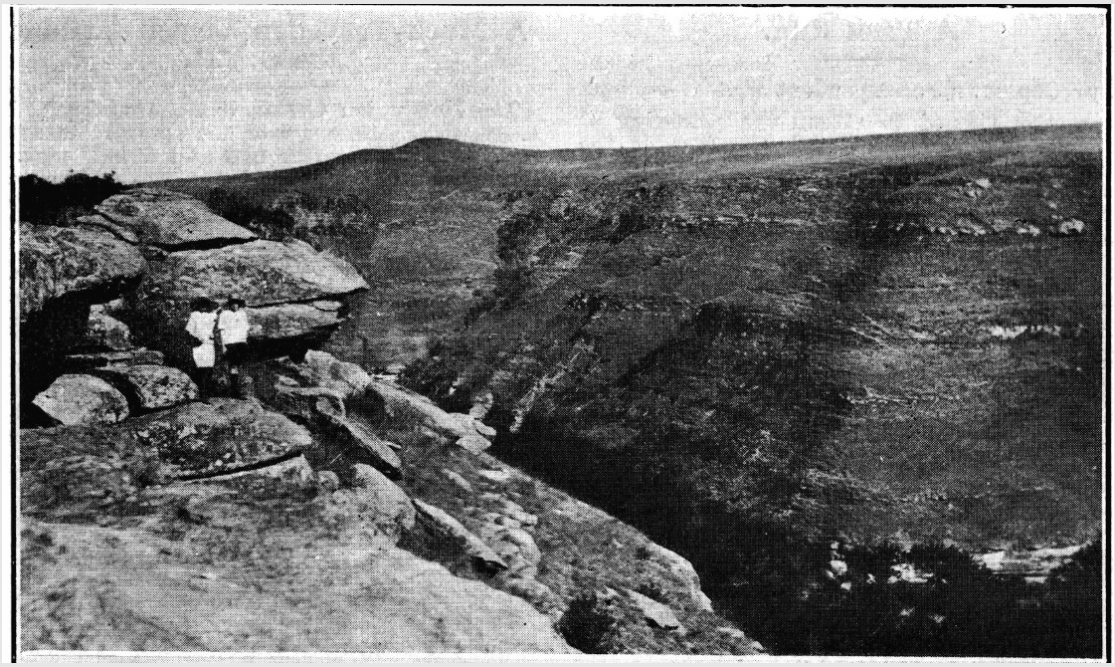


In 2018 *photo: author*

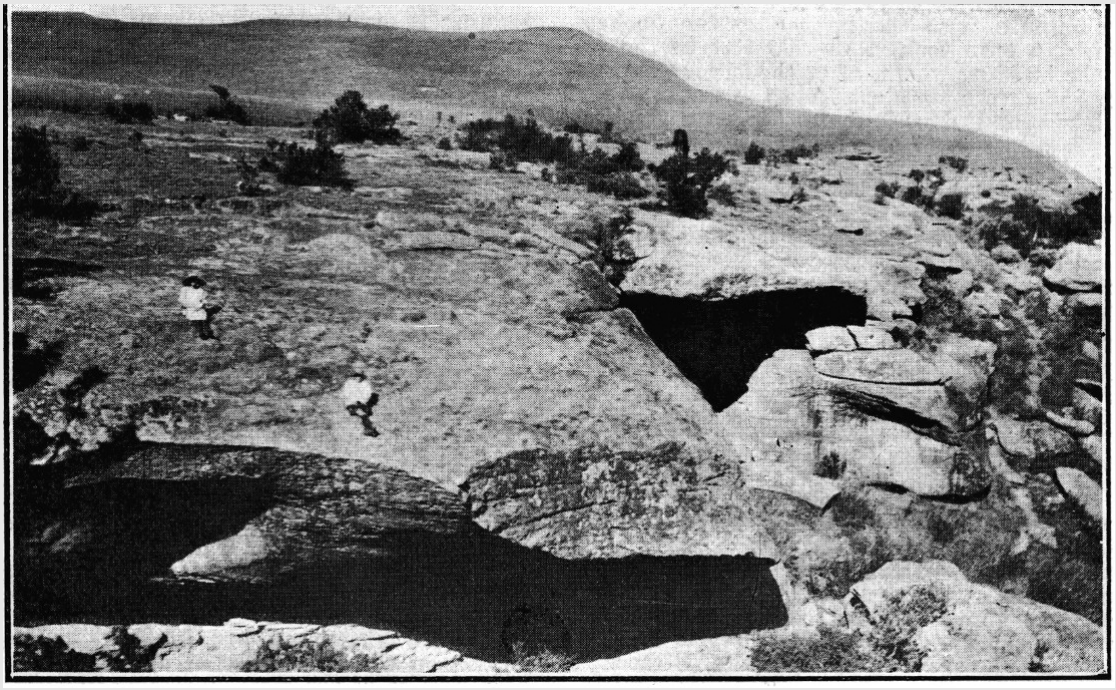


1913 Postcard view

Figure 2.10: The main panel at Scotston



Bushman's Caves



Nolan's Kloof

Figure 2.11: David Preller's photographs of the Scotston site. *S.A. Railways and Harbours Magazine, Sep 1924.*

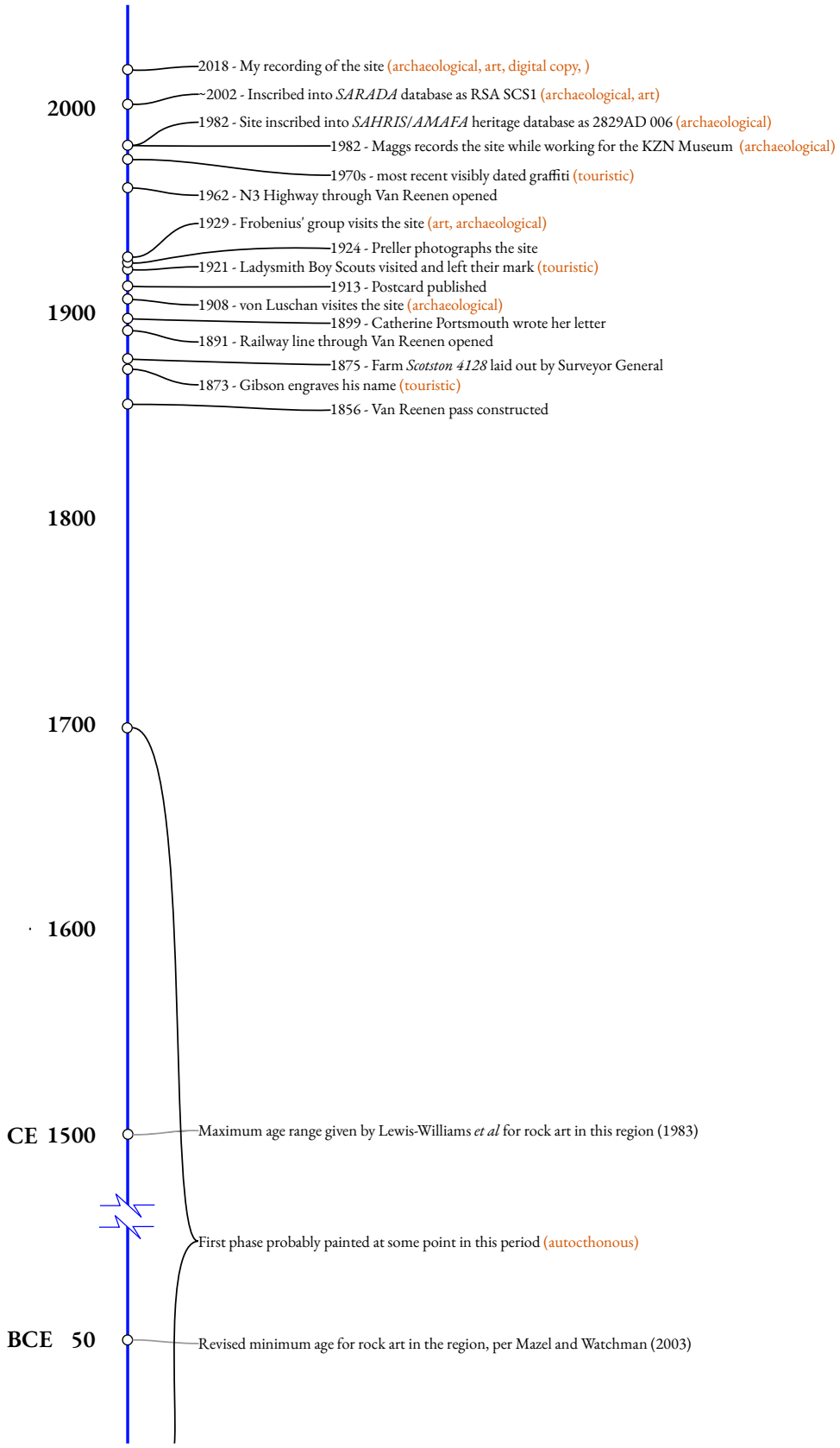


Figure 2.12: Key events and shifts within my Scotston case study's biography

As with NM176a, figure 2.12 outlines selected points in the life of the Scotston site. I have arranged these points on a timeline, and — in brackets — identified the ontological contexts discussed in this section.

2.5 DISCUSSION

While my case studies' ontological situations shift over time, at most points in their life they have indeed been ontologically multivalent, and may still be so today. For example, NM176a and others from the same body of work simultaneously occupying the position of commodities on the art market, extant within a musem context (this alone affording them the concurrent status of epistemic objects, phenomenological objects and state property), and instruments through which to examine the practices of a 19th-century Zulu artist.

Furthermore, being initially anchored within a given context did not preclude their being forced into another ontology, for instance being recorded within a classification schema in a museum, itself being constructed within — and as model of — a specific ontology. This forcing may also have occurred through a grazing collision with a differing ontology, such as in the early colonial phases of the Scotston site when it was still a living rock art site with cultural significance for its creators. When ontological forcing takes place, some elements may be translated — where classification systems allow for this, while others are forced into alignment — for instance the limited vocabularies used to describe Zulu pottery discussed in chapter 1. Unfortunately though, some elements are discarded as there is no mechanism for their mapping between ontologies. As such, I will rely on the term *ontological ambiguity* for describing their existence. The term is not particularly descriptive or enlightening, but will serve as a placeholder in this research.

This ambiguity frames not just my case studies and their lives, but also the processes involved in their digitisation. The act of digitisation within projects is frequently treated as a *quantitative* problem at various scales, from the small scale — scan resolution, precision and accuracy of the process, colour reproduction, mesh size and number of vertices; to the large scale — file size and storage, number of objects digitised (often a needed target for funded projects). Furthermore, the individual digital objects themselves are frequently *also*

treated as nothing more than data, and their individuality is lost (or neutralised) in the pool of data and the pipeline of production. As a response to this, I will quote Lucas and Olsen's reading of Artur Ribeiro in calling for the reassertion of the "qualitative case study as a counterbalance to the quantitative reductionism of big data and the third science revolution" (Ribeiro 2019; Lucas and Olsen 2022, p. 352).

Lucas and Olsen consider this an important critical rethinking of the very nature of the case study in archaeology (2022, p. 352), where the most common approach — the archetypal humanities and social-science usage — of the case study is "an intensive study of a single unit for the purpose of understanding a larger class of (similar) units", often described as the *proof of concept* (Henare, Holbraad and Wastell 2007, p. 5; Lucas and Olsen 2022). This involves, as Gerring states, ".. in-depth study of a single unit (a relatively bounded phenomenon) where the scholar's aim is to elucidate features of a larger class of similar phenomena" (Gerring 2004, p. 341). As in the so-called "hard" sciences, this approach uses the case study as *data to which theory is applied*, challenging, testing and validating existing theoretical models (Henare, Holbraad and Wastell 2007, p. 5).

I argue that in the context of this research, the processes of engaging with the thing, digitising it, and producing derivative knowledges (and other *things*), are themselves epistemic tools, and involve learning *with* the thing, not just *about* the thing, or the *formal properties* of the thing. The idea of the *thing as heuristic* stems from Henare's suggestion of allowing the *thing* to dictate its own terms (Henare, Holbraad and Wastell 2007, p. 5).

Historian Carlo Ginzburg articulates this approach in his remarkable work of microhistory[20], *The Cheese and the Worms*,[21] recounting the trial of a 16th century Italian miller for heresy. Ginzburg focuses on the smaller-scale of history, using individual events or cases which he considers representative, and subsequently uses as entry points to his theoretical analyses (Ginzburg 1980). Lucas and Olsen discuss this form of engagement as the *exemplar*, which works by "juxtaposition and analogy" (Lucas and Olsen 2022, p. 359). They argue that

20 His work is also a compelling example of research involving alternative ontologies *within* Western culture.
21 *Il formaggio e i vermi. Il cosmo di un mugnaio del '500.*

this form is not a venue for testing or demonstrating theory, but rather a *site of encounter* where propositions and theories are "modified, developed and challenged" (2022, p. 364). Furthermore, they state that

> Such case studies, moreover, often work best when they deal with the marginal, the anomalous, the aberrant because they expose contradictions or blind spots when they juxtapose two norms or conceptual frameworks (2022, p. 359).

I designed my study and chose my exemplars with this in mind, having sufficient compelling similarities and juxtapositions to act, as Lucas and Olsen suggest, as *sites of encounter*. I have constructed their biographies and itineraries, and looked to various significant turns within these biographies to highlight the dominant ontological contexts of their existence across space and time. In order to fully understand the epistemological situation of the thing at these points, one should ideally unpack the systems within which they are classified and constructed as epistemic objects, looking closely at the artificial ontologies, and the decisions informing them. To do so in depth, however, is beyond the scope of this work and will be something I look forward to for future research.

Instead, I have acknowledged their overall ontological ambiguity, and the epistemological frameworks within which they are anchored and will consider how this informs both knowledge production *involving* the thing, and phenomenological engagements *with* the thing. After this examination of my exemplars at a larger scale, in the next chapter I will move to a smaller scale, and unpack the digitisation process itself using a *chaîne opératoire* approach.

3

PROCESS, PRACTICE AND THE MODEL

> This whole tired question of the correspondence between words and the world stems from a simple confusion between epistemology and the history of art. We have taken science for realist painting, imagining that it made an exact copy of the world.
>
> Bruno Latour, 1999, *Pandora's hope: essays on the reality of science studies* p. 78

In the previous chapter, I discussed the need to survey the ontological landscape of the *thing*, both in physical form and its subsequent digital translation. I investigated the biographies of things and their multiple ontological states using two methodological approaches. Firstly, at a larger scale, I explored the use of Kopytoff's notion of the *object biography* in conjunction with Joyce's *object itineraries* to historicise the thing, and situate it within an ontological and epistemological state at various points throughout its life. Secondly, at a smaller scale, I proposed the use of Leroi-Gourhan's idea of the *chaîne opératoire* in order to peer inside the *black-boxed* processes of digitisation. I then elucidated the chosen approach to my case studies, and my reasons for treating them as *exemplars* — as sites of encounter — in order to bring them into conversation with my theoretical explorations.

In this chapter, firstly, I outline the reasoning behind my use of the term *model* for the 3D digitisation, the term simultaneously meaning *maquette*, *conceptual tool* and *empirical form*. I then discuss the need to engage with prior practices of three-dimensional reproduction, and how 19th century practices of plaster casting of sculpture, architecture and artefacts reveal compelling similarities (and stark differences) with three-dimensional digitisation, as both a means of copying and mass (re)production, and a means towards producing things

that are both epistemic and phenomenological objects. Casts were produced by craftspeople whose labour and practices were frequently erased. Three-dimensional computer modelling has, since its inception, been positioned as a craft practice, yet the hand of the craftsman is rarely credited or made visible.

I follow this with a discussion of the uncertain ontological state of the digital model, and an overview of the general processes of digitisation, and then a more detailed description of the act of photogrammetric modelling, and its congruence with casting. In discussing the technologies used in (and before) digitisation, I will acknowledge their origins and the epistemological circumstances under which they have been created and used. Finally, I document the *chaîne opératoire* of photogrammetric modelling of one of my exemplars, and then discuss the observation that the balance of agency within the processes of digitisation remains unclear in many cases — the technical equipment is credited with an inordinate agency over the practitioner. I conclude that we can — and should — challenge discourses of 3D digitisation as being objective, and foreground the practitioner and their practice, and reevaluate digitisation as more than just documentation, but as a process of learning *from* and *with* the thing. To this end — borrowing from Caraher's *slow archaeology* and extending Kansa's *slow data* — I suggest the idea of *slow digitisation*: disavowing neoliberal academia's requirements for efficiency and metrics in favour of thoughtful engagement with the thing throughout the processes of digitisation.

3.1 CHOICE OF TERMINOLOGY - THE MODEL

Throughout this work I refer to the digitised 3D *model*. This term has consolidated itself within the practices of visualisation, 3D recording, and related areas, including their deployment within heritage adjacent fields. The first use of this term within the computerised 3D recording and visualisation that I was able to find is in a 1968 paper from the proceedings of the *7th Annual Meeting of UAIDE*[1], presented by computer scientists Roy Davis *et al*,

1 *Users of Automatic Information and Display Equipment* — an early group of researchers working on computer animation.

entitled *A model making and display technique for 3-D pictures* (J. R. Davis, Nagel and Guber 1968).

The term as I use it here results from a convergence of definitions from many adjacent fields. Firstly, it owes allegiance to the notion of a model as *maquette*, this form of model being defined by Ottó Petrik as "the representation in concrete form of some object, phenomenon or concept; it is calculated to reflect (reproduce) the original in accordance with its purposes" (Petrik 1971, p. 238). This model can be full-size or miniature, and furthermore, may present a reproduction of the original in different materials to the original (Gluziński 1985, p. 114). Miquel i Serra describes a model in a museum context as

> Something that serves as an object of imitation, which is to say: the nature of the model exists as a function of the copy. It remains, therefore, well differentiated from the original, which stands by itself, and may or may not also be eventually taken as a model (Miquel i Serra and Morral i Romeu 1985, p. 129).

Secondly, the term *model* is used within fine art, loosely, to describe a person, object or idea which either serves directly as the subject for a work, or at least informs it. Then, various technical and analytical disciplines use the concept of a model as a predictive heuristic, a simplified representation of a phenomenon, process, or system, which is used to understand, explain and make predictions about the world. These models can be mathematical, conceptual, computational, or physical, depending on the nature of the system being investigated. Eighteenth-century scientists and engineers built small-scale models of their ideas and designs in order to test them; shipbuilders have long built "half-models" of their designs rather than drafting them, embodying their mental model of an ideal form (Schaffer 2004, p. 72). Perry highlights the importance of the multivalence of these models as as both ubiquitous representations and novel mechanisms of knowledge making (ch. 14 Perry 2013).

Similarly, the artificial ontologies within which things things are classified and canonised as epistemic objects, such as internal museum classification systems, or formal metadata schemata such as *Dublin Core* or *CIDOC-CRM* are *themselves* models of an ontological reality.

All of these definitions are deeply entwined within my research, in which I approach the model as an amalgam of all of the above manifestations: maquette, inspiration, conceptual tool, and resident of a larger epistemological model.

3.2 PRECEDENTS IN THREE-DIMENSIONAL COPYING - CASTS AND COPIES

Opgenhaffen writes that

> Most technology presented as something new is often rather old practice in disguise with ostensibly familiar looking outputs, produced from centuries old visual modes of representation (Opgenhaffen 2021, p. 1693).

As such, in order to understand current practices in 3D digitisation of things there is an obligation to engage with prior practices. Plaster casting is one of the few pre-digital means of producing an accurate three-dimensional copy of an original artwork or artefact. Casting was the only direct, precise method which proved practical for a wide range of objects of varying shapes, scales, and materials. The 19th century saw other means of producing copies, such as James Watt and Benjamin Cheverton's sculpture-copying machines, but these were designed for roughly cylindrical objects such as busts and small statues, and so were severely limited in scope.

Art historian Anthony Hughes reiterates that the traditions of European sculpture have long embraced the "transference" of images between media; from wax to stone, from clay to marble, and so on (Hughes and Ranfft 1997, p. 32). Plaster casting allowed for reproduction of a work in many different materials, such as plaster, clay or ultimately bronze. Similarly, the digital model *requires* a shift in material and materiality, it being recast in "digital material" (Ingold 2010, p. 93).

Furthermore, casting is not just a means of *duplicating* an extant original, but explicitly affords the ability to produce a *series* of originals. Sculptors would produce a clay master model which was then used to mass produce plaster casts or bronzes (Van de Ven 2017). Mazuran-Subotić calls this *multiplication* of a work (Mazuran-Subotić 1985, p. 116), which is something that can be repeated infinitely with a digital model, resulting in not just

identical virtual models, but physical models[2] as well, through the use of rapid-prototyping technologies such as 3D-printing or CNC milling.

The final casts, being moulded from pure plaster, produce a featureless[3], white surface completely congruent with the original from which the mould was taken. They are invariably hollow to save weight and raw material and so are unable to replicate mass, material properties and other markers of the original's materiality, and so their entire existence depends on their surface. If the surface loses its correspondence with the original, the entire replica is compromised (M. Nichols 2006, p. 116). Similarly, A 3D digital model is, arguably, nothing *but* surface, it has no physical properties whatsoever, its entire connection with the original is in the replication of that surface. Minkin writes that "The surface of identification in a digital model has no thickness and contains nothing", calling it a shell, a *husk* (Minkin 2016, p. 118).

Finally, they are ontologically polyvalent; they simultaneously occupy the states of being as things of research and knowledge — *epistemic things*, and of *phenomenological things*, positioned by Maroević as being in "communication with visitors" (Maroević 1985, p. 117). Further to this, as intimated by Nichols, is that casts — much like digital models — occupy an awkward space between art and documentation (M. Nichols 2006, p. 118). These ontological situations form the hinge around which debates on the relevance of authenticity — and thus the very nature of the copy — pivot (Hughes and Ranfft 1997; M. Nichols 2006; Dunstan 2014; Fyfe 2015; S. M. Foster and Curtis 2016; Marchand 2019).

Looking closely at these traditions and the questions they have raised regarding the nature of authenticity and the copy, the 3D scan then, at first glance, appears to be the logical successor to the art of plaster casting and highlights many of the same issues regarding provenance, authenticity and process. The connection has been asymptotically approached from various directions, for instance Van de Ven (2017), who looks primarily at 3D-printed

2 For instance Khunti and Geismar (Khunti 2018; Geismar 2018, p. 105); and the idea of "additive archaeology" (Beale and Reilly 2017, p. 4.2).

3 Although many were then treated to mimic the original material's surface - bronze, marble, stone, and so on (Frederick 1899, p. 104; Payne 2020, p. 5).

output rather than scanning itself, and conversely, Galizia *et al* (2015) and others who have, in an interesting inversion, looked at producing plaster cast replicas from numerically milled or 3D printed moulds made from 3D scans.

Given their similarities, there is a notable lacuna of work positioning these processes as relatable. As such I will use this intersection as a departure point in unpacking and highlighting these factors as they apply to digitised objects. Firstly, though, a brief history of casts and casting is in order.



Surface of a plaster cast Surface of solid 3D model

Figure 3.1: Surfaces compared*images: author*

3.2.1 *A Historicisation of casts*

In 1892 the "Times" of London reported on a legal case in which one of the players was accused of "pirating" the products of another (Lending 2014, p. 197). The complainant in this was the well-known firm of "D. Brucciani and Co.", internationally renowned producers of plaster casts. At this point in time the business of producing plaster casts (and obviously, the moulds from which they were made) was a widespread and popular European and American phenomenon. Brucciani was one of the better known Italian *Formatori*, with a showroom and factory in Covent Garden in London. He had formal relationships

with both the British Museum and the South Kensington Museum[4], and his catalogue and showroom showcased items ranging from casts of flowers and fruits, to copies of classical sculpture, popular with collectors and museums alike (Wade 2018).

Brucciani was, indirectly, a product of the groups of Italian *figurinai* — young boys who migrated seasonally from the Tuscan province of Lucca — wandering their way across Europe, through the Alps, to Paris, Calais, and eventually to England, selling small plaster casts of significant artworks, religious icons, and regional souvenirs along the way (Wade 2018, p. 4). Plaster casts of existing sculptural works have a long history, and there is no need to relate that here; Haskell and Nicholas cover this extensively in "Taste and the Antique: the lure of classical sculpture, 1500-1900" (Haskell, N. Penny et al. 1981), as do Payne and Nichols (M. Nichols 2006; Payne 2020); however, I will discuss key turns in their history as they relate to ideas of both physical and digital three-dimensional reproductions.

Casts and collectors

The Roman spa town of Baiae on the Gulf of Naples, dated roughly to the first century BCE, produced in a 1954 excavation some 400 fragments of plaster casts of 5th and 4th century BC Greek bronzes, used as infill in a cellar. These were probably used in a studio as reference works for the creation of full-size marble copies (Landwehr 2010, p. 35). Given the scale and detail of the original works, some of the moulds for these casts must have involved close to 200 individual sections (2010, p. 37). Historiographically, little attention seems to have been paid to casting until Giorgio Vasari mentions Andrea Verrocchio working with life-casts of animals and plants in the mid 1400s (Ballestriero 2018, p. 12). In 1540 the French Royal court commissioned Francesco Primaticcio, Abbé of Saint Martin de Troyes, to produce casts of significant Roman statuary, an undertaking requiring not just significant technical skills, but also skills in negotiation, particularly where Rome and the Vatican were involved (Cupperi 2010; Haskell, N. Penny et al. 1981, p. 2). Casts were at this point frequently deployed as a conspicuous marker of wealth, and were an integral part of the

4 Later to become the *Victoria and Albert* Museum.

need for "completeness" in a collection. In 1830, English writer Horace Smith described plaster casts as

> The most delightful of all inventions, the printing of sculpture, which, diffusing and perpetuating the glorious works of Phideas and Praxiteles, enables us to place celestials upon our shelves, to set up a gallery, and keep a Mount Olympus of our own, at the expense of a few shillings (Wade 2018, p. 5).

They were also means of owning a piece of classical sculpture, and could "stand in" for unobtainable and inaccessible marbles or bronzes (Bury 1991, p. 122) and were, in some senses, an alternative to travel in Napoleonic Europe, when this was becoming increasingly difficult and dangerous (Thompson 2016, ch6).

Didactic casts

The high Renaissance saw the rise of plaster casts alongside prints as references for students of art; despite the skill of sketch artists and painters in reproducing images of significant works, the fact remained that casts were "absolutely reliable replicas" (Haskell, N. Penny et al. 1981, p. 16), and relatively cheap. Art historian Morgan Ng, in his introductory presentation at the *Future of the Virtual Past* conference in 2022 in Cambridge (Ng 2022), described plaster casts as *epistemic instruments*, noting characteristics which informed this idea: casts are "mechanically exact copies"; they "erased inconsistencies in the surface of objects" — from a point of view of pure form, the copy was arguably "better than the original" — they afforded greater access to the object across wider audiences (this is a theme we see repeatedly where the "digital" is concerned); and formed the basis for a universal language of formal analysis.

In 1728, a Scotsman named John Smibert began importing casts of important European works into the American colonies, with the intention of using them as teaching aids. After this plan fell through he opened a studio in Boston and displayed these casts, after which they essentially became a "school" for local colonial artists without access to any of the collections offered on the European continent. Over the next two centuries or so, the plaster

cast became not just a tool for teaching, but also, it has been suggested, a means of "elevating public taste" (McNutt 1990). By 1870 or so, casts were a major public attraction in American museums (McNutt 1990; M. Nichols 2006). In addition, many European museums in the period had their own casting departments; the Louvre had their *atelier de moulage* which was founded in 1794 and is still producing casts and moulds of notable works, having added modern techniques such as 3D scanning and 3D printing to their set of techniques and tools (*The Molding Workshop | Boutiques de Musées* 2022), similarly, the Berlin *Gipsformerei* was founded in 1819, and still continues to produce replicas, many from original moulds, and in many cases where the original work no longer exists (Berlin 2023).

At the same time that casts were being deployed as teaching instruments, they were an important process in the colonial circulation of natural history objects and subsequent knowledge production. These casts included animal specimens, fossils, and even casts of plants and fruit (Půtová 2021). In 1867, Henry Cole, director of the South Kensington Museum drew up an agreement, which he had fifteen heads of state sign during that years' International Exposition in Paris. The agreement, titled *[the] Convention for Promoting Universally Reproductions of Works of Art for the Benefit of Museums of All Countries*, encouraged the production and circulation of photographs, electrotypes and casts of objects and monuments (Lending 2014, p. 200). Copies were a vital aspect of the formation of cultural capital, being one of the primary ways in which the visual arts were communicated in the period (Fyfe 2015, p. 48), evidenced by the number of *formatori* in the latter half of the 19th century. There were up to fifteen studios in London in this period, and around forty in Paris (Malone 2010, p. 165).

Archaeological, anthropological and Colonial casts

In the 1800s colonial expeditions brought back extensive collections of casts; despite later, wholesale removals[5] of objects to European collections, larger immovable pieces were

5 There *were* dissenting voices to the removal of objects - a comment in "The Times" (21 May 1883) suggests that the removal of objects is "veritable vandalism", and "a defiance of the system of using plaster casts" (Barringer and T. Flynn 2012, p. 23).

primarily copied in cast form, using plaster or papier-mâché moulds. British and American voyages to central America brought back casts of Mesoamerican stelae and reliefs; historic Norwegian stave-church portals were cast and displayed at the South Kensington museum, as was a cast of the Portico de la Gloria from the cathedral of Santiago de Compostela. Trajan's column from Rome was moulded (at Napoleon's behest) to be displayed in Paris (and remoulded and copied for the South Kensington museum); extensive casts were made of the Khmer temples of Angkor (T. A. Joyce 1929; Fash 2004; M. S. Falser and Heidelberg 2011).[6] Many of these casts were also available as copies produced by notable *Formatori* such as Brucciani and Gherardi (Malone 2016; Wade 2018). Outside of architecture and art, Flinders Petrie describes these processes as being already well established in archaeology in his 1904 manual *Methods & Aims in Archaeology* (F. Petrie 1904, p. 60).

As in the case of organisational schemas, taxonomies and proto-metadata, casts became an inevitable tool in the execution of the European colonial project. The 1898 Cambridge expedition to the Torres Straits islands brought back casts of the indigenous people, and these casts and those from similar expeditions were invariably deployed in service of "racial science". As related earlier with the case of rock art, scientists were attempting to prove the "primitivity" of these peoples and fit them into a European-supremacist structure of evolution (H. G. Penny and Bunzl 2003; A. D. Evans 2008). Large collections of Nordic rock art were cast for Himmler's *Ahnenerbe* in the 1930s as part of the movement to promote the superiority of the "Nordic race" (S. M. Foster and Curtis 2016, p. 125).

As a South African, one cannot forget the case of Sara Baartman, who was taken to England in 1810 by surgeon Alexander Dunlop, and then displayed, examined, cast, and ultimately dissected. Her full-body cast and skeleton were on display in the *Musée de l'Homme* until the 1970s.[7] Scottish taxidermist James Drury, based at the South African Museum in Cape

6 Unfortunately, many of these casts and moulds sat unused and neglected in the stores of notable institutions, including the British Museum, the Peabody and the Met, until invariably auctioned off for next to nothing, or destroyed (Fash 2004; M. Nichols 2006).

7 When her remains were repatriated, a cast accompanied them on return to South Africa. Interestingly, this was a *new* cast made from the original wax moulds, which seem to still be held by the *Muséum National d'Histoire Naturelle* (Tobias 2002).

Town, also cast a number of San people and families between 1907 and 1923, with some of the casts on display well into the 1980s (Du Pisani 1980; Davison 2001; Steven 2006, p. 485).

3.2.2 *The practice of casting*

Moulding a complex work in order to produce plaster casts was a skilled art. The moulds were invariably in the form of "piece moulds", as the abundance of protrusions and acute angles on the original work meant that the moulds had to be made in small parts so that they could mechanically be removed from the original without damaging it. The *formatore* had to assess the surface of the original and make complex decisions about where to situate seams of the pieces, how thin and acutely angled pieces would mould and if they would release properly while retaining detail (Frederick 1899; M. S. Falser and Heidelberg 2011) In order to make a plaster mould from an original piece, it had to be coated with some sort of releasing compound[8], after which it could be coated with wet plaster to produce a master mould. This piece casting method also left a fine network of lines or ridges on the surface of the reproduction, marking the seams between the various pieces. Marden Nichols notes that these "reveal to the eye, or the finger-tips, that this is *not* the original" (M. Nichols 2006, p. 116), however, when ordering reproductions from cast-makers, these flashing ridges were only removed and smoothed over by special order. American castmaker William Brigham suggests, in his 1874 catalogue, that

> If the casting has been successful the cast will be marked with a network of fine lines made by the joints of the pieces of the mould (see the photographs of the Faun, No. 38). The fineness of these lines and the sharpness of their intersections indicate the condition of the mould and the consequent value of the cast. … Hence it is better to purchase casts with these marks on them.> (Brigham 1874, p. 27)

8 Such as oil or liquid soap.

Frank Frederic, in his 1889 manual on cast-making acknowledges that instead of being detrimental to the finished cast, these ridges instead highlight the quality and accuracy of the piece (Frederick 1899, p. 77).

Esther Leslie, discussing Benjamin's 1934 essay on Dadaism, suggests that traces[9] of the world — or at least their imprints reinforce the connection of works of art with the real, physical world. She states that:

> Fingerprints and the handprints of the potter are not signatures; such traces differ from the individuating, authenticating autographs of high art. *Their virtue lies in their hinge with actuality, not their market value* (Leslie 1998, p. 9) (emphasis mine).

The moulds, if the original was large, important or otherwise inaccessible, were then used to make an intermediate model[10] from which production moulds could be made. This left the original moulds — the ones which had been in direct contact with the original — intact and safe for future use (Frederick 1899; Neilson 2019; Payne 2020). Each subsequent copy produced in a mould is effectively the same "distance" from the original as is the first. Wade relates, in discussing a significant piece of 19th century work, that

> …it was considered novel and faithful because the mould had been in direct contact with what was still one of the most admired sculptures of the classical canon (Wade 2018, p. 44).

The cast was unique as a form of reproduction in that there was a direct, traceable provenance of contact between cast reproductions and the original work.

3.3 WHAT IS DIGITISATION?

The move from physical object to representation of that physical object in any medium follows a series of steps (Olsen 2012, ch 5); the transition to digital media (digitisation) is

9 *Spuren*
10 A process known as *surmoulage* (Malone 2010, p. 172).

no different. However, to paraphrase Olsen, despite many of the steps being transparently defined, one step could be seen as the "obligatory passage point" in the translation, the "folding of many micro-steps into this defining transformation of digital media" (2012, ch 6), the point at which the physical object or phenomenon is sampled and converted into discrete units. Manovich clarifies this:

> First data is sampled, most often at regular intervals, such as the grid of pixels used to represent a digital image. Technically, a sample is defined as "a measurement made at a particular instant in space and time according to a specified procedure". … Second, each sample is quantified, ie. Assigned a numerical value drawn from a defined range… (Manovich 2002, p. 50)

This is the crucial differentiation between digital and analogue recording. Analogue recording by nature affords continuous representation, whereas digitisation (and "born-digital" images) produce discrete representations. For instance the analogue photograph offers continuous variance spatially and tonally; it has no physical or spatial "steps", and the tones in colour (or black) are smoothly varying (Mitchell 1994, p. 3). A digital image, on the other hand, is constructed both spatially of steps (pixels or points), and each of these is allocated a value (at least Red, Green and Blue) from a fixed range. No matter how large the pixel count of the image is, or how large the colour-space is, or what form of encoding it uses, each fixed-size pixel can only be represented from within a fixed range of values.

The digital object produced through the processes of sampling and quantification is stored in flash memory or on disk as an array of numeric data. Manovich describes these objects as "new media objects", and notes their key characteristic as being "composed of digital code; they are numerical representations" (Manovich 2002, p. 49). All data stored on some form of computational media is numeric, with a varying level of precision, depending on its purpose. For instance a raw text file can be stored as 8-bit numbers[11], this is enough to describe the

11 That is, each number can fall in the range 0..255 (2^8)-1

standard ASCII[12] text encoding form (which is notably American and Eurocentric in its design, hence only describes English characters).

On the other end of the continuum would be files generated, say, by particle accelerators, often stored in 32-bit precision (with a corresponding numeric range of 0..4 294 967 295). A high-resolution digital image falls somewhere in the middle, probably 12 or 14-bits precision, while a scanned 3D model *may* have up to 64-bit precision. The final product of these processes is an algorithmically defined sequence of numbers in a file on a storage medium — a flash drive or rotating disk. The sequence and nature of this file is dependent on the algorithms deployed in its production and the formal machine ontologies which describe its nature and afford reconstruction in a form understandable to us. Manovich describes this:

> On the level of representation, it belongs to the side of human culture, automatically entering in dialog with other images, other cultural "semes" and "mythemes". But on another level, it is a computer file .... On this level it enters into a dialog with other computer files. The dimensions of this dialog are not the images' content, meanings or formal qualities, but file size, file type.... In short, these dimensions are that of the computer's own cosmogony rather than of human culture (Manovich 2002, p. 63).

The digital file/object's current relationship to the original physical object which it reproduces or reflects is entirely dependent on the algorithmic operations performed in digitisations (electronic, mechanical and computational). On disk (or other storage medium) a series of data could just as easily be a sound file, an image, a rendition of *Ode to Joy*, a digitised copy of Leni Reifenstahl's *Triumph of the Will* or a 3D scan of a Benin plaque, nothing more than anonymous bits on a disk. Theorists Daniel Rubinstein and Katrina Sluis construct this as a "break in the infinite chain of signification, in which every signifier can be represented by another signifier, once the signifier is a number (or a bit) it cannot be represented by something else" (Rubinstein and Sluis 2013, p. 34).

12 American Standard Code for Information Interchange.

Logically, we have reached the point of maximum and complete fragmentation (and de-contextualisation) of the digital object, it is *perfectly* and *exquisitely* contextless, carrying no meaning until recontextualised within the appropriate ontological framework, and informed by (and of) the appropriate structure and algorithms in order to be read, interpreted and visualised and ultimately be useful as an epistemological object. The file is identified by arcane markers: "magic numbers" — specific configurations of characters at the beginning of the file, or file extensions[13], which we all know as the last few characters of a filename after the "dot", for instance ".docx" or ".jpg". These are entirely external markers, a form of metadata, which if altered, many programs will reject as being an invalid or corrupt file, despite the file contents being perfectly compliant with the appropriate requirements.

The process of sampling and quantisation takes many different forms — digitisation of an image and reduction of samples to pixels is dissimilar to digitisation of a 3D object and derivation of the X, Y and Z coordinates of points on the surface of the object. Both the manner in which quantisation happens and the data points which are sampled depend on a predetermined paradigm, which Tarte notes as "encapsulating expectations and intentions" (Tarte 2011, p. 8). Furthermore, the paradigm dictates *which* points are sampled, and so there is an additional layer of decision and interpretation in the process. The sampling of some points is a function of the surface properties of the thing; some points are chosen due to their unique visible configuration in the digital image, and yet others are chosen due to internal algorithmic decisions made by the programmer of the software.

The history of digital imaging — the root of most current digitisation — has a complex, entangled relationship with practices of observation and surveillance. The first practical digital imaging device was a camera developed for astronomical research by James Westphal and Thomas McCord, described in 1972 (McCord and Westphal 1972), and by 1976 similar technologies had been subsequently deployed on a series of American surveillance ("spy") satellites — the KH-11 "Keyhole" series (Richelson 1984, p. 137). These practices of both "looking in" at earth, and "looking out" at the universe have a long record of intersection

13 Thankfully now being superseded

in terms of both expertise and funding, driven by the Cold War and the colossal budgets afforded to the military-industrial complex of the period. Media theorist Lisa Parks writes that "military and scientific remote-sensing programs treated the surface of the earth as a domain of unobstructed Western vision, knowledge, and control" (Parks 2005, p. 79), and as such reinforce the Western scientific gaze and its classifications of the world.

3.3.1 *The model*

Points and samples: scans and casts

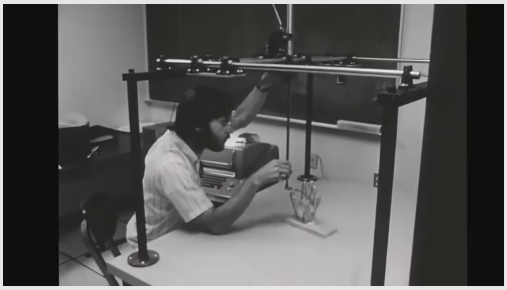
In his landmark 1972 paper, *A system for computer-generated movies*, computer scientist[14] and digital graphics pioneer Edward Catmull described the process of digitising his hand for his groundbreaking short film, one of the first computer animations. The film depicts a 3D human hand which moves and flexes. In order to "digitise" his hand, Catmull made a plaster cast of his hand, drew polygons on the surface of the cast, and manually measured the coordinates of each point of intersection of the polygons (Catmull 1972). Each of these points, initially in physical space, and then in object space, had a set of X, Y and Z coordinates describing its position, which then informed the digital recreation of this object (see figure 3.2). Catmull's process of digitisation involved manually measuring these points. Many current processes still use this technique, albeit in a more sophisticated and controlled manner than using a tape measure or ruler[15], but still involving direct point-contact with the surface of the original object and some form of mechanical measurement of this point.

14 And notable figure within the fields of computer-generated-imagery for movies at *Industrial Light and Magic* and *Pixar*.

15 Contact-type digitisation is still used extensively in industrial applications for digitising and replicating machinery and similar parts; it is of limited value in most museum and heritage situations due to its need for contact with a thing's surface.



Plaster cast of hand



Digitising the cast



3D Mesh



"Solid" 3D model

Figure 3.2: Ed Catmull's hand – Stills from "A Computer Animated Hand" (1972)

Attempts at production copying of sculpture and other three-dimensional forms has traditionally followed a similar schema, for instance James Watt's sculpture copying machines of the late 1800s (Insley 2013) , or Benjamin Cheverton's "Three-dimensional pantograph" (Wade 2018, p. 50).[16] The pinnacle of this craft was arguably Italian sculptor Augusto Bontempi's "sculpturing machine", which produced "mathematically perfect" copies by probing points on the surface of the original and drilling holes in matching positions on a block of plaster, thus informing the surface to be produced from these points (Dunstan 2014). This method of point for point measurement followed either by some form of quantification and recording or immediate mechanical fabrication of a copy ensures a record which is truly isometric with its referent. Although the process of photogrammetry — which I

16 In a notable first for non-contact copying, but one might argue, in "analogue" form, in 1859 French inventor François Willème first demonstrated the production of plaster sculptures of people taken from a sequence of photographic silhouettes traced into clay, and then cast (Sobieszek 1980).

will describe in the next section — involves no physical contact, there are processes of algorithmic inference which have the same end result, points on the original object being identified, quantified, and remapped. This may be directed onto a substrate — drilling holes in a plaster blank mounted on Bontempi's machine — or into the potential of an imaginary 3D space, solidifying the algorithmic outputs into a series of X, Y, and Z points. Repeated many thousands of times, this produces a virtual, digital facsimile of the original object.

Digitisation via laser-scanning holds true to this model; although the tool here is a laser beam — or more correctly, a pulse, which translates to a spot of light on the surface of the object, the process still fundamentally involves contact, and as with the above processes, that spot also informs a point in three-dimensional space. This point occupies coordinates in physical space until, through measurements intrinsic to the hardware of the scanner[17], it is mapped to a point in object space. Whatever its origin, once imagined in the digital space, the vertices pin the 3D model to its physical counterpart, much as Bontempi's machine in which the points (realised in the form of a drill-hole of particular depth) inform the outline or surface of the new copy, or the contact of a plaster mould with its original. On a somewhat metaphysical level, these measurements could be seen as a form of contact between the software tools and algorithms and the physical object, bringing to mind art historian George Didi-Huberman's notion of the *empreinte*. This is a multi-faceted concept, at once describing both the *mark* produced by pressing an object onto a surface[18], and also the *process* of doing so. Translation to English misses the nuances of this term and its multiple connotations of *print*, *impression* and *trace* (Larsson 2020, p. 98). Didi-Huberman uses this to refer to the form of contact between the object and an intermediate stage of copying, specifically wax and plaster moulds and models of people, artworks and antiquities. Larsson extends this by correlating it with Jacques Lacan's notion of the *point de capiton*, or *quilting point*. Lacan describes this as the point where the "signifier adheres to the signified", with reference to the use of a button sewn through multiple layers of fabric and padding to hold upholstery together (2020, p. 112).

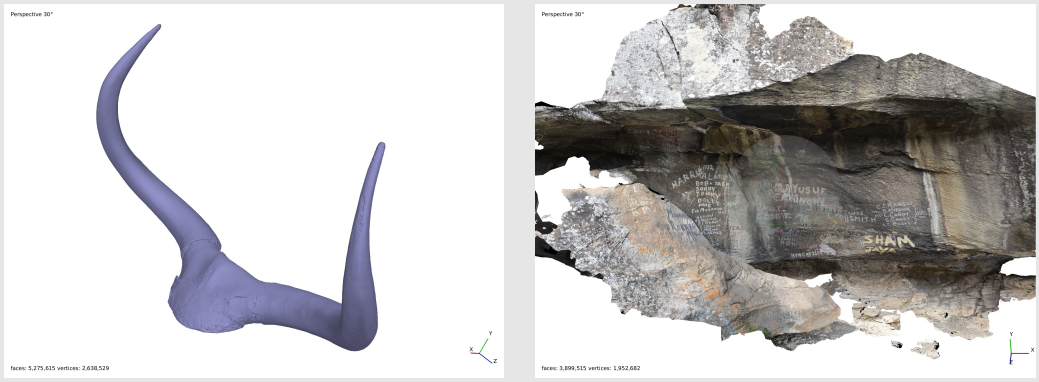
17 Such as rotation angle around various axes, and time-of flight, or the time taken for the laser pulse to be reflected back from the object, see for instance Wulf and Wagner (2003).

18 Produire une marque par la pression d'un corps sur une surface.

The points and vertices produced through digitisation — manually, as in the case of Catmull's hand — or automatically, through a laser scanner or photogrammetry — behave in a similar manner. They *pin* the otherwise free-floating model in virtual space to the referent, offering some anchorage in relation to the object and the physical world. Further concretisation of these anchors may occur with the use of tools such as *ground control points* or *fiducial markers*, markers applied to known physical points which appear in the photogrammetric source images. The anchorage is not perfect or permanent though, as further computational processes may lead to slippage between these points and their physical-world referents.

The ontology of the 3D model

A 3D model consists of a network of points each having an X, Y and Z coordinate in a cartesian space, described by Bernadette Flynn as a "divided, directional space that reduces the complexity of spatial experience down to an XYZ grid of mathematical absolutes" (B. Flynn 2007, p. 350). The model may be based entirely on points, producing a *point cloud*, which, when visualised displays a somewhat ethereal, translucent rendition of a thing or scene. Alternatively, the coordinates will each inform one corner or *vertex* of a flat polygon, usually a triangle or quadrangular shape or facet, usually referred to as a *face*. This is often referred to as a *solid* model. Each vertex or face may be equipped with additional attributes, such as colour, or a reference to coordinates on a digital image known as a *texture* which is then projected onto the surface defined by the faces (see figure 3.3). As I will describe later in this chapter in detail, the points themselves are calculated algorithmically from features on the surface of a physical thing, photographed digitally and extensively processed.



NM176a, solid model Scotson site, textured model

Figure 3.3: “Solid” 3D models

The 3D model produced from these processes possesses some unique features. Firstly, as mentioned above regarding the general process of digitisation, the model is defined by a paradigm specific to the type of digitisation being performed. The model exists as nothing more than a collection of points in a theoretical 3D space; this space in which the points defining the object exist is purely imaginary, as there is nothing anchoring this to the physical space of the original object. The space is also, as the term implies, mostly empty, and is unique to this model — it is not contiguous with 3D space defined for/by other models — it is a finite and bounded universe centred on this object. The model is unframed, and its extents defined only by the numeric range occupied by its coordinates. As David Berry offers:

> A notable feature of digital artefacts is that they tend to be unbound in character. Unlike books, which have clear boundary points marked by the cardboard that makes up the covers, digital objects boundaries are drawn by the file format in which they are encoded (Berry 2014, p. 45).

Additionally, the model is purely *potential* at this point. The 3D model on disk occupies a similar state to that of the intermediate plaster mould of a classical sculpture. It is not the final thing (that happens when we work with or visualise the model), but it looks towards this action. As Louise Minkin notes, its “transcoding, movement and replication

are anticipated" (Minkin 2016, p. 119). The digital model is only apparent as such (to us) when we visualise or manipulate it with a software tool. Without these external tools and definitions within those tools, the model is unavailable to us. The definitions within the tool (software such as Meshlab, Blender or Sketchfab) tell it how and what to display, allowing the faces to "behave in ways similar to the real environment, taking on properties such as color, reflectivity, transparency, and influencing their surrounding digital environment" (Earl 2013, p. 227).

When we view the model on a flat computer screen, manifesting the 3D points in an imaginary cartesian space somewhere behind the screen, there is a sense that the object is solid, and has volume, but it has no material fabric. As with a cast, the model is defined by its surface only.[19] Paul Reilly describes this phenomenon as the "mere husk of an object" (Reilly 2015, p. 230), while Minkin calls it a *meniscus* (Minkin 2016, p. 117). As such, there is no concept of volume, mass, inside or outside, the model's internal ontological framework (more precisely that of the software tools and file definitions) encounters a fundamental disconnect from ours. This is still just a digital 3D model — what Hui would call a *data model* (Hui 2016, p. 26). It is not yet an epistemic object or true digital object, as it has not been inducted into the systems and schemas which allow its utilisation, visualisation and further interpretation. This happens, as Hui states, when the data objects are "formalised by metadata and metadata schemes, which could be roughly understood as ontologies" (Hui 2016, p. 26). This parallels my discussion in chapter I regarding physical things and their formalisation as epistemic objects using classification systems built within *artificial ontologies*.

The polysemic model

Art historian Jennifer Jane Marshall observes that "semiotic indeterminacy is the order of the day in contemporary material culture studies" (J. J. Marshall 2008, p. 198), and

19 The 3D model has no internal fabric, while casts are made hollow to save weight and material. In both cases though, what may or may not be internal to the surface is irrelevant.

digital models conspire to further complicate this idea. They need to be examined in the context of their ontological plurality, as digitisation and creation of the 3D model is an explicit act of translation across multiple ontological boundaries. The black-boxing of the processes of digitisation handily obscures the smaller-scale acts of translation, those involving lenses, filters, sensors, bits, pixels, file formats and software. Simultaneously this draws our attention to two further levels of ontological interrogation of the process, one involving the nature of the digital model itself and its relationship with the original thing, and the second, larger scale question which hinges on the ontological shifts as a result of the model being inducted into formal schemata as discussed in chapter 1.

Papyrologist Ségolène Tarte suggests that "the ontology of most images and representations in Western culture has been perceived as mimetic" (Tarte 2011, p. 7), and this carries into modern Humanities fields with the use of the term "surrogate" and "digital surrogate". This term implies that the digital object (or "digital artefact", as Tarte uses) can be used as *a complete replacement* for the original (it also implies a neutrality in the digitisation process, which, as we know, is impossible). However, Manovich suggests digital objects are primarily indexical, noting that "any new media object — a Web site, a computer game, a digital image, and so on — represents, as well as helps to construct, some outside referent" (Manovich 2002, p. 40).

Archaeologist Kevin Garstki argues that "digital objects are more closely related to photographs than is commonly acknowledged", in both an affective manner, and in engagement with the technology (Garstki 2017, p. 742), and in fact many of the arguments mirror those having taken place (and are still ongoing) about the nature of photography, particularly moving into the realm of digital imagemaking (Moxey 2013; Elkins 2013, p. 130). André Bazin describes photography as unmediated and mimetic — "mechanical production in which man plays no part", and explains that "Originality in photography as distinct from originality in painting lies in the essentially objective character of photography" (Bazin and Gray 1960, p. 7). On the other hand, Mitchell reiterates Weston and Strand's argument that the "quasi-scientific procedure" of the chemical photographic workflow precluded any intentional departure from objective truth (Mitchell 1994, p. 8).

The counter-argument is that the photograph is Indexical, this being the relationship between the image and "what stood in front of the camera when the picture was struck" (Lefebvre 2007, p. 1). The argument continues, and could not be better articulated than the discussions in James Elkins' *Art Seminar* series (Elkins 2013). James Friday, in this work, argues that the photograph, instead of just being an index, is in fact the coincidence of both an icon and an index, that is, an icon that points indexically, "pointing to something in front of the camera" (in Elkins 2013, p. 137). Elkins goes on to suggest that the notion of indexicality, starting in the 1970s was:

> A way to say that photography was a legitimate medium—that it was able to support serious critical attention—without either returning to a naïve realism, or giving it away to aesthetic values that would have been imported from painting (Elkins 2013, p. 143).

In response to Elkins *et al*, Martin Lefebvre reaches the conclusion that both photographs and CGI (computer-generated imagery) are dyadically connected to the world in a *potentially limitless number of ways*, each one of which can form the basis for an indexical function (Lefebvre 2007, p. 6). Ultimately, Rubinstein and Sluis settle the argument, in the context of digital imaging, by suggesting that the resemblance of the image to an object has *little to do with indexicality* anymore, but has more to do with the *algorithmic processes* within the camera (Rubinstein and Sluis 2013, p. 27).

The multitude of steps in the digitisation process all contribute to the algorithmic assemblage abstractly connecting the final model back to the original thing. The camera contributes optical, mechanical and low-level software actions, the photogrammetric software contributes complex algorithmic implementations of mathematical principles, and this is all tied together by the decisions, interpretations and skill of the practitioner. In fact the form of the digital model can be thought of as being *entirely dependent* on the entanglement of these factors (Molloy and Milić 2018; Opgenhaffen 2021; Rösch 2021; Sapirstein 2021). As such this involves both explicit and implicit interpretations within the process (Lopes 2009), and as Tarte observes, the ontology of this type of recording is then "slipping away from mimesis" (Tarte 2011, p. 7).

Bruno Latour suggests that we can "point with an index finger" at the model, and through "a series of uniformly discontinuous transformations" link ourselves back to the original thing (Latour 1999, p. 79). Given Rubinstein and Sluis' earlier noted position that *algorithmic processes* rather than *indexicality* define the modern photographic process, I suggest that we can explain their black-boxed algorithms in terms of Latour's *discontinuous transformations*, where he constructs a chain of knowledge generation through the transformation of *matter* to *form*. Latour states that

> In none of the stages is it ever a question of copying the preceding stage. Rather, it is a matter of aligning each stage with the ones that precede and follow it, so that, beginning with the last stage, one will be able to return to the first (1999, p. 79).

Each step performs a small transformation or mediation on what was produced in the step before, and generates the input for the stage following, there is no direct copying or mimesis occurring from stage to stage. In our case, these stages comprise a set of tools, software, equipment and actors articulated in a specific sequence to produce a digital model. Latour observes that the chain of processes *must remain reversible*, and the "succession of stages must be traceable" (1999, p. 69) for the sequence to continue producing "truth". There must be an ability to circulate freely backwards and forwards through the chain, making adjustments and observations as needed, some of which may propagate back through to the model at the end. Envisioning the process of generating a model in this manner also provides us with an additional theoretical overlay with which to enhance the more pragmatic observations made through the use of a *chaîne opératoire*.

Latour frames this in the form of *circulating references* (see figure 3.4). The general sequence moves from left (material) to right (symbolic/virtual). We have *reduced* many characteristics of the original, we have lost locality, particularity, materiality, multiplicity and continuity (1999, p. 71) and produced what lies at the point of the triangle, the digital model. Conversely, looking at the overlaid triangle with its base on the right-hand side of the diagram, we see that we have simultaneously *amplified* certain properties, properties which have either been reinforced or generated within the numerous steps of the process. Latour characterises

these as "greater compatibility, standardisation, text, calculation, circulation, and relative universality" (1999, p. 70).

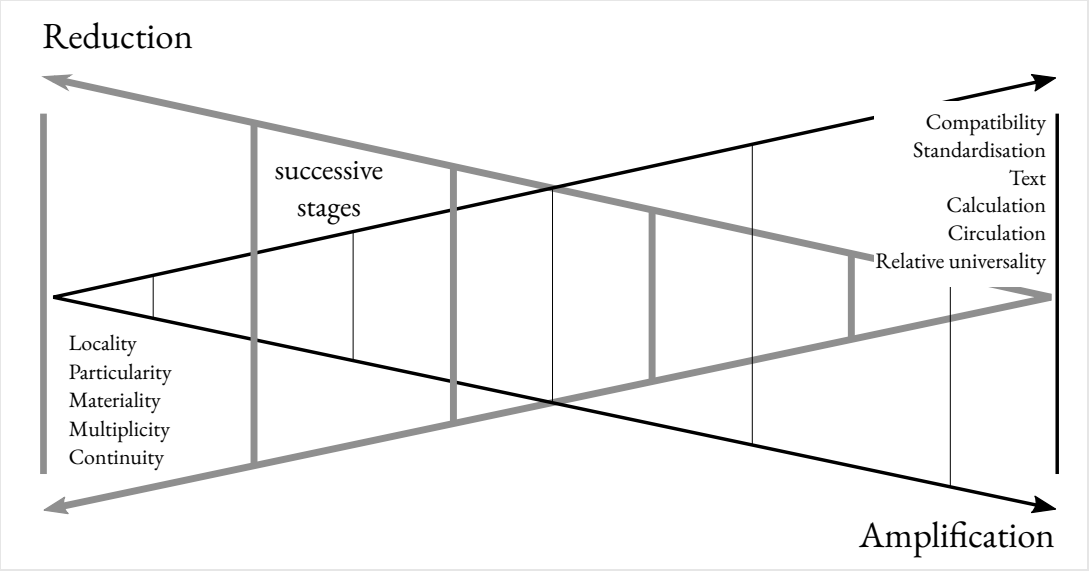


Figure 3.4: La tour's circulating references, from (Latour 1999, p. 71)

These amplifications — particularly the attribute of *relative universality* — entail digital models being conscripted into various ontologies and schemata. On the most pragmatic, functional level is that which affords it identity as a unique 3D model amongst a myriad of other unrelated files on disk, fulfilling its adherence to existing widespread standards — for instance the universally employed *Wavefront* 3D file format. This format could be seen as one of Latour's systems of "conventional coding", without which, according to Latour, our model would be the digital equivalent of "formless scribbles" (Latour 1999, p. 67). Moreover, in a more abstracted sense, its accession into formal knowledge systems and schemata allow the model to now relate to others like it, and subsequently to be networked, recombined, mixed, distributed and copied, as I discussed in chapter 1.

3.3.2 *The photogrammetric process*

I will attempt to unpack and illustrate some of the ideas I put forward in the previous section by explaining the process of creating a 3D digital model using the process of "Structure-From-Motion" photogrammetry. To summarise the process, this involves photographing the physical object from many different angles, feeding the images (anywhere from 20 to 1000) into the appropriate software, which then, after extensive computation (some models may take many hours or even days to calculate), will produce a digital 3D model of the original. I will investigate the process in more detail shortly.

The processes of photogrammetry are not intrinsic to the digital realm, in fact the basic aims and techniques predate even photography (Doyle 1964). The techniques involved were originally concerned with geometric studies of perspective, as both Leonardo da Vinci and later Albrecht Dürer constructed devices to investigate the properties of perspective. This being said though, the the mathematical tools to describe the concepts did not arrive until the late 1700s (Ghosh 1993). With the advent of photography and its coercion into the colonial project as a tool of recording and mapping[20], various physicists and surveyors devised means of measuring landscape and architectural elements from photographs (Doyle 1964; Ghosh 1993). These tools were then applied primarily to land surveying, which, at the time was not just about creating geographical knowledge — in the colonies it was a key tool in the creation and maintenance of order and hierarchy, and critical to processes of extraction and taxation (Braun 2015, p. 14). Forester and surveyor Henry Fourcade made some of the earliest photogrammetric surveys in South Africa (figure 3.5), using his "stereocomparator" apparatus, which he presented before the Philosophical Society of Cape Town in 1901 (Ghosh 1993, p. 311). A 1910 patent by Willy Selke (who in fact worked with inventor and artist François Willème – see footnote 16) describes machinery and techniqures for automatically taking photogrammetric measurements off photographs and transferring them to a "plastic mass" (eg. clay) for creation of three-dimensional models (Selke 1915). It is uknown whether he made this *work* at any point, though.

20 By 1854 the Royal Geographic Society had wholeheartedly adopted photography as a tool (Ryan 1997, p. 22).

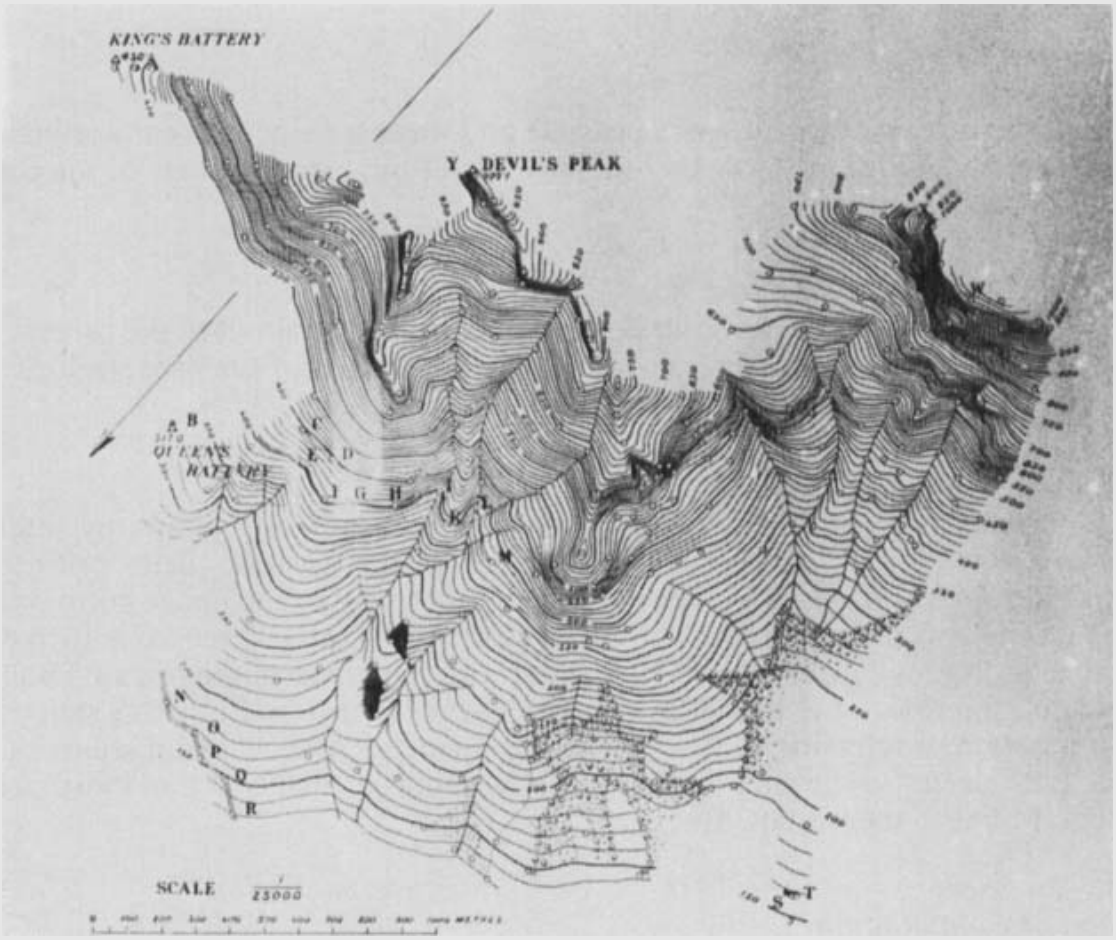


Figure 3.5: Fourcade's survey of Devil's Peak, from Adams (1987)

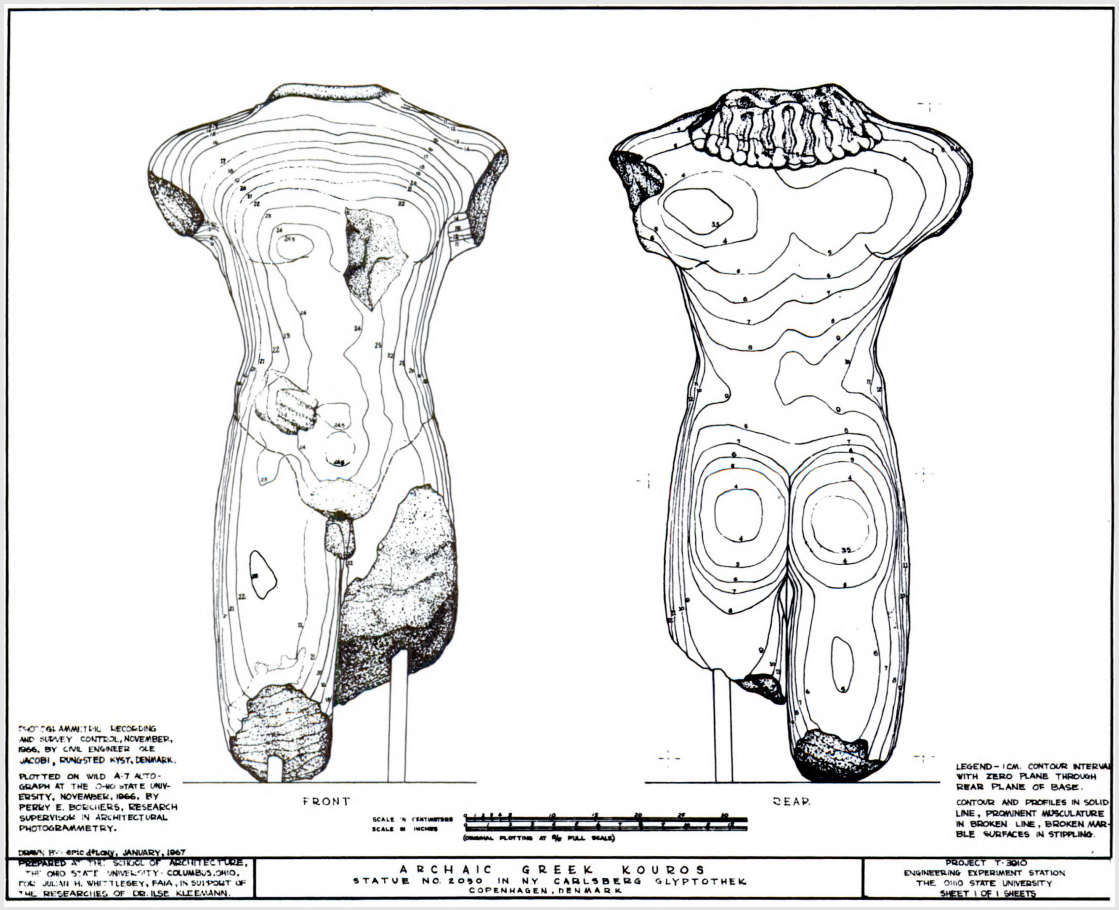
In the heritage domain, similar techniques have been used for mapping archaeological sites, heritage buildings, and monuments. The techniques of stereophotogrammetry were advanced significantly during the second world war in the interests of military mapping and targeting, and the instruments developed were both well-suited and cheaply available after the war for mapping historic architecture (Borchers 1977). By 1956, for instance, Belgium had recorded a large proportion of their historic architecture using photogrammetry, and the technique was used on monuments such as the Great Buddha in Kamakura, Japan (Maruyasu and Oshima 1965), and tested on architectural decoration and sculpture (Borchers 1977). In 1971, former archaeologist and curator of the McGregor Museum in Kimberly, Dr Fock, suggested to Natal surveyor D.A. Scogings that they attempt the application

of photogrammetry to recording rock art (petroglyphs) in the Northern Cape (Scogings 1978).[21]

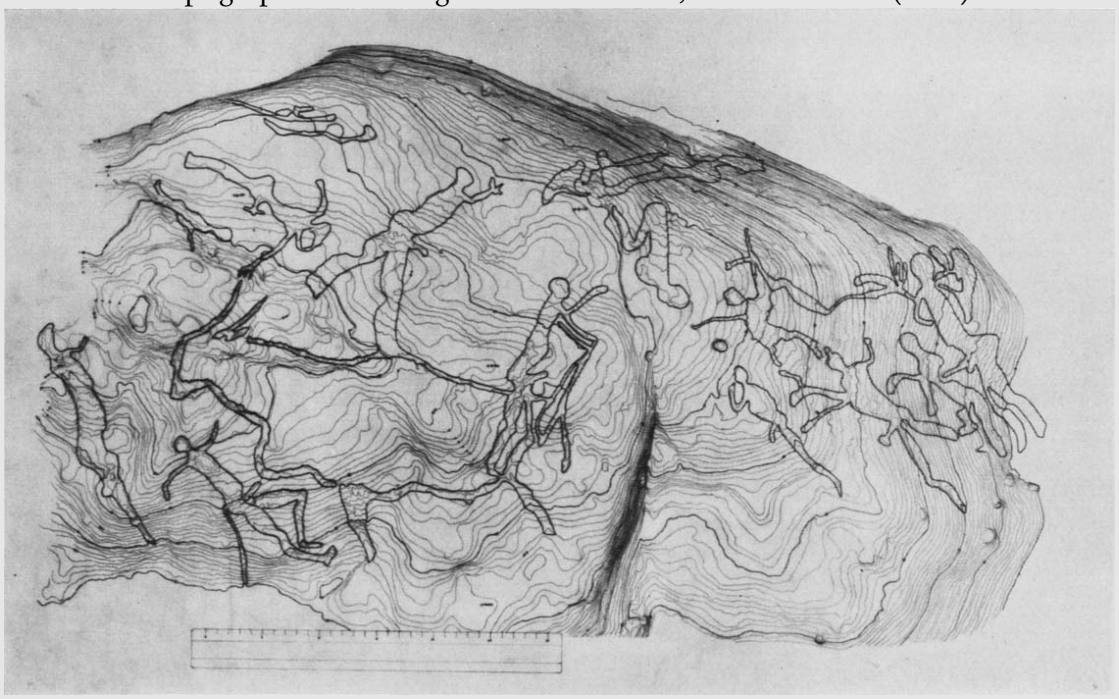
The process, as mentioned above, is not intrinsically digital, nor is it *dependent* on being digital. Manual pre-digital photogrammetric techniques used a stereo-pair — that is, two photographs of the object or area taken from the same place, separated horizontally by a known distance — similar to a stereogram (West 1996)). Digital photogrammetry (commonly referred to as *Structure from Motion* or SfM), uses many tens or hundreds of photographs, and rather than deriving spatial coordinates for hundreds of points, can produce millions to tens of millions of points in a fraction of the time.

The term *Structure from Motion* was first suggested by MIT computer scientist Shimon Ullmann in 1976 for reconstructing 3D information from a series of images or film strip (although using different mathematical approaches) (Ullmann 1979). However the first truly practical demonstration of this was Noah Snavely *et al* and their publication in 2006 of their paper *Photo tourism: exploring photo collections in 3D* , exploring the use of tourist photos harvested from the Internet to produce 3D point clouds as entry points from which to cluster and explore photos spatially (rather than for making 3D models) (Snavely, Seitz and Szeliski 2006). Snavely's software and algorithms[22] still form the basis for more current open-source photogrammetry software such as *Colmap* and *Meshroom*, and likely inform the algorithms within *Metashape* (although that is pure speculation on my part).

21 On the farm Kinderdam, site RSA KID1 in SARADA.
22 Publicly released as *Bundler* (Snavely 2023).



Topographic recording of Greek Kouros, from Borchers (1977)



"Eland Dance", from Scogings (1978)

Figure 3.6: Pre-digital photogrammetric recordings

The process of SfM (Structure-From-Motion) photogrammetry

Inside the machine

Over the course of this research I evaluated numerous software applications for photogrammetry. Initially I settled on an open-source pipeline, based around *Colmap* (Schönberger and Frahm 2016), however it is overly complicated to use, and time is always at a premium when performing photogrammetry, I decided on the commercial application *AgiSoft Metashape Standard*, which offers a significantly improved user experience, and has technical support available (which is always problematic in the context of open-source software). The technician-invoked steps involved in producing a model run approximately as follows.

Image alignment

After ingesting the images into the software, the technician will select the accuracy of reconstruction to be used - from *lowest* to *highest*, with *highest* taking significantly higher computing resources and more time to completion. After selecting *photo alignment*, the software looks for features on the surface of the object, although at this point there is no concept of "the object", as it will detect features anywhere in the image, and thus any visible surroundings. These features are uniquely identifiable sets of points, which are then used to detect correspondences across images — that is, to identify all images in which each feature is visible. Often the alignment will fail for a selection of photographs, possibly due to insufficient overlap, lack of detail, lack of focus, or a variety of other reasons. A frequent problem is that of occlusion — an undercut[23] or similar feature being obscured, which will then manifest as a "hole" in the surface of the final model. The technician will then identify the problematic photographs (or camera angles), and using this information, return to the object, rephotograph as necessary, and replace or supplement the images currently loaded into the software.

23 Apparently also a problem with casting - undercuts would often be filled with clay in order to make moulding easier (Payne 2021, ch 2).

From metadata embedded in the images by the camera, the software can look up the intrinsic characteristics of the camera sensor and lens, including focal length, pixel density of the camera sensor, and any distortion characteristics. We do not know the positions in space from which the photographs were taken; these (and the direction in which the camera is pointing for each image) must also be calculated by the software before anything else can be done, and this position and view for each camera is usually referred to as a *pose* or *frustum*. Once these are known, the spatial locations (in X, Y, and Z) of each feature can be derived, providing a *sparse point cloud*. This is a set of points in 3D space which are located on the surface of the scene — we still don't know which points correspond to the object of interest and which points are other objects or noise, as the algorithms have no concept of "object".

The technician will now select those points in the sparse point cloud which are understood (visually) to belong to the object of interest. These points are now explicitly privileged in the process from here, and those points belonging to the surrounding environment (table, background, etc.) are selected and deleted by the technician, thus informing the software that they are no longer to be considered in assembling the 3D model.

Dense Cloud

From the information computed in the previous step, consisting of the camera positions and the sparse point cloud, we can now construct a *dense point cloud*. At this point the technician will select the quality required, again with the corresponding time consequences — the higher quality (denser) the cloud, the longer computation will take. The points in the sparse point cloud inform the algorithms as to which points are visible across different images, and then allow it to pair adjacent images and produce *stereo pairs*, much as in the practice of traditional pre-digital photogrammetry described above. From here, it is straightforward (for the software, at least) to produce the dense cloud of points defining the object surface in a 3D space which is unique to this model. For the sake of this discussion I'll borrow Borcher's term "object space" (Borchers 1977, p. 20). In traditional stereo-pair photogrammetry, the camera positions were known with significant accuracy within the real world, with their locations being chosen and located using traditional surveying techniques. This provided a

series of rigidly linked anchors connecting *object space* of the recording with that of physical reality. In contrast, our digital model has none of these anchors yet, and indeed may never do so.

Mesh construction

Often the dense point cloud is left as the final product of the process, particularly when recording archaeological sites or architecture, as there is a significant amount of labour involved in moving from this stage to a finished 3D surface model, and often for basic recording or measurement the point cloud is sufficient.[24] The size of these files is also important, as, for instance, the dense point cloud of my model of NM176a contains some 5 million points, which is about average for a detailed model of this sort of object. A point cloud of a large site may run well into hundreds of millions of points — both labour and computer processing capability are a significant factor in processing files of this size. However, for the purposes of this research, I'm interested in three-dimensional surface models (or "solid" models), as they are the form most commonly used for display and public visibility, and are particularly important, as in the example I'm using, with objects which have surface detail, embellishment or polychromy.

Simply, this process involves the software triangulating, or linking points in the dense point cloud, and producing a polygonal — usually triangular — like a fishing net draped over the object. The faces on the mesh are bounded by *edges*, and the points defining the corners are now known as *vertices*. The software can now treat each of these triangles as an opaque facet, displaying the object in "solid" form. The density, and thus the size of each of these triangles is dependent on the number of points in the point cloud - the fewer points, the larger the triangles, and vice-versa. Obviously, with more points and smaller triangles, the object will both look smoother and less blocky and discontinuous, and will correspond more closely with the surface of the original object. The 3D digital model is now a *solid*

24 Generally when 3D scanned sites are visualised in popular media, for instance PBS' television show "Time Scanners" or National Geographic's "Lost Cities", the models are depicted using dense point clouds (*Time Scanners* 2014; *Lost Cities with Albert Lin* 2019)

in imaginary object space - actually a mesh with each cell of the net being a surface, all of which resolve (if there are enough triangles) into a smooth, recognisable representation of the original object surface. It has no colour other than that which we assign to it in the software, usually a flat white or light grey, reflecting the unfinished state of a plaster cast, as I mentioned earlier. This stage affords the possibility of discerning fine, otherwise invisible detail on the surface of the object, such as engraving, scratches or other marks.

This stage is also important when refining a model, which is an iterative process involving re-running many of the previous stages. For instance, often the technician will create a low-quality dense point cloud and a low-quality model in order to use the model itself to mask out the irrelevant areas in the original images, namely the background, support equipment, people, and so on. This minimises the technician input required to remove extraneous points not belonging to the object. The entire procedure — from alignment onwards — is then rerun in order to produce a correspondingly cleaner and finer mesh and model. Often the model requires some form of finishing and removal of malformed faces or edges, reminiscent of the scraping and sandpapering off of seam lines from a plaster cast (Payne 2020, p. 3) or the *fettling* of a cast bronze to remove flashing or excess metal (Bassett and Fogelman 1997, p. 21).

The mathematical procedure used in the mesh creation step is often based on a process known as *Poisson Meshing* (Kazhdan and Hoppe 2013). This stage effectively "blows up a balloon, constrained by the points" (Havemann 2016, p. 157). Up to now, the processes of alignment, sparse cloud creation, and dense cloud creation have resulted in correspondingly *more refined* and *more accurate* outputs, building on their input data, while this stage, in contrast, *invents* and *interpolates* new data between and around the existing points. As Havemann observes, "the resolution of the output mesh is decoupled from the resolution of the input" (Havemann 2016, p. 157). While this is neccesary for the formation of a surface for the model, it has the the effect of weakening our ability to retrace, in reverse, the paths of the translations and mediations within the process, as I discussed earlier (Latour 1999, p. 69).

Texturing

The term "texturing" is somewhat of a misnomer. Counter to embodied, material understanding of the concept, this is not about a tactile surface quality but a term deployed within the realm of 3D computer graphics to describe the application of an image to the surface of a 3D model. This involves a process known as *parameterisation*, in which a two-dimensional coordinate system (called UV coordinates), is mapped to the points defining the body of the model.

As discussed earlier, each vertex is defined by a set of X, Y, and Z coordinates, locating it in three-dimensional object space. The mapping process assigns two additional coordinates to each vertex, being the U and V, which correspond to the horizontal and vertical axes of the two-dimensional ("flat") texture image. This allows for the translation of the information from a two-dimensional image into three-dimensional object space. The 3D model is *unwrapped* or flattened, in a manner reminiscent of peeling an orange. The unwrapped surface of the model is called a *UV map*, and retains the topology and shape of the original while representing it in two-dimensional — flat — space. There are numerous algorithms and computational techniques used in unwrapping a model; specific mappings may be more appropriate than others for a given model's shape and detail, as the aim is to apply the texture to the model surface both seamlessly, and with minimal distortion (Blinn and Newell 1976; Heckbert 1986). The resultant texture map — normally one or more large image files — is, to the human eye, almost incoherent, as pieces from each of the input images are stitched together in a sequence which makes sense only to the algorithms and the UV map. Notably, the texture is not an inherent part of the 3D model, but a separate file which is referenced by the code describing the mesh. Often the texture succeeds in concealing a low-quality, low-resolution mesh (for instance this is the case with 3D city models in Google Earth).

Oftentimes one might not require this stage, as the surface detail or form of the model is of greater importance, for instance in recording petroglyphs. This reflects common practice in casting — despite classical sculpture more often than not being polychromatic (little

of which survived antiquity[25]), European collections were marked by their uncoloured marble and stone-ness. Connoisseurs, educators and *formatori* alike considered any surface colouring a distraction from study and appreciation of the form of the sculpture, and so most collections were left as blank, unfinished plaster (Frederick 1899, p. 108). However, for display and private collections, finishes were often applied to mimic the material from which the original was produced. For example, C. Henneke's 1896 catalogue[26] offers stone, bronze, gold, terracotta, marble and antique silver finishes (Hennecke 1889, p. 1). Frederick observed that without any sort of colour, in comparison with the marble of many original works, the plaster looks "weak, characterless, and dead" (Frederick 1899, p. 107). Casts of things for study within palaeontology and archaeology were usually carefully hand-painted to match the original, although this did lead to their being treated with suspicion at times, as they were, at first glance, indistinguishable from the originals when viewed side-by-side (Rieppel 2015, p. 488).

3.3.3 *Digitisation: the* chaîne opératoire

I discussed the idea of *chaîne opératoire* as a methodology for describing technological processes in chapter 2, with the understanding that

> In a technical activity, a *chaîne opératoire* takes the form of an ordered train of actions, gestures, instruments or even agents leading the transformation of a given material towards the manufacture of a product, through major steps that are more or less predictable (Karlin and Julien 1994, 164 footnote 1).

I will map the process of my digitisation of one of my case studies — NM176a — following the stages or events I outlined in chapter 2, as adapted from Hermon's description of the main stages of this methodology (Hermon 2016, p. 20). The stages, as I have already described, are

25 Much of this was due to environmental weathering or rapid deterioration of pigments after excavation. Some was due to poor practice; Stone writes that, for instance, while making a cast of the Portico of Santiago Cathedral in 1868, Brucciani and his craftsmen ended up taking off much of the original pigment from the portico while removing the moulds (Stone 1911, p. 10).

26 Wisconsin, USA.

setup, *production*, *refinement*, *utilisation* and *preservation*. I will reflect on interactions with both the object and tools, decisions made, actions taken and their consequences. In each stage of the technical process the input data are modified and produce new data — a new *digital inscription* at the output — dependent on the input data from the previous stage, and the nature of decisions and interactions between the operator and the tools. The boundaries between many of these operations can be somewhat fuzzy, and so will require reflexivity and iterative approaches to producing the final model (Miller 2007, p. 1; Opgenhaffen 2021, p. 1694).

The sequence of digitisation of my NM176a case study

Setup

I had been approached by Dr. Justine Wintjes at some time in the past to attempt a 3D reconstruction and an "unrolling" of the detail from a similar pair of horns held in the Pitt Rivers Museum in Oxford[27] (Ward and Wintjes 2018) based on an existing set of digital photographs. When I subsequently found myself at the KwaZulu-Natal Museum, Dr. Wintjes suggested I use NM176a as both a test —from scratch — for the photogrammetric process and post-processing[28] and to produce a 3D model for the museum's website. Challenges experienced in the photography of NM176a were both its size — this is a large set of cattle horns, loosely plugged onto the front part of a fragile skull, and tip-to-tip, they span around 900mm — and the reflectivity ("shininess") of the surface of the horns, which would make both lighting and later texturing of the model difficult.

Photogrammetric practice usually suggests that the object be placed on a turntable in order to facilitate photography from as many angles (in azimuth) as possible, and further, that the entire object be in each frame with greatest possible depth-of-field. This would have proven adequate for developing the overall shape of the object, but would have precluded capture

27 Objects 1994.28.1 and 1994.28.2.
28 In the form of unrolling or creating "rollout images". For similar work see Houska et al. (2021).

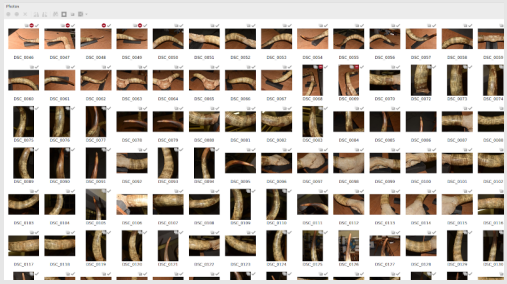
of the fine detail on the surface, which is an essential feature of this object. The surface is intricately engraved and painted with "visual narratives of encounters between British and Zulu regiments in the Anglo-Zulu war of 1879 and surrounding events" (Davison 2016, p. 82). The decision was made to photograph the horns at close range, at a roughly consistent distance from the surface in order to capture the fine detail.

Opgenhaffen observes that environmental factors also come into play and affect the visualiser's choices for "techniques, methods and tools" (2021, p. 1697). In this case, the "photographic studio" was a temporary table in the storeroom, with limited lighting other than a set of photographic modelling lights, which were unsuited to fine, close-up work. Ideally the situation would have called for a ring-light on the camera lens, but as this was unavailable (I was still in the process of building a suitable equipment collection), I decided on using an incandescent modelling light hand-held, with the camera also hand-held.

Given this sequence of photography and the size of the horns, the use of a turntable was not possible. Also, as the central skull-piece and attachment to the horns was quite fragile, excessive movement of the object was discouraged. In order to minimise movement, I placed the horns on a bed of archival foam with each horn in turn exposed beyond the edge of a table, requiring no more than three moves of the object throughout photography. This did however require that much of the session saw me in a supine position on the floor photographing the object from underneath. In order to build a photogrammetric 3D model, the object must be photographed consistently from all angles, with a large overlap in coverage between adjacent images — this object involved approximately 300 photographs. Fewer images would probably have sufficed, but when one is shooting in the field and then processing back in the lab, it is wise to have too many rather than too few. In this case my sequence of shooting was to photograph a row of images from the base of each horn out towards the tip, with approximately a 50% overlap in images. The next row would run parallel to the previous, again with 50% overlap, but rotated along the central axis of the horn. Despite the curvature of the horn surface, the small area of each photograph and the large overlap ensured no issues with unfocused detail.

Production

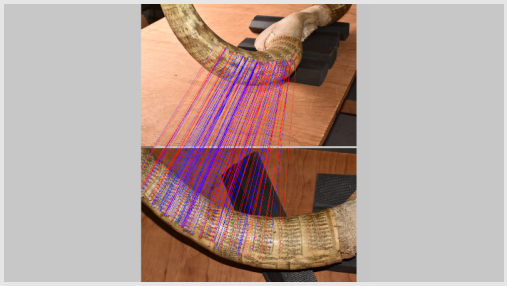
The photographs were then ingested into the software. At this point the initial stages in processing revealed gaps in photographic coverage, and some unusable images, requiring a return to the studio to rephotograph parts of the object in order to acquire the missing information. Often this may happen more than once, as generating the 3D model of a high quality using photogrammetry is an iterative process, sometimes requiring multiple attempts using different settings or adjustments to the images, and dealing with issues such as exposure and lighting, depth of field, and other factors.



Input images



Features in a single image



Feature matches across adjacent images



Camera poses

Figure 3.7: Production: first steps

As mentioned earlier in this chapter, the algorithms employed are unable to distinguish between the object of interest and other objects in the image, and so the technician may assist at this stage by creating masks on a representative sample of images and returning to the initial stage of processing. This entails, in the case of *Metashape*, the use of the *intelligent*

scissors tool, deploying prefigured assumptions about what constitutes object and what constitutes background (based on contrast of adjacent image pixels). This assumes that due diligence has been performed in lighting and arranging the object in order to distinguish it from its surroundings.

The operator may also intervene in setting a *bounding box* around the desired part of the scene, by drawing a 3D box which will define the boundaries of the object's universe (object space). Additionally, after expert consultation with preliminary results, as Opgenhaffen notes, this "may confront the visualiser with divergent expectations or standards of the specialist and other participants, forcing them to repeat the whole enterprise or even adapt certain methods to meet the demands" (2021, p. 1697).



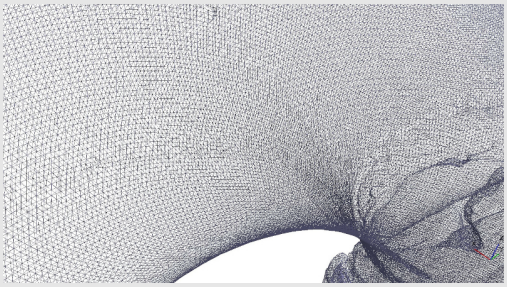
Point cloud with extraneous points



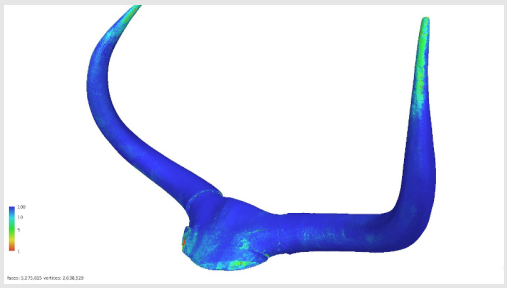
Extraneous points removed



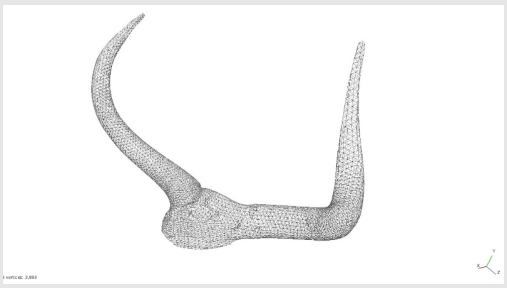
Dense point cloud detail



Mesh detail



Confidence: green=low, blue=high



Final mesh view

Figure 3.8: Production: further steps

Refinement

The output from this stage was a *solid* model representing the original thing. The surface, much like a raw plaster cast, being solid and featureless and requiring finishing, by being coated in a *texture*. As discussed earlier, this operation *wraps* the model with an image, constructed as a mosaic of selected input images. Given that the surface detail of this model

was deemed so important, I carefully selected a subset of the original set of images, based on their sharpness and consistent lighting, ensuring that they overlapped sufficiently to fully cover the surface, but not duplicate coverage excessively. This resulted in a carefully curated set of around 150 images used to represent the surface. The software then generated the "skin" for the model, in the form of a 15 Megabyte, 8192x8192 pixel JPEG which it then applied to the blank surface of the raw model.

As is suggested within the *chaîne opératoire* approach, this step requires tools, which in this case are (amongst other actors) the camera (a Nikon D3400), and a computer with software (Agisoft Metashape). The output of this stage is a 3D model, with a photo-realistic texture (surface). The model may require further refinement, which may take the form of simplifying the model (for instance for web use), exporting to different formats, and so on. In the case of NM176a, a smaller model was required for web use, which involved reducing the number of vertices and faces in the model (from around 3 000 000 faces to around 300 000), which resulted in a significantly smaller file size. In addition, we were wanting to experiment with "unrolling" to examine the surface engravings in more detail and to consider the artwork as a contiguous piece, and so a workflow was developed in "Blender" 3D modelling software in order to modify the texture file to produce a warped, unrolled image. This stands alongside Maggs' approach of tracing the surface detail of the horns, engaging with the artwork in great detail while being aware of distortion produced through a "flattening" of the complex curved surfaces (Maggs 1990, p. 147).

Utilisation

Challenging the traditional notion of the digital object — a 3D model in this case — as the "final product" (for instance Opgenhaffen constructs this stage as the final stage of "delivery" (Opgenhaffen 2021, p. 1693)), I would rather consider this the beginning of the existence of the digital object. The model now has to be invested with attributes which make it a usable epistemic object, without which it might very well end up marooned on disk or on a thumb drive in someone's desk drawer. In order for this to take place it has to be resituated within a network of links and relationships; probably within some form of

database storage with allowances for metadata and paradata. Alternatively, it may have been created exclusively with the aim of being used as a *phenomenological* object; being used in an online or real-world exhibit in a museum or other context. I will discuss this in detail in the next chapter.



Textured model



Texture map



"Unrolled" surface detail, determined by an arbitrary seam line on the horn

Figure 3.9: Refinement

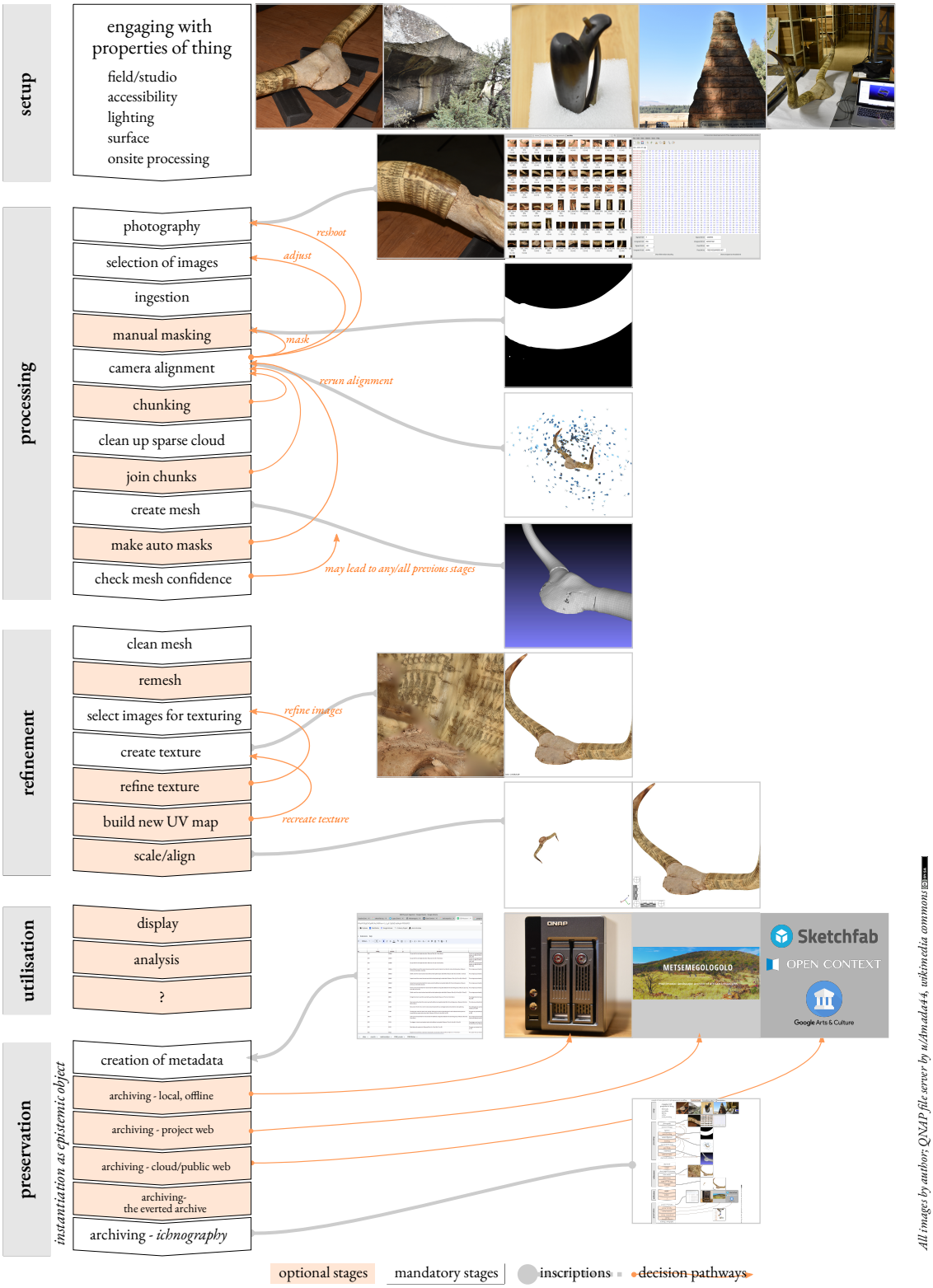


Figure 3.10: The *chaîne opératoire* of digitisation of NM176a

3.4 DISCUSSION

The balance of visible agency within these processes is often unclear. The technology and the algorithms themselves are frequently constructed as capable of performing their tasks with little intervention by the operator. Moreover, within certain practices, the practitioner may be seen to dominate the process, while in others — notably digitisation — the digital technology is generally accepted to assume the greater balance of agency (Huggett 2021, p. 419). The agency we afford to the assemblages of equipment and software may, on the one hand just be applied metaphorically, according to Lindstrom (2015, p. 228), but might also be considered to be a product of the interaction and entanglement between us and the tools (Hodder 2012, p. 38), and is actualised "through/with/by/in things" (Lindstrøm 2015, p. 228).

This shift in balance in favour of the tools, I suggest, is a function of our tendencies — and that of software companies, equipment builders, and the nature of technological society itself — to purposefully black-box things. This black-boxing is in fact celebrated, and to use a term from software development, considered as *not a bug, but a feature*[29], in that the systems and software are designed and marketed as *just working*, requiring little skill and input, the operator generally also being devolved to mere *user*, rather than practitioner.

Whether or not this is always the case within given processes and with certain tools, this, as I discussed in chapter 2, obscures the *processes themselves*. However, additionally, it obscures variations in *individual practice* (Leighton 2015, p. 67). While Leighton is specifically discussing variations in archaeological excavation practice, this idea applies as well to other practices which involve any form of craft modes of production, such as digitisation and in this case, photogrammetry (Perry 2015; Caraher 2016, p. 432). Perry notes that these technologies "claim an objectivity and efficiency that are beyond critique" (Perry 2018, p. 219). This claim to objectivity stems in part from the 19th century attempt to remove the person, the body, and the resulting imprecisions, idiosyncrasies and prejudices from

29 Steele (1981)

experimental inquiry. This *mechanical objectivity*, as noted by Daston and Galison involved scientists enlisting

> … self-registering instruments, cameras, wax molds, and a host of other devices in a near-fanatical effort to create images for atlases documenting birds, fossils, snowflakes, bacteria, human bodies, crystals, and flowers—with the aim of freeing images from human interference (Daston and Galison 2007, p. 121).

Most scientific visualisation and recording of the period was a result of collaborations with skilled craftspeople — painters, lithographers, etchers and other illustrators, whose skills and contributions were very rarely recorded (Daston and Galison 2007, p. 123; Moser 2014; Sapirstein 2021, p. 137). Scientific, antiquarian and archaeological visualisation techniques have a long history of not just being illustrative, but also expanding our ability to interpret and understand the material being illustrated. Stephanie Moser reflects that initially, artefact illustrations were used as a means of "defining the primary characteristics of ancient objects", however, by highlighting the "key attributes" of artifacts, illustrators transformed drawings into "interpretive statements" (Moser 2014, p. 59). Moreover, as Moser notes, the creation of a "visual system" for representing objects was critical to the development of systems of classification and ordering (2014, p. 59), and led to a shift from using these visualisations as mere illustrations, to them offering new avenues for interrogation of the artefacts themselves.

Practitioners of technical drawing observe that a deeper understanding of an object results from having to draw it (Lopes 2009; Olsen 2012; Sapirstein 2021). Morgan *et al* argue that illustration occupies an essential place in the understanding and recording of the archaeological record. Furthermore, the offer that archaeology is a special case here, in that the excavation process is itself destructive, and so, unlike other primary sources, digitisation can often not be performed or repeated at a later time (C. Morgan, H. Petrie et al. 2021; C. Morgan and H. Wright 2018; J. D. Richards 1997).

The making of models across various fields has been similarly described, Chadarevian and Hopwood writing that this was claimed to "produce knowledge that could not be acquired in other ways" (Chadarevian and Hopwood 2004, p. 9), and Perry notes the importance

of model, diorama and cast making in archaeology in the construction of intellectual and social capital (Perry 2013). Gaining a more complex and nuanced understanding of material through the drawing process has been discussed within rock art research as well, where manual tracing has long been the preferred means of recording[30] Lewis Williams writes that

> Decisions taken while tracing are fundamental: features omitted at this stage are lost to a research project forever. Far from being a mechanical documentation of 'facts', tracing is a form of analysis that is more than merely "descriptive" (Lewis-Williams 1990, p. 127).

I argue that photogrammetric recording offers similar unprecedented opportunity to *apprentice oneself* to the thing, even more so than other forms of digitisation. As I mentioned earlier, the balance of agency between the technical tools and the practitioner shifts depending on the thing and the tools used; for instance Opgenhaffen recounts the digitisation of a thing using a Structured-Light scanner, involving far less human intervention:

> So far the initial material interaction with the original artefact, as it swiftly shifts to an intimate relationship between the stationary scanner and the digital artefact as the scanning proceeds. During this creative event, I become completely distracted from the artefact while scanning, wholly absorbed by almost mechanical operating gestures and motor habits, and responding to circumstantial events interfering with the scanning session. (Opgenhaffen 2021, p. 1700)

Opgenhaffen here observes the balance of agency shifting towards the tools; the primary engagement is between the tool (the scanner) and the thing, with the practitioner role minimised to that of an operator. Contrast this with my description earlier in this chapter of engagement with my NM176a exemplar as I performed the gestures and actions of photography and creation of the photogrammetric model. Distancing oneself from the

30 This technique is however being superseded by digital tracing off-site of photographs, and the use of tools such as DStretch (mentioned earlier in this chapter). Concerns have also been raised about tracing damaging the art, as it involves direct contact with the tracing film.

thing, whether through the use of more remote or automated processes of digitisation, or by delegating fragments of the recording to other practitioners may constitute a "divorce from the subject" (Sapirstein 2021, p. 152). This, as noted by Sapirstein, runs many risks, including an "impoverished understanding of the resulting 3D simulacrum" (2021, p. 152)

Opgenhaffen suggests that

> … A visualisation is much more than a technique or a "statement of reality" (Clark, 2010, p. 63), it is a creative, generative, and experiential research method that considers the multiple human and material/nonhuman digital agents in the process of translation of artefacts into visual formats."(Opgenhaffen 2021, p. 1686)

The shift towards tools of so-called objectivity, notably photography, was, as Daston and Galison note, an attempt to "repress the willful intervention of the artist-author" (Daston and Galison 2007, p. 121), as the desire was to "let the specimen appear", without the distortions accrued through the observer's *habitus* (2007, p. 121). 3D recording and visualisation techniques are presented as similarly objective, as Ireland and Bell observe, that they offer implicit claims of being able to neatly fix reality in *digital aspic*, (Ireland and T. Bell 2021, p. 150), and as such, this tends to obfuscate or outright erase the inputs, contributions and other interactions of the practitioner with the software, systems and algorithms. The models we produce using these tools are inflected with assumptions, choices, — and biases and presuppositions. Ireland and Bell, after approaching the photogrammetric technique as archaeologists — not digital specialists — note that

> It became apparent that the pursuit of digital objects using this software, attempting to direct cohesion from a mass of images, is marked by judgements, choices, decisions. The process does not hold to the principles of objectivity that the promotion of these products might emphasize – the models are inflected by the convictions, persuasions (and persistence) of the human at the helm (Ireland and T. Bell 2021, p. 158).

The finished model is ultimately modelled, rendered and viewed (as well as measured, cross-sectioned, analysed, researched and often remixed), but the techniques involved in its creation reveal knowledge and insights about the physical thing itself. Far from being objective and automated, the process requires extensive intervention, decision making, and *savoir faire* — or *technical know-how* (Hermon 2016, p. 20; Opgenhaffen 2021, p. 1688), and deploys learned gestures and actions which shape the final object (Dobres 1999, p. 124).

NM176a was one of the first museum collection objects from which I created a 3D model, and as I discovered (and has been repeatedly reinforced since), it is relatively straightforward to make an *adequate* 3D model, and ultimately, quite difficult to make a *good* 3D model. Doing so requires reflexivity and recursion, constantly evaluating outputs (Latour's *inscriptions*) and adjusting settings, re-running stages of computation, or returning right to the first step and taking additional photographs to supplement those already captured. In many cases, this requires rephotographing the entire object using alternative camera settings, different lighting or a modified shooting sequence. Archaeologist Shawn Graham, in a post on his *Electric Archaeology* blog, observes that when teaching photogrammetry to students,

> .. it is remarkably hard to produce a decent 3d photogrammetric model and in the *process* of taking the photos over and over again, building and rebuilding the model, they come to know the object very well indeed. It is because these steps are the ones that are intuitive when one puts pen to paper: the digital forces the students to think these normally unexamined steps out in full (Graham 2017)

In the initial stages of engagement with the thing and its materiality, the algorithmic processes performed by the software and within the computer are deferred, as at this stage the entirety of the practitioner's focus is towards the object. Decisions on the type of process, tools needed, environmental issues and necessary expertise are made based on the material properties of the object. For instance, with NM176a, factors of concern were the size and fragility of the object, and the reflective nature of parts of the horn surface. The material attributes of the object shape the process from the initial step. Subsequently, while photographing, one is constantly engaging with the object; peering into cracks and crevices

to ensure that they are being lit correctly; what is the nature of the detritus being left on the table as one moves it — are those insect droppings? Dust? Flakes of material off the object itself? What is that detail there? Is that area overly reflective? How should I mitigate that? The object reveals attributes and detail which would in many cases be missed.

Additionally, as a function of the photogrammetric algorithms, a higher density of images of a part of the object results in a finer quality model in that area (more points in the point cloud, and therefore more vertices in the final mesh), and so directly influences the final model. In order to anticipate the needs of the software tools, and thus ensure a good final model, informed by Hermon's *connaisance*, or the mental representation of an *ideal form*, (Hermon 2016, p. 20)), the practitioner both requires — and has gained, through interaction with the thing during photography — a solid understanding of the morphology and topology of the thing.[31]

Further to this, the practitioner responds to the requirements and demands of the tools — the software and its algorithms — as the output inscriptions suggest new or modified actions and gestures, and modifications to the practitioner's behaviour (Ireland and T. Bell 2021, p. 159), thus shifting agency in favour of the tools themselves. The practitioner dictates what they want the tools to do for them, however this has to a large extent already been predetermined and constrained by the developers (whose agency is itself masked, potentially leading to algorithmic bias and other problematic assumptions (Huggett 2021, p. 422)). As Hugget notes, "Our use of these tools is ultimately mediated by the actions and decisions of those who designed and created them – and may well have done so without our mode of use specifically in mind" (Huggett 2017, p. 10).

The interpretive acts and decisions, alongside the technical know-how and learned gestures woven through the processes have consequences which not only affect the *quality* of the model, but also its final *configuration* (Garstki 2017, p. 744).

31 Not to mention an abstracted alliance with the maker and later curators, conservators and custodians.

Early discourses around 3D computer graphics constructed their activities and practices as analogical to craft traditions (Turk 2006, p. 64; Holliday 2019). Similarly, Perry proposes that the work of engagement and knowledge production within 3D digitisation and modelling is also a form of artisan craft (Perry 2015, p. 195). Considering these craft practices through the lens of the *chaîne opératoire*, we see raw materials of bits and bytes, digital images, code, algorithms and other forms of "digital material" (Ingold in Garstki 2017, p. 745), rather than flint, obsidian or clay.

The craft involved in 3D models extends well beyond the initial model-making. The stages of *shaping* and *utilisation* I discussed in the *chaîne* of operations of digitisation of my NM176a exemplar can be far more complex than they imply. There may be "holes", or missing faces in the mesh which require filling in; removing "noise", or unwanted elements on or around the model where the algorithms have recorded a section of background or a piece of equipment. These actions require a series of decisions, interpretations, and interactions between the practitioner, the tools, and the data (Dawson et al. 2021, p. 6). Minkin observes that

> A mesh file acquired through photogrammetry will not be a well-formed object without substantial work. Despite the logic of simulation through calculation, things may not compile as they should. Algorithms are buggy, automatisms glitch. It will need artisanal assembly, retopology and cleaning to produce a workable model (Minkin 2016, p. 118).

Geismar reiterates this, noting that 3D models "seem like photographs, but in fact are hand-made, hand-stitched models.." (Geismar 2015, p. 319). The notion of *hand-stitched* models recalls the production of casts; which depended on sensitivity from the craftsperson in making the piece mould on the original thing, which then determined the accuracy and usefulness of the copy (M. Nichols 2006, p. 116), and as Payne notes, these casts were simultaneously "reflecting a historical craft tradition", but also practical tools for research within archaeology (Payne 2020, p. 12).

The infrastructures that underpin these technical processes remain invisible, and are in fact taken for granted, particularly in such evocative yet pervasive fields as computer graphics. In an experimental reaction to the empty, anonymous creations of many digital visualisations, archaeologists Tracy Ireland and Tessa Bell explored the use of photogrammetry in order to be aware of the *making* of digital models (Ireland and T. Bell 2021, p. 150). They record having a perception of 3D model making as a "soulless practice" which obscures any human involvement (2021, p. 152). The hand of the practitioner is both occluded in formal records, and invisible in the final digital models themselves. Despite, as I mentioned not long ago, early discourse around computer graphics and modelling being rendered in terms of craft and artisanal work, Sara Perry remarks that

> What appears to have been stripped from computer-based visual production is, to borrow from Cain (2012), the 'craftsmanship aesthetic': the literal sight of skilled laborers – good citizens – doing the hard, identifiable, generative work that Sennett (2008) positions as being at the core of democratic society (Perry 2015, p. 198).

This is not unique to digital recording and modelling practices — for instance Gordon Fyfe, examining museum reproductions in the late 19th and early 20th centuries, observed that this work was "backstaged through the concealed labour of authenticity", and that museum staff of the period did not expect their reproductions "to be signed or have the identities of technicians and photographers identified" (Fyfe 2015, p. 51). Patrizia Di Bello suggests that both reproduction of sculpture and photography relied on the "disavowal of the anonymous, mechanical labour that went into making them" (Di Bello 2013, p. 412).

3.4.1 *Documenting and recentering practice*

I have considered the *chaîne opératoire* approach in order to draw attention away from the digital model, and towards the *process*, and in doing so, have made the practitioner — and their responsibility for the model — visible. The task now lies in attempting to record and document this practitioner or craftsperson using the tools we have available to us. The

process needs to be documented, firstly, in a technical, semantic manner (see next chapter), within formal databases, metadata schemata and documentation standards. However, it also needs to be documented in a narrative form, as many subtleties of practice are lost in formalising this information.

Opgenhaffen suggests reconstructing "personal or project" *chaînes opératoires* (Opgenhaffen 2021, p. 1698), affording detailed insight into the processes and practices of the practitioner. These *chaînes* should be closely linked with the digital model somehow, as the thinness of formal documentation practices in the form of metadata and paradata support the alienation of the practitioner from the model, reducing their formal involvement to nothing more than a name, identification of tools and tool configurations. We might consider the need for a form of *ichnography*, following the traces of the practitioner as they walk (and often re-walk) the steps of photogrammetry (Shanks 2008, p. 8; Serres 1995, p. 19). Beyond tracing practice, this is critical towards the maintenance of Latour's *circulations*, such that the transformations are made visible and enriched beyond the reductive limitations of paradata (Witmore 2013, p. 130).

Communities of practice

When we look — from a distance — at these processes and the disciplines within which they are deployed we see the defining ontologies and their epistemologies with their explicit and implicit frameworks of structure. However, zooming in to the individual and community practices, we see people, practitioners, craftspeople, craft and *agency*. We also see *Communities of Practice*, described by educational theorist Etienne Wenger as

> … communities that share cultural practices reflecting their collective learning: from a tribe around a cave fire, to a medieval guild, to a group of nurses in a ward, to a street gang, to a community of engineers interested in brake design (Wenger 2000, p. 229).

Within the field of 3D recording and modelling within digital heritage and adjacent fields, many techniques (and in fact tools) are inadequately documented — particularly where

open-source software tools are concerned. Complex and arcane techniques are learned through word-of-mouth, online forums, or practitioner-made tutorials posted on *YouTube* or elsewhere. Perry observes that

> Other unseen and lengthy activities – for example, participating in chat forums dedicated to highly specialist programs or techniques that seek to offer communal advice and critique – also have precursors in the craft guilds of the Early Modern era, which acted as essential spaces of knowledge transmission, training, and networking (Perry 2015, p. 199).

Further to this, these communities *span disciplines*, uniting practitioners based on their practice, not where they practice it (Opgenhaffen, Lami and Mickleburgh 2021, p. 1653). In my personal experience as a practitioner in this field, this holds true. Informal modes of knowledge transmission play a critical part in circulation of these skills and techniques. For instance, online aggregations of these communities of practice with which I am familiar include *r/photogrammetry*[32] on Reddit, the *Agisoft Metashape forums*[33], discussions on *Twitter*, and websites such as Palaeontologist *Dr. Peter Falkingham's personal site*[34]. It is worth noting here that one of the areas in which craft practices are more pronounced — that of refinement and post-processing of the model — is the least formally documented. Most of my practice in this case has been learned from fellow practitioners within these communities.

Reclaiming agency

Understanding these processes at the level of individual agency and practice allows us to see the landscape of structure informing the disciplines within which they are utilised; firstly, as I discussed in chapter I, that these disciplines and their systems of documentation are burdened with colonial baggage; and secondly, that they are firmly rooted within the

32 https://www.reddit.com/r/photogrammetry/
33 https://www.agisoft.com/forum/index.php
34 https://peterfalkingham.com/tag/photogrammetry/

neoliberalisation of academia and research, and so value is determined by increased demands for efficiency, throughput, and other metrics (E. Kansa 2016, p. 446)

Calling attention to ongoing criticisms of the accelerating speeds of technology, capital and daily life, William Caraher offers the idea of *slow archaeology* as a response to "negative impacts of the accelerated pace of archaeological work made possible by digital tools" (Caraher 2016, p. 422). He emphasises that a practitioner should perform thoughtful, considered work, and not be driven exclusively by issues of efficiency and throughput, and furthermore, to "recognize the particular emphasis on efficiency, economy, and standardization in digital practices within the larger history of scientific and industrial knowledge production in archaeology" (2016, p. 423).

Caraher's approach is informed in part by Eric Kansa's proposal of *slow data* and the need for space for "thoughtful digital curation", writing that:

> The most important value of research data does not center on its scale, efficient collection, or even efficient interoperability. Rather, a slow data approach can highlight how data collection, management, and dissemination practices need to be considered integral to the larger ethical and professional conduct of research (E. Kansa 2016, p. 466).

Extending these two concepts, I offer the idea of *slow digitisation*, a similar need to consider an equilibrium between data collection — digitisation — and *intellectual reasoning* with the thing being digitised (Dell'Unto 2018, p. 58). 3D models are positioned at the very end of pathways of production and interpretation, and considered to be "digital artefacts", or simple shifts of the physical thing into digital space. As such their potential as interpretive or learning tools is believed to reside here too, ignoring the generative capacity latent within their production. By performing digitisation in a slow, thoughtful manner, working and learning *with* the thing, decentering the finished digital model, and considering craft practice in its making there is potential for emancipation from the reductive, data-driven imperatives of mass digitisation.

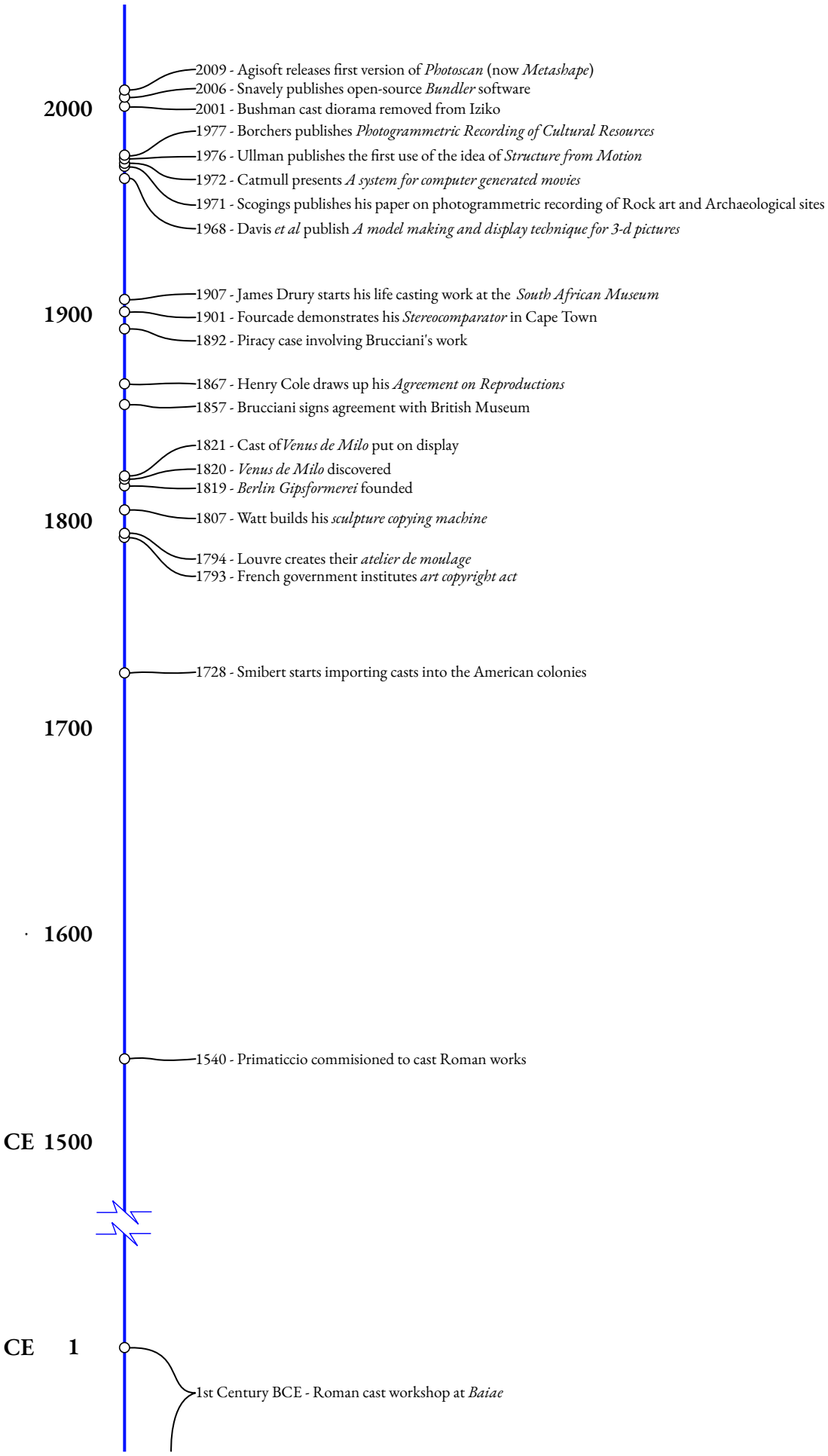


Figure 3.11: A timeline historicising significant turns in this chapter

4

FROM DATA TO MEANING: THE NEW DIGITAL OBJECT

> In the age of the Anthropocene, climate change, terrorism and political conflicts, many archaeologists see technology as the remedy that will save objects from obliteration by digitizing them, storing them in databases and, in some cases, presenting them to the wider public. In its radical form, this technological turn is not a way of negotiating or balancing between technology and materiality; it is a move towards rejecting the material and asserting the digital or virtual as sufficient replacement.
>
> Monika Stobiecka, 2020, *Towards a Prosthetic Archaeology* p. 347

> The authority of the text is no longer personal, but lies in adherence to abstract codes.
>
> Ian Hodder, 1989, *Writing archaeology: site reports in context* p. 272

In the last chapter, I discussed digitisation as practice, and looked at the polysemic nature of the digital model. Continuing from there, in this chapter, I will first look at the discourse around digital objects and archives— how they are seen and constructed from both the point of view of a researcher and that of a viewer, or "consumer", then outline some of the most frequent obstacles regarding digitisation of objects and subsequent use of the data.

Following this, I will look further into historic classification systems (as discussed in chapter 2), and how they are mapped into digital systems in the form of metadata, and how metadata — and therefore current archives and databases themselves — still carry assumptions and biases inherent in these earlier systems. I will highlight the problems and lacunae in discussions around ontologies and metadata, and finally, I will contemplate how we might regain some

of what was lost when digitising the object; how we might recontextualise the digital object and reintegrate it within the networks and connections in which the original resides.

To this end, I will build on the notion of "slow digitisation", which I introduced in chapter 3, concentrating on a materially and contextually-oriented engagement with the object, focusing on digitisation as a practice rather than a process. Simultaneously I will address the need to challenge existing systems and schemas into which we digitise objects, in order to ensure that we proceed with an awareness of the ontological implications of working with the legacies of historic schemata. Furthermore, there is a need to reconcile domain knowledge with digitisation praxis and the formative processes in which formal ontologies, grammars and metadata schemata are constructed.

The digital model produced as a result of practices and techne in chapter 3 is just that; it is a 3D digital model, with no context, and unanchored in a material, historic, epistemic and affective sense. It is a data file which is of little use until it is recontextualised through its curation into organisational systems, used as a "technical object" in the creation of new knowledge, and presented in some form of visualisation. Once this occurs, I argue, it becomes a "digital object", it has context, agency and potential for the creation of knowledge and affect.

4.1 AUDIENCES FOR THE DIGITAL OBJECT

Numismatist and archaeological data scientist Ethan Gruber recalls early engagements with 3D models where specialists described them as a "sexy technological endeavour with little or no scholarly application" (E. Gruber 2015, p. 63). The initial articulation of need and "audience" for digitisation of objects is frequently disregarded or put in abeyance in favour of more immediate concerns. In previous chapters I have used a somewhat reductive approach by using the convenient differentiation of *scholarly* and *popular* audiences —that is, digitisation performed for research purposes, including preservation, versus that performed for public entertainment or education purposes. In a similar manner to the case of plaster casts which I discussed in chapter 1, digital objects, when applied to these categories, can be

either cognitive artefacts or simple visual representations (Bearman 2011; Garstki 2017), however, this is an over-simplification which obfuscates the complexity of the issue.

Archaeologists Timothy Clack and Marcus Brittain, looking at communication and media within archaeology, identify four types of texts along a continuum:

- *Intraspecialist* – typified by the specialised academic publication with empirical data, supporting expert theory, and references to other key works.
- *Interspecialist* – including those texts and presented papers that bridge between related academic specialisms.
- *Pedagogical* – or the textbook stage of communication, in which the completed theory and paradigm is presented and set within a historical perspective of disciplinary progression
- *Popular* – in which characteristic images and analogical metaphors are presented in the popular press and broadcast documentary. (Cloître and Shinn 1985, p. 32; Clack and Brittain 2007, p. 31).

Michael Shanks notes, in this light, that critical appraisals of representation in archaeology generally separate *popular* and *pedagogical* from *inter- and intra-specialist* representations. This, he states, implies that some representations "remain closer to the data", while those aimed at popular communication "inevitably stray from certainty" (Shanks and Webmoor 2013, p. 96). This highlights numerous challenges on this front, many dependent on the intended audience, and some common to all.

4.1.1 *Motives and discourses*

Public and academic discourse on digitisation tends towards three dominant tropes. These are:

- Digitisation affords unprecedented access and "democratises" access to collections,
- Digitisation will allow new and novel forms of research on objects and collections, and

- Digitisation offers the ability to preserve endangered heritage objects or collections.

As noted by archaeologists and linked data practitioners Eric and Sarah Kansa, these tropes express a tension between *archival* and *analytical* purposes of data (S. W. Kansa and E. Kansa 2018, p. 90), where the incentives for democratisation and preservation result in differing objectives and metrics to those for pure research. Following sections will offer an overview of these discourses to provide context when I consider a new model for the digital object later in this chapter.

Access

Melissa Terras *et al* observe that GLAM (Galleries, Libraries, Archives, Museums) institutions are now generally *expected* to host a percentage of their content online (Terras et al. 2021, p. 2). This is particularly important given the public reach of the internet and public expectations that institutions have an online presence, preferably one providing, if not access to their entire collection, at least a curation of some of their most popular or charismatic objects. Digital historian Tim Sherratt summarises this discourse:

> Everyone, everywhere will be able to find and use our cultural collections. Hidden riches will be revealed. Obstacles to discovery and exploration will be removed. Technology, it is often assumed, can push collections across a threshold — it can make them *open* (Sherratt 2019, p. 2); emphasis in original.

This is by continuation, the *public education* aspect of museums — as I discussed in chapter 2 — transposed into the online space. Fiona Cameron agrees, and finds that the value of a digitisation is in its "potential to promote the radical democratisation of institutions in regard to access and engagement with their collections" (F. Cameron 2022, p. 99).

Archaeologist and heritage specialists Tracy Ireland and Tessa Bell explore the affordances of 3D photogrammetric models, and note that

> …Substantive questions have been raised around their openness, ownership, long-term usefulness and capacity for re-use, and around exactly how these

> digital objects will fulfil promises of making heritage more widely available and 'democratised' (Ireland and T. Bell 2021, p. 150).

The term "access" is rarely defined (Terras 2010, p. 3), and furthermore, Digital humanist Tim Sherratt concludes, access is never "truly open" (Sherratt 2019, p. 3). Numerous factors conspire to ensure this; lack of connectivity, failure of systems, inadequate context, intentional withholding of material, or decisions that are made about what to digitise and what not to digitise. The same political issues and forms of gatekeeping that manifest in physical collections and archives are reinscribed in digital form, amplifying some voices and silencing others (Pickover 2014, p. 9).

Sherratt provides an example of what might be seen as "democratisation": online digital collections provide people who might never consider themselves "researchers" the ability to browse collections without the "intimidations of architecture" or the "questioning of gatekeepers" as might be encountered in a physical museum, archive or library (2019, p. 3). While access to these materials is undoubtedly massively improved, obstacles to widespread acceptance and usage remain. Where archives of digitised materials do still persist, paywalls, passwords and highly controlled access abound (Blom et al. 2016, p. 13).

Controlling access to some extent is desirable, for both ethical and safety reasons.[1] Nevertheless, barriers are sometimes difficult (or expensive) to overcome. For instance tDAR[2] (the Digital Archaeological Record), maintained by Arizona State University and funded by the Mellon foundation, amongst others, allows unpaid downloads of material, but charges users per file for upload and storage on the system. Similarly, commercial platforms such as Sketchfab[3] charge up to US$1000 annually for storage of models, (with limited metadata capability). Despite these arguments, external access is not necessarily an aim in the first place regarding digitisation projects. A 2019 project following digitisations across heritage institutions in the Western Cape province of South Africa reported that only 29% planned

1 This is more of a granularity issue, for instance reducing the precision of spatial coordinates of sites, thereby protecting the exact location.
2 https://core.tdar.org/
3 https://sketchfab.com/

to provide external access to the digitised material, the others only offering access through physical terminals at the institution itself (De La Porte and Higgs 2019, p. 9). Furthermore, where archives and repositories are made available to the world, access is tightly controlled dependent on the role of the user; whether they are (or are perceived to be) a valid scholarly user or contributor, or a member of the public at large.

Web-based platforms which have extensively branded themselves as *open access*, such as CyArk[4], have severe legal restrictions on the use of their material, even having ostensibly deployed Creative Commons open licensing (E. Kansa 2016, p. 456). Other platforms such as Google's *Open Heritage* leave models and data in the hands of giant technology corporations, with no access whatsoever to original material. This leaves the objects trapped in digital vitrines, much like the untouchable artefacts in the traditional didactic museum.[5] Further decisions, based on neoliberal economic forces, political and other factors, determine what is digitised *in the first place*, and so this provides another aspect to access or lack thereof.

This being said, there are success stories in the drive to preserve archaeological data. The UK-based *Archaeological Data Service* or *ADS* was instituted in 1996, with the brief to

> Collect, describe, catalogue, preserve and provide user support for the re-use of digital data generated in the course of archaeological resarch by British archaeologists, wherever they are working (J. D. Richards 1997, p. 1058).

The aim is to facilitate access to archaeological material and archives – including so-called "grey literature", and also afford access to "orphaned", or unmaintained and "unowned" datasets. Initiated at the level of the UK higher education funding council, it is part of a group of similar initiatives across the humanities, and is self-sustaining, charging a once-off fee for deposit of data, while allowing free access to this data (J. D. Richards 1997; J. D. Richards 2017). The *ADS* has also implemented the ability to store and view 3D models, albeit mostly in the form of recordings of excavation layers (Galeazzi et al. 2016).

4 https://www.cyark.org/

5 Notably, as of late September 2023, Sketchfab has laid off their cultural heritage team. Practitioners working in the field are speculating that much of this material is consequently endangered.

Research possibilities

Digital collections offer the potential for institutions to make previously inaccessible materials available to researchers. The availability of metadata should allow the use of tools such as the *semantic web* and *linked data*, which allow for sharing, comparing and contextualising digital objects and associated data from across the spectrum of institutions and collections (with the caveat that these schemata tend towards universalism, as I discussed earlier). Heidy Geismar comments that

> Many people understand digital technologies – particularly those that produce the expansive internet, sometimes referred to as Web 2.0 or more recently as the semantic web – as extending the civic capacities of museums, opening access, democratising curatorial authority and destabilising values of authenticity and the aura of singular artefacts. (Geismar 2018, p. xviii)

This is mirrored by Deegan and Tanner who add that it will "allow the virtual reunification of dispersed collections, facilitate in novel research, and encourage greater use of our institutional collections, albeit from afar" (Deegan 2008, p. 32). However, as I have already briefly discussed above, access is a problem when looking for models too. Virtual heritage specialist Erik Champion characterises 3D digital heritage models as

> hard to find, impossible to download and edit, in unusual, unwieldy or obsolete formats. Many of the freely available models are stand-alone 3D meshes with no accompanying metadata or information on how the acquisition of the data [sic]. (Champion 2017, p. 15).

The problem here is manifold. Firstly, 3D models do not fit comfortably within existing archival and repository structures and formats. This applies to both research archives and academic publishing systems. Commonly deployed archival systems such as "DSpace"[6] or "AtoM"[7] have no facility for dealing with 3D models in any coherent form; if they can be

6 https://dspace.lyrasis.org/
7 https://www.accesstomemory.org/en/

added to the archive, they are simply treated as another "resource" or "file" attached to a record in the database and so cannot exist as a standalone object. Subsequently, the 3D model is effectively demoted to an inferior status within the archive.

Digitisation efforts involving more "traditional" materials, such as documents or manuscripts, also have quite different metadata requirements, and also rarely track the operational chain of digitisation, semanticised as so-called "paradata". In response many institutions or projects either upload their models to a commercial, cloud-based repository, the most popular of these being Sketchfab, or resort to developing their own proprietary solutions, examples being the Smithsonian Institute's "3D Scanning Frontier"[8] and the Metsemegologolo[9] archive.

Secondly, there is little scope within academic publishing for providing supplementary data alongside a publication, whether book or article; objects have to be uploaded to an external data repository, for instance Zenodo[10] or OpenContext[11], and then linked to the article (hoping that the link is published alongside). Caraher observes that despite the ability to produce 3D models "having existed for some time" they remain "difficult to publish outside a few academic publishers" (Caraher 2016, p. 433). One of the few offering this capability is the journal *Internet Archaeology*[12], which is aligned with the earlier mentioned *ADS*. The journal's model allows for publication of traditional papers and data-driven papers, referencing datasets held in the *ADS* (J. D. Richards 2017; J. D. Richards and Winters 2015).

Parallel with this is that there is no notion of peer-review for evaluating the quality of digital heritage data (Koller, Frischer and Humphreys 2009, 7:4), which itself foregrounds the complication of metrics and standards for digital heritage data, something which initiatives such as the *London Charter* have attempted to address (Beacham, Denard and Niccolucci 2006; Beacham 2012).

8 https://3d.si.edu/
9 https://www.metsemegologolo.org.za/artxi/object/16000
10 Zenodo is funded by the EU and run by CERN, the European centre for nuclear research.
11 https://opencontext.org/
12 https://intarch.ac.uk

The third issue is that heritage related fields are habituated to producing (and citing) literature — articles, narrative reports and similar work, rather than data (in the form of models, etc) (S. W. Kansa and E. Kansa 2018, p. 90). The nature of extant work within art history, archaeology, museology and adjacent fields is that it is in this form already; and this is the material which has to be referred to, cited, and semantically linked with a 3D model in order to contextualise it. Doerr observes that in fact most work involving "conclusions and judgement about the past" is published in academic texts rather than "encoded in data structures" (Doerr 2009, p. 481). Koller *et al* argue that

> …The creators of virtual heritage products are not rewarded by their peers for creating digital models and related written documentation, because there is no peer review agency evaluating the quality of the work and accepting it for publication. Finally, the end-user, whether a scientist, student, or member of the general public, has no way to access a model, let alone an online resource offering a wide range of high-quality scientific 3D digital models of cultural heritage monuments which he or she may wish to download. (Koller, Frischer and Humphreys 2009, 7:4)

Furthermore, one of the most significant barriers to adoption of publication in any structured data form relates, again, to the invisible labour and craft of the practitioner. The creation of these forms of information are not yet considered part of standard practice within heritage fields, and tend to be backgrounded into the "unofficial" workload of already busy practitioners. Finally, within academia, formal "reward" structures favour traditional publication over digital products — which are also usually highly collaborative — another metric which is not recognised, and so digital projects frequently find themselves marginalised within academic disciplines, or even completely external to academia (E. Kansa 2016, p. 447).

Preservation

The catastrophic fire which destroyed reams of historic material at the University of Cape Town Jagger Library in 2021 (Johnson 2021) reinvigorated calls for preemptive digitisation of endangered and fragile materials. The highly visible destruction of the Buddhas of Bamiyan and the Syrian city of Palmyra and more recently in 2019, the fire which resulted in the partial destruction of the cathedral of Notre-Dame de Paris have led to European Union programmes and funding to digitise cultural heritage objects and sites across Europe and the world (Cardozo and Papadopoulos 2021).

A notable example is the recreation of the "Arch of Triumph" in Palmyra, destroyed by ISIS in 2015, prompting the newly-formed *Institute for Digital Archaeology* to create a 3D photogrammetric model derived from historic photographs (Denker 2017). Other projects have used comparative methods to determine damage due to weathering and vandalism, or, for instance to determine the verisimilitude of the cast copies of the Parthenon Marbles in comparison with the originals (Payne 2019). Khunti notes, however, that this is not without its problems. There are numerous ethical issues to consider, not least of which the fact that — in the case of the Palmyra arch — there is no remaining original against which to test the veracity of the copy — which in this case — is known to be inaccurate and reductive (Khunti 2018, 2:6).

"Digitise Everything": the mirage of mass digitisation

Digitisation projects are consistent casualties of certain complications which have bearing on the nature of the digital objects they produce, the manner in which they are presented and that in which they are used. In light of the COVID-19 pandemic and its consequences for researchers unable to perform fieldwork or access archives, and events such as the abovementioned fire at the UCT Jagger library, there has been considerable discourse calling for the "digitisation of everything", particularly within the popular media.

The drive towards "massification" and data-driven processes tends to leave digitisation projects in a precarious position regarding quality and detail. Digital Librarian Astrid Verheusen refers to the *Google Books* project, for instance, having digitised millions of books globally, while being "criticized for the inferior quality of their images, the emphasis on the English language, the violation of copyright laws and the lack of attention for preservation issues" (Verheusen 2008, p. 28). Similarly, standards for metadata consistency and cleanliness often suffer given the scale of such projects (for instance within the *Internet Archive*) . In heritage digitisation projects the term "mass digitisation" is regularly deployed (MacDonald 2006; Terras et al. 2021) in this regard.

Projects are beholden to increased oversight and restriction regarding what they can and must do in the form of metrics and quantitative measurement of throughput, output, profit and impact. Art historian Claire Bishop draws attention to the fact that this reflects trends within the neoliberal economy, and the neoliberalisation of higher education and research, and that these trends are also tracked by the rise of the *digital humanities* (Bishop 2018, p. 126). Kansa summarises the issue as such:

> Simply put, "neoliberalism"—a loosely associated bag of ideologies that emphasize fiscal austerity and relentless competition, market transactions, and certain management techniques centered on metrics and surveillance—now permeates academic institutions (E. Kansa 2016, p. 446).

As a result many digitisation efforts fall prey to this unending need for quantification and measurement; volume; throughput; resolution; storage and the fact that there is constant pressure for everything to be quantified, containerised, and categorised in order to be seen as a "successful" and "productive" project, and conversely, these goals rarely consider the quality and effictive use of the subsequent digital material (Poll 2010). Further to this are attempts to determine success and impact of the materials and their repositories *post-facto*, that is, looking at website views, user engagement, citation metrics, or press coverage (Zahidi, Lim and Woods 2014; Borrego 2020).

Alongside the drive for quantification lies a tendency toward technological determinism; the idea that all problems — whether technical, social, political or cultural — can be solved technologically. Technology theorist and writer Evgeny Morozov calls this "solutionism", which he describes as

> Recasting all complex social situations either as neatly defined problems with definite, computable solutions or as transparent and self-evident processes that can be easily optimized—if only the right algorithms are in place!—this quest is likely to have unexpected consequences that could eventually cause more damage than the problems they seek to address (Morozov 2013, p. 5).

This attitude has arisen across the multitude of fields involved in digital heritage. Ross Parry quotes museologist Tomislav Šola and his warnings of the "technology trap", pursuing knowledge for its own sake (Parry 2005, p. 333), while archaeologist Jeremy Hugget calls for awareness of "technological fetishism", where the computer is "worshipped on account of its supposed inherent magical powers" (Huggett 2004, p. 85). Similarly, Bishop talks about digital art history, and the larger (somewhat ethereally defined) sphere of "digital humanities" as dealing in "technopositivism" (Bishop 2018, p. 126). In the more abstract realms of government policy, Parry notes common tropes of "digital salvation", where ICT (Information and Communication Technology) is seen as a panacea for many problems within heritage (Parry 2005, p. 343).

A further agenda for mass digitisation involves trends towards quantitative research in heritage and digital art history; including techniques such as computational analysis of large corpora of art images and the deployment of "big data" (being large datasets of thousands of works) (Kienle 2017; Bishop 2018, p. 124), and a convergence of art history and data science (Manovich 2015).[13] Similar concerns are appearing given the current (early 2023) uptake of so-called "AI"[14] or "Machine Learning" systems working from sample sets of up to 600

13 Although this is not mutual; as is often the case this involves scientists working from the position that computer science can generalise and abstract problems to such an extent that domain knowledge is unnecessary.

14 Artificial Intelligence

million images (for instance "Stable Diffusion"[15]) which can produce synthesised images, so-called "artworks" from a written text prompt.

Reuse of digital data

A recurring issue with digital data and its reuse within heritage, archaeology (and academia in general) is that researchers are extremely reluctant to reuse other's data. There is a notable lacuna in research on re-use of digital data and models within museum collections or heritage as a whole[16], however digital curators Ixchel Faniel *et al* have undertaken research within groups of archaeological practitioners. Archaeologist Jeremy Huggett has collected statistics from such collections, and determined that of the major repositories (such as OpenContext, tDar and similar platforms), less than 1% of archaeological and heritage datasets held have been cited in any academic publication (Huggett 2016). He thus concludes that researchers are far more likely to *deposit* digital data into repositories than *re-use* data deposited by others. Faniel *et al* argue that ultimately, one of the greatest barriers within intra/interspecialist re-use of models and data is that of context and the need to "understand, verify and trust the data" (Faniel et al. 2013, p. 303). They note, however, that

> examination of current data documentation guidelines, standards and ontologies showed much of the context needed for reuse was not being incorporated into practice (2013, p. 303).

Within the surveyed groups, they recognised that factors influencing re-use of digital datasets amongst heritage practitioners and archaeologists include: provenance data, attention to metadata, the practitioner who created the data (and their training, including institution and PhD supervisor), and to a lesser extent the repository in which it is stored (and its institutional affiliation) (2013, p. 301).

Dell'Unto writes that

15 https://en.wikipedia.org/wiki/Stable_Diffusion

16 There is some work on *needs assessment* (Koller, Frischer and Humphreys 2009) and extant platforms (Benardou et al. 2017; Champion and Rahaman 2020), but little on uptake and usage.

> Three dimensional models emerge in fact as a result of a number of choices made by the operators to address specific research questions, and their characteristics reflect (1) the types of instruments chosen for acquisition; (2) the kind of acquisition process performed by the operator; and (3) the type of post processing that is applied to produce the final visualisation. In order to be useful in the future, these datasets must meet certain quality standards, must be documented with a certain degree of rigour and they need to be linked and related to other visualisations using shared concepts (Dell'Unto 2018, p. 56).

These problems become that much more complex when dealing with a dataset such as a 3D digital model, being a complex assemblage of raw input data, field (and studio) practice, and multiple complex steps of decision and computation, all of which should be documented in order to provide the context which Faniel *et al* discuss as being so important.

4.2 CONTEXTUALISING THE MODEL - THE MAKING OF THE "DIGITAL OBJECT"

4.2.1 *The marooned object*

As plaster casts are often forgotten and neglected in storerooms (M. Nichols 2006; Lending 2014), or displayed with no context in grand "cast courts" (García-Estévez 2019), so digital objects (and sometimes entire archives) often end their careers on some sort of storage medium, isolated in a desk drawer or storeroom. Whereas support for traditional archives and museum collections takes storage *in perpetuum* as given, funding of digitisation projects rarely has sufficient provision for sustainability and ongoing maintenance and storage costs of the resulting digital archive and supporting infrastructure. Archivist Michele Pickover characterises this funding as being "directed at production, and so is inevitably short-term, transient and has strings attached" (Pickover 2014, p. 11), and as a result, data languish in inaccessible and unsafe places.

Fiona Cameron states that attention is paid to processes of recording and data collection while "digital machines and data languish in the museum storerooms, and billions of files

lie like sediment in the cloud, in hard drives and all manner of devices" (F. Cameron 2021, p. 4). Tringham and Ashley refer to a colleague's significant 3D model of the Mayan city of Palenque which "we believe sleeps/rests on his personal hard drive" (Tringham and Ashley 2015, p. 36). This happens as the intersection of two concurrent problems; that of funding and storage discussed earlier, and that of scale: only a small fraction of the raw data collected is used to produce the final output, the process of *data reduction*. For instance, in producing my NM176a model, the input data comprised 340 digital images weighing in at some 5 1/2 Gigabytes, while the finished 3D model comprises 3 files totalling 48 Megabytes.

While many of these issues are the result of funding and its cycles, they are often due to the appropriate frameworks for collection, contextualisation and utilisation being insufficient or non-existent. Creating archives and collections without a framework for handling the objects and *the processes used in their creation* results in the possibility of collections "which do not have sufficient information to support research" (Dell'Unto 2018, p. 55). We might consider these objects *marooned*, in a number of senses, not least of which is that they will not be afforded the same "regimes of custodial care" (Hamilton and Leibhammer 2017, p. 24) as other objects in a collection, being digital and intangible.[17]

4.2.2 *Meaning, context and metadata*

Classification systems, ontologies and grammars, as discussed in chapter 2 manifest at a pragmatic level within traditional archiving, digital archiving and digital heritage as *metadata*. The term was first used by computer scientist Philip Bagley in 1968, where he defined it as

> The ability to associate explicitly with a data element a second data element which represents data "about" the first data element. This second data element we might term a "metadata element" (Bagley 1968, p. 26).

17 And therefore by common discourse "inauthentic".

Gartner states that the most familiar type of metadata is *descriptive*, in that it provides what we need in order to locate the data we are looking for, such as the title or author of a book, or unique identifiers such as an ISBN or DOI identifier (Gartner 2016, p. 6). Despite ostensibly being used to describe "data", the concept is core also to fields where the material being described is not necessarily "data" in the classical sense but objects or documents, for instance traditional archives, museums and other GLAM institutions (Doerr 2009, p. 467.)

In its most basic form, metadata can be used for simply *finding*; this is probably the most common form, being used in libraries and digital archives built upon more traditional archival principles. Conversely, metadata may also be constructed to offer *semantic interoperability*, offering a semantic bridge between scholars, disciplines or systems. As Doerr notes, the study of the past is highly interdisciplinary and requires collaboration across multiple adjacent fields (Doerr 2009, p. 463), with a subsequent requirement for standards. He continues:

> Interoperability between various highly specialized systems, integrated information access and information integration increasingly becomes a demand to support research, professional heritage administration, preservation, public curiosity and education (2009, p. 463).

These functions of metadata are rapidly converging, in that metadata is rapidly becoming the data itself (Huggett 2023, p. 2), producing what is often named "structured data". Hacıgüzeller *et al* define this as "any data set that is 'born' organized and relatively easy to search through by machines, or organized at a later stage using metadata and other means to improve its searchability (Hacıgüzeller, Taylor and Perry 2021, p. 1710).

Probably the most commonly used metadata schema is The *Dublin Core* schema, developed in Dublin, Ohio in 1995 (Kunze and Baker 2007). It comprises 15 basic elements, including the familiar fields such as "title", "creator" and so on. Dublin Core could be classified as an *enumerative* standard, in the same vein as the *Dewey Decimal* system, where each element occupies a rigid position in a hierarchy (Gartner 2016, p. 67).

4.2.3 *Ontologies and the Limits of Standardisation*

I discussed the idea of ontologies in chapter 2, and how, in organisational systems, we can work with an ontology as being a conceptual model of the field we are attempting to catalogue and describe, or, as Gruber suggests, "a specification of a contextualisation", being "an abstract, simplified view of the world that we wish to represent for some purpose" (Thomas R. Gruber 1995, p. 1). Karmacharya and Wefers define these ontologies as "major computational artefacts that provide logical representations of a particular domain of interest"(Karmacharya and Wefers 2017, p. 161). While a metadata schema, or system, defines the standards by which we describe something within a digital collection or archive, dictating the names, types, and sometimes importance of individual *fields*, for instance "accession number" or "date received", an ontology reflects the larger "world" or domain which we endeavour to describe using this metadata and data. An ontology — as I outlined in Chapter 1— provides tools and vocabularies for describing phenomena, objects and relationships within this domain, and as such, they are the "current phase of concretisation of digital objects" according to Hui (Hui 2016, p. 76).

Gartner explains the benefits of a formal ontology for knowledge organisation as such:

> The crucial difference is the way in which an ontology brings its components together. Gone are the rigid rungs of the enumerative or even facetted ladder: now concepts can be related to each other like the strands of a spider's web, a network of ideas and linkages that can be as flexible as the subject being modelled requires (Gartner 2016, p. 82).

The key rationale behind using an ontological approach in classifying material, Gartner says, is that it can be "considered a more accurate way of representing the structures of knowledge as we humans perceive it" (2016, p. 83). While compelling, this does reflect the universalist tendencies within information and data driven fields, and highlights the ongoing tension between *some* need for commonalities for interoperability across archives, and the understanding of ontological pluralities within the materials we are digitising and archiving.

The act of classifying an object, which I also noted in chapter 2, involves projection from one ontological domain — or world — into another. This invariably results in a form of *ontological violence* in which Western defaults take precedence and categorisations and interpretations are determined by this reference and this reference only (Cipolla 2020a). Gavin Lucas interrogates the universalist tendencies of these systems, in asking "How do we deal with different ontologies that accompany the different epistemic cultures which might engage with museum collections?" (Lucas 2018, p. 90). Cameron and Robinson describe this as a problem of "conceptual fit", which highlights the "difficulty of prescribing categories that can be applied universally" (F. Cameron and Robinson 2007, p. 167), and as an example, they offer standard museum collection documentation and its Eurocentricity: European chronologies, "categories of use and subject", and how these problems play out regarding Maori *Taonga* (treasures).

According to a Maori curator

> We have problems putting taonga into boxes/classifications. Some are classified under work and industry but they should also be part of a spiritual/religious process. The critical conceptual base is to consider the relationships between these things and what is the thematic link—more lateral/sideways thinking is required. (Cameron and Kenderdine 2001, 31)

Further to this, early documentation systems favoured "type" and "function" over any cultural meanings, and so, in many cases, this information is simply missing (F. Cameron and Robinson 2007, p. 168). For example, observing the catalogue card from my NM176 case study (figure 4.1)— we observe that the relevant fields are, reductively, "name", "vernacular name", "cultural affinity" and "function", most of which are blank.

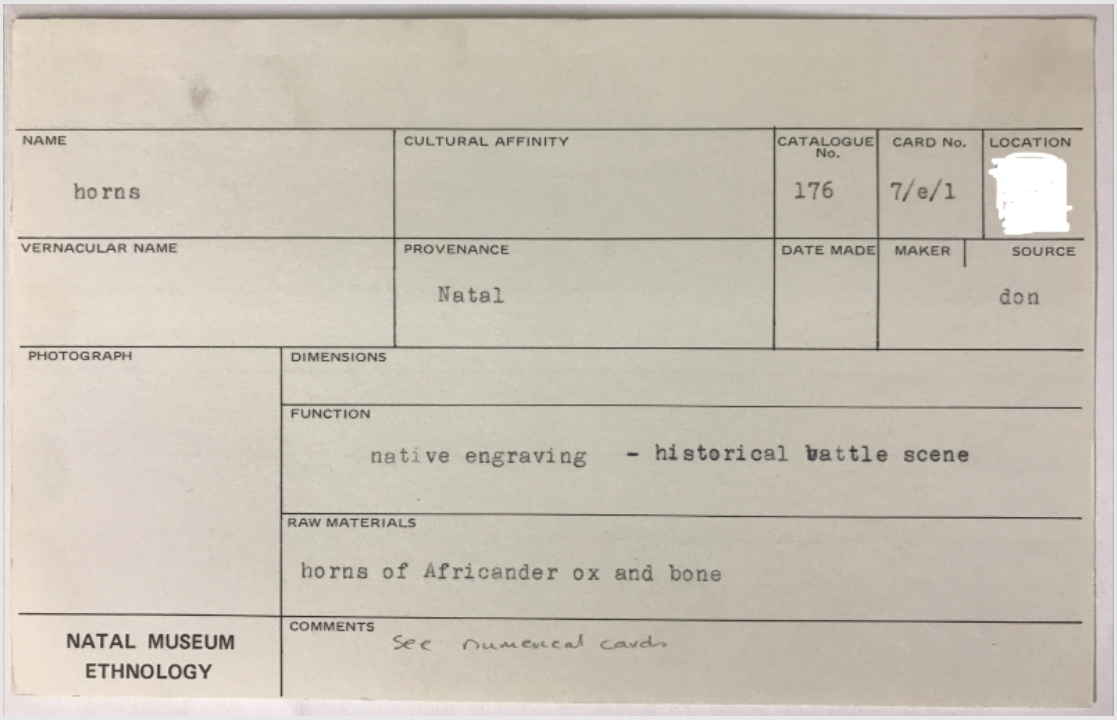

NAME
horns
CULTURAL AFFINITY
CATALOGUE No.
176
CARD No.
7/e/1
LOCATION
VERNACULAR NAME
PROVENANCE
Natal
DATE MADE
MAKER
SOURCE
don
PHOTOGRAPH
DIMENSIONS
FUNCTION
native engraving - historical battle scene
RAW MATERIALS
horns of Africander ox and bone
NATAL MUSEUM ETHNOLOGY
COMMENTS
See numerical cards

Figure 4.1: NM176, catalogue card (front), ca. 1980 *photo: Dr. Justine Wintjes*

Martin Holbraad offers the position that working with the idea of multiple, parallel ontologies does as much to safeguard *our Western* scientific ideology and ontology as it does any "native" ontology (in Alberti, Fowles et al. 2011, p. 903).

4.2.4 *The colonial connection*

Historian and archivist Howard Zinn said, in 1971 that

> The scholar may swear to his neutrality on the job, but whether he be physicist, historian, or archivist, his work will tend, in this theory, to maintain the existing social order by perpetuating its values, by legitimizing its priorities, by justifying its wars, perpetuating its prejudices, contributing to its xenophobia, and apologizing for its class order (Zinn 1977, p. 18).

In rethinking the digital object, its nature and its place, we need to be aware of the systems in place for legitimising the object as both a popular and an epistemic object. The systems themselves build on legacies of colonial collecting and administrative practice, and as users of such we should be wary of how we might be reinscribing these practices in making a new hopefully more enlightened digital object. At the very least, we need to remember that simply having these objects in collections, studying and digitising them keeps them within the borders of the "hegemonic epistemological order" (Duarte and Belarde-Lewis 2015, p. 684).

As we have seen regarding the construction of systems and schemas as discussed in chapter 2, they were built in the shadow of a universal, colonial European ontology which had no space for, and no desire to deal with alternative systems. They were built not just for reinforcing the Western scientific episteme, but also for organising the processes and formalities of the colonial system itself, describing, classifying and controlling the colonised and their world, and the resources therein (Foucault 2012; Adler 2016).

Melissa Adler observes that

> It is now widely acknowledged by KO scholars and practitioners that our current systems were established in the late nineteenth and early twentieth centuries by white, propertied, Protestant men, who adopted Enlightenment era scientific principles to order knowledge according to disciplinary conventions (Adler 2016, p. 632).

This is reinforced by archivist Samantha Winn, noting that we work within a supposedly *neutral* vocabulary and narrative style that "conforms to the expectations of the hegemonic default — white, male, heterosexual, gender-normative, upper-middle class, Global North — an allegedly blank canvas against which any deviation will contrast" (Winn 2017, p. 2). Any deviations from the norms will be immediately obvious, mainly in that there is no way (and nowhere) for them to be catalogued — as Gartner suggests, besides masking the "cracks of imperfect knowledge", metadata works within an ontology which "does not acknowledge those gaps" (Gartner 2016, p. 42).

Furthermore, Hacıgüzeller *et al* recognise that the systems ignore "the voices, values and protocols of communities on the ground" (Hacıgüzeller, Taylor and Perry 2021, p. 1710). Despite these obvious shortcomings, such systems, standards and controlled vocabularies *espouse universality* and *pretend neutrality*. This commitment to neutrality obfuscates the inbuilt biases, and, according to Mai "hinders conversations about the cultural effects of classifications that marginalize and exclude views outside of the politicial, social, and ethical mainstream" (Mai 2016, p. 327).

In discussing practices of cataloguing anthropological data within such systems, Lindsay Poirier *et al* argue that in fact, creating definitions for what are essentially "standard" terms such as "creator", "rights" and "subject"[18] is an explicitly political act. This demands that one have an active position on the creation and ownership of cultural narratives, and furthermore, what it means to force them into these structures (Poirier et al. 2020, p. 231).

Digital archives, as Roopika Risam states, are often "heralded prematurely for their contributions to the historical and intellectual project of decolonization" (Risam 2019, p. 47). However, digital classification systems — ontologies, vocabularies, thesauri and metadata schemas — are the natural inheritors of the legacy of colonial documentation practices. As Turner notes, "systems of formal documentation inscribe and re-inscribe many of the epistemologies developed in the forms that come before them" (Turner 2020, p. 65).

The question here is then how do we transcend this problem of different worldviews — or as Alberti uses, "alterities" (Alberti 2016)— which demand different ontologies — while still allowing for digital objects to be stored, found, used, and knowledge built from and around them? There is a notable lacuna regarding usable solutions to this problem. As an example, library science has provided a pre-digital approach to the non-Western ontology side of the problem, in the form of the *Brian Deer* classification system, developed by Brian Deer, and indigenous American librarian in the 1970s and '80s (Cherry and Mukunda 2015). This was primarily a response to the American Library of Congress and their "LCC" (Library of Congress Classification) system.

18 Probably the most common fields across metadata standards, including Dublin Core.

The LCC, and similarly the familiar Dewey Decimal system (DDC) are constructed around "sameness", which as Olson reiterates, is culturally grounded (Olson 2011, p. 120). These hierarchical schemata are not just based on Eurocentric categories, but also often place European knowledge at the top of the hierarchical trees. Besides marginalising other ontologies it also hinders the ability to *find* non-Western material (Olson 2002; Olson 2011). The Brian Deer system attempted to acknowledge the ontological alterities of North American Indigenous peoples, with the understanding that their corresponding epistemologies have "substantively different foundations to those derived from European frameworks" (Cherry and Mukunda 2015, p. 550).

Deer's first classification involved topics which were of immediate, local interest, such as *resource management*, *land claims* and *self governance* (2015, p. 553). Further revisions to the system ordered sections, notably History and Culture in a geographic sense, again starting at small, local scale (British Columbia), then expanding outwards in an expanding spiral to eventually encompass the whole of Canada (2015, p. 556). The Brian Deer system is anchored in a local context, eschewing the usual tendencies toward universalism in schemata, and thus has little scope for interoperability across ontological boundaries and dissimilar systems.[19]

Systems and categories tend to offer weak prefiguration of the nature of an object, dependent on the institution or collection. The original ontological existence and potential of the object is reduced to a handful of keywords and assertions, drastically limiting future potential for engagement and interpretation. Despite these limitations, researchers tend to often quite successfully work around them; again, this is a critique of the systems, not the practitioners. Furthermore, metadata is *fundamentally unable* to coherently communicate non-rigid and non-standardised concepts, such as ambiguity, any sort of informal text or narrative, or conclusions (or interpretations) which are not clearly derived from an evidentiary lineage within the data.

19 At this point the inevitable question arises — should we be sharing indigenous knowledge in this manner, and if so, which parts should be shared? The ethical considerations are beyond the scope of this research, but there is some compelling work on access in Montenegro (2019) and Christen (2012).

4.2.5 *The CIDOC-CRM Heritage-oriented ontology*

To illustrate this, I will construct some examples annotated using the CIDOC CRM[20] schema (I will refer to this as CRM from here onward). The aim of CRM, in constant development since 1997, is to "enable information interchange and integration between heterogenous sources of cultural heritage information, archives and libraries" (Doerr 2005, p. 1). It defines complex interrelationships and entanglements between objects, actors, places, documents and other entities within heritage and archaeology. The CRM is designed to span multiple disciplines in heritage and aligned fields, such as art history, archaeology, built heritage, and so on, and as such does not include vocabularies from specific disciplines. Instead, it reaches for the lowest denominators common to all fields, expecting specific terminologies to be added in an additional layer above the commonalities. This is a core philosophy of the CRM, working from the hypothesis that mapping relationships between things, people, events and places is more useful to knowledge production than terminology (Doerr 2005, p. 2). Furthermore, as Doerr notes, a core tenet of CRM is that "Information is event centric", that all relationships happen via events. He offers the position that describing objects with metadata, specifically CRM, allows for the reconstruction of *possible pasts* (2009, p. 475) .

My choice of CRM as exemplar stems from my personal experience of designing and constructing the digital archival database for historic, ethnographic and archaeological material for the *Metsemegologolo multimodal landscape archive of african urbanisms* project. This archive holds a collection of materials reconvened from widely dispersed assemblages, and of varied forms, such as historic text, historic maps and "born digital" geospatial data, 3D models, photographs and audio files. CRM provides the ability to link the objects within the archive with each other (and externally) based on relationships. The examples I use here do not comprehensively detail each full property/class relationship as defined in the CRM,

20 The International Council of Museums (ICOM) International Committee for Documentation (CIDOC) Conceptual Reference Model (CRM).

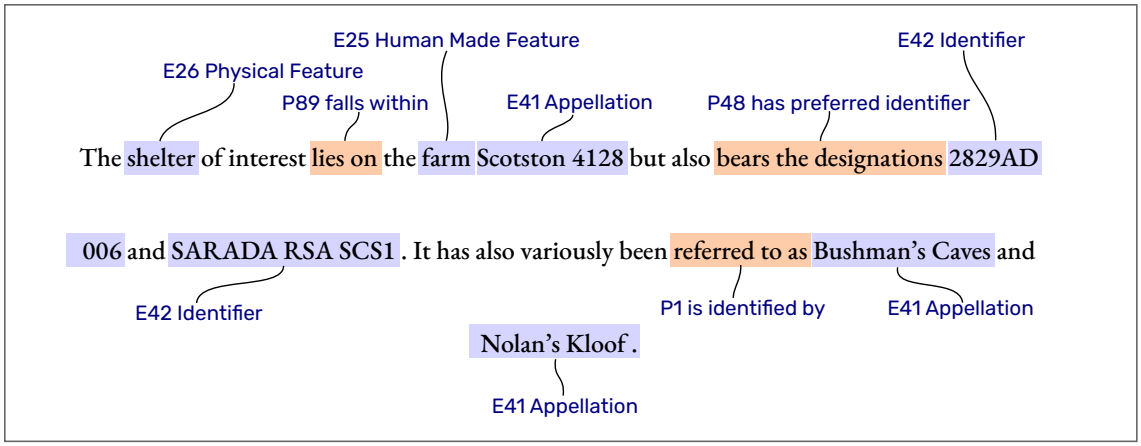


Figure 4.2: Example 1

but are used to illustrate the core principles, their affordances, and their shortcomings.[21] Furthermore, the event-driven nature of the CRM means that it takes significant effort and complexity to disambiguate/deracinate and map a narrative passage onto this schema, as these examples illustrate.

As Hacıgüzeller notes, CRM comprises a "set of metadata elements describing the most fundamental relationships that connect things, concepts, people, time and place" (Hacıgüzeller, Taylor and Perry 2021, p. 1715). In the above examples we can see the elements describing "entities", with a prefix of "E", for instance, in example 1 (Figure 4.2), "E25 Human-Made Feature".[22] Elements with a "P" prefix describe relationships between entities, defined in the CRM standard as "properties", for instance "P1 is identified by" which relates an entity - in this case the "E26 Physical Feature" of my Scotston rock shelter example — to the "E41 Appellation"[23] which identifies it as "Bushman's Cave" (CRM requires an additional P1 for the appellation "Nolan's Kloof"). Additional properties relate the site to its "E42 Identifiers",

21 For instance I have compressed the person "David Preller" into the entity "E21 Person", where correctly, this should be "E21 Person -> P1 is identified by -> E41 Appellation -> David Preller".

22 Defined as: "physical features that are purposely created by human activity, such as scratches, artificial caves, artificial water channels, etc. In particular, it includes the information encoding features on mechanical or digital carriers." (Doerr, Bruseker et al. 2021, p. 20).

23 Defined as: "… compris[ing] signs, either meaningful or not, or arrangements of signs following a specific syntax, that are used or can be used to refer to and identify a specific instance of some class or category within a certain context….

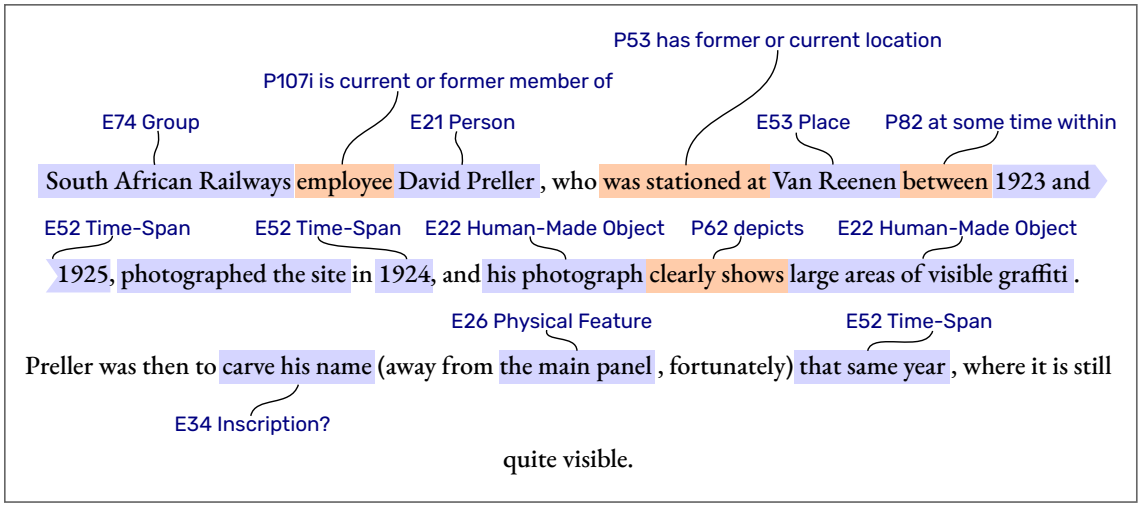


Figure 4.3: Example 2

which identify its formal entries in archives and catalogues, for instance "2829AD 006" in the South African Heritage Database.

This brief example demonstrates the complexity of mapping a narrative form into structured data and metadata; the entities and properties are still open to ambiguity, such as "human-made feature" versus "site" versus "place". In performing similar annotations, Hacıgüzeller *et al* observe that

> The tensions we observed in the annotation process, we suggest, closely resemble the tensions involved in any other attempt (e.g., during archaeological fieldwork) to structure archaeological wisdom, knowledge, and information into data that fit under predetermined column/field names (Hacıgüzeller, Taylor and Perry 2021, p. 1716).

Furthermore, they suggest that this process of experimentation highlights which forms of knowledge and information might be lost in the process of transcription into metadata, and those which may be "overrepresented", given the reliance on systems such as CRM which are designed around — and require — rigid formal structure.

Example 1 discussed above is relatively straightforward; we are naming and formally identifying a physical feature. Example 2 (Figure 4.3) describes actions taken by an actor. "Employee"

would map to "E21 Person, David Preller" -> "P107 is current or former member of" -> "E74 Group, South African Railways". His action of carving his name into a rock is more problematic. The act of carving produces an "E34 inscription", but being able to represent this relies on the pre-existence of two other assertions: his *presence* on the site taking photographs, and the *event* of his carving his name. Additionally, how would one approach the phrase "large areas of visible graffiti" or "away from the main panel"? As neither of these phrases asserts any formal event, metric, position or action — in other words quantifiable statements of "fact", they are effectively untranslatable within the formal structure of the CRM.[24] Hacıgüzeller observes CRM's unsuitability for expressing spatiotemporal relationality, having an identity which "depends upon everything else going on around [them]" (Hacıgüzeller, Taylor and Perry 2021, p. 1720).

These instances act as "a clear reminder that natural language and the texts that convey it are inherently complex archaeological representations that will readily challenge attempts to structure them" (Hacıgüzeller, Taylor and Perry 2021, p. 1718). This is indistinguishable from the problems inherent in classification in earlier, pre-digital documentation practices, described by Cameron as "emphasiz[ing] physical description and other 'verifiable' details such as date, maker, technique, style, and others, and one interpretation of an object presented as a truth statement" (F. Cameron 2013, p. 84).

Example 3 (Figure 4.4) reflects similar complexities. The uncertainty of the time period — "around 1884" – cannot be represented, and so would have to be constructed as a time span, with arbitrary finite bounds. In contrast, the concept "the extents of the British Empire" can be straightforwardly mapped to a space-time volume — "the extents of the British Empire in 1884" (assuming the boundaries are known, geospatially mappable, and undisputed (Doerr, Bruseker et al. 2021, p. xxvii). This unmasks a further question — what exactly *is* "the British Empire"? Is it a "E74 Group", "E72 Legal Object" or just "E39 Actor"? The case may be argued for all three, or something else, leading inevitably to further confusion and pedanticism. Despite the inability to record uncertainty, and other subtleties

24 They may be added as attached notes, but this, again, removes them from the body of the statement, relegating them to unfindability.

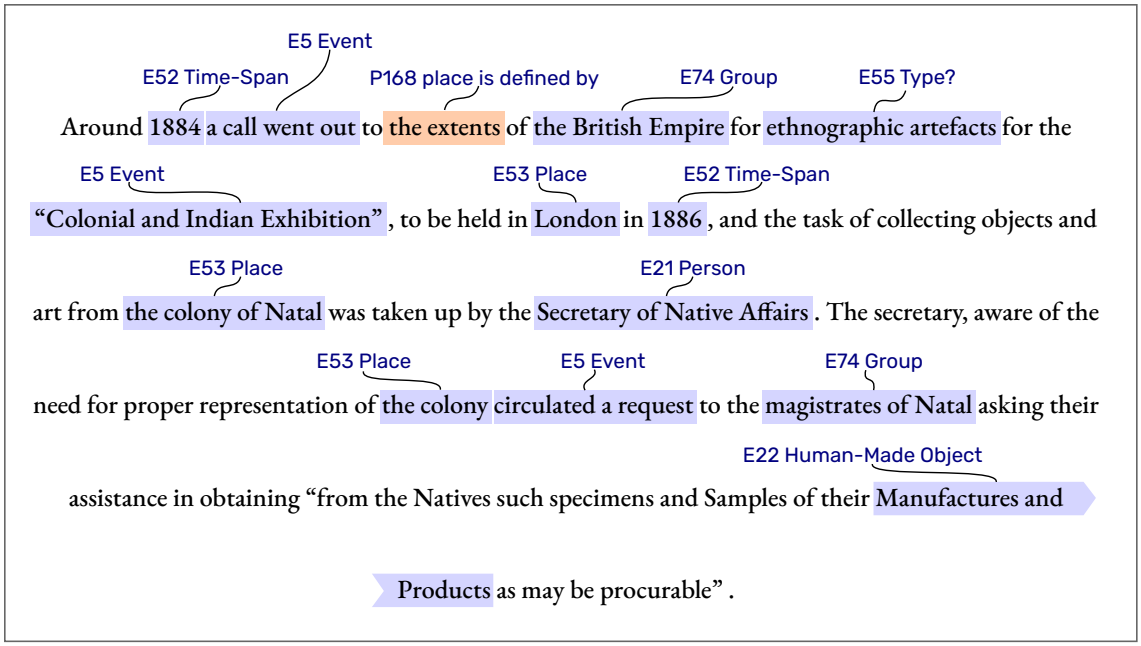


Figure 4.4: Example 3

— such as that seen within the Secretary's communications; ("aware of the need for proper representation")— this example could arguably be recorded with less *loss-of-knowledge* than examples 1 and 2.

Bekiari *et al* assert that the aim of CRM is "not to capture, in a structured form, everything that can be said about an item", but that the intent is for it to "focus on the high-level entities and relationships needed to describe data structures" (in Hacıgüzeller, Taylor and Perry 2021, p. 1717). However, in ostensibly providing a framework for defining relationships and events involving objects, places and people, much non-technical, informal (and colloquial) language found in narratives, reports, documentation of *chaîne opératoire*, transcriptions of spoken word (and so on), slips through the cracks. Hacıgüzeller *et al* discover in their exercise of transcribing practitioners texts from the Çatalhöyük project, these structured data schemas tend to break down in the face of the types of unconstrained language found in the abovementioned materials. Summarising their findings (2021, p. 1718), they define the cases where narrative text is not mappable to metadata schemas as

- Non-technical discourse (recalling, remembering, emotions, etc.)
- Spatiotemporal ambiguity (below, elsewhere, over time, nearby)

- Ontological ambiguity (living, presence, spaces/rooms/buildings)
- Interpretations with little basis in empiricism (the atmosphere in that room)
- Difference (some differences, although, other, alternatively)

This mirrors the processes of digitisation which I discussed in chapter 3. While the digital model itself undergoes a process of photography and algorithmic transformation involving sampling of the continuous analogue into the discrete digital, so do narratives and rich descriptions attached to the original thing. The smooth continuum of a story or description is sub-sampled into a series of granular steps dictated by the metadata schema, and as such, things are lost, misrepresented or packed into the catch-all drawer of "close- enough".

4.2.6 *Paradata*

If we consider metadata to be the formalisation of the epistemological context of a digital object, then the practice through which that object was created can (potentially) be recorded in the form of *paradata*. The London Charter, developed as a response to the "issue of intellectual transparency of visualization-based research" (Kafel 2012, p. 4) defines paradata as:

> Information about human processes of understanding and interpretation of data objects. Examples of paradata include descriptions stored within a structured dataset of how evidence was used to interpret an artefact, or a comment on methodological premises within a research publication (Beacham 2012, p. 7).

Huvila underlines the criticality of "meticulous documentation" and "communication of contextual information" when users of data come from multiple disciplines without shared knowledge of data collection and processing practices (Huvila 2022, p. 30). I briefly discussed this earlier in this chapter in the context of digital data re-use, and how the availability of detailed context is a key factor in whether or not practitioners consider data and models collected and created by others as valid.

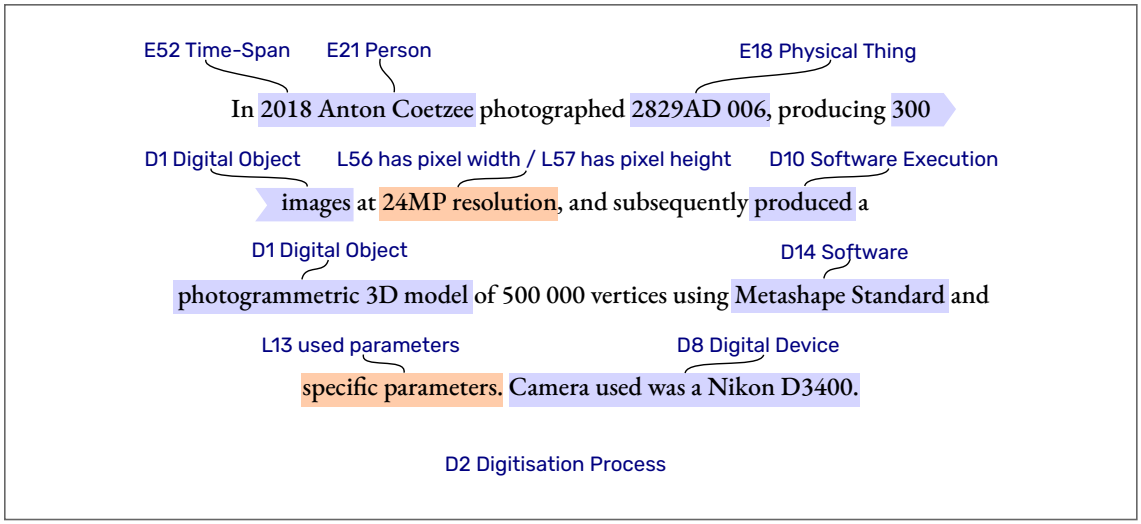


Figure 4.5: Example 4

Similarly to the exercise I performed earlier, Example 4 (Figure 4.5) shows annotation of some phrases from the *chaîne opératoire* of the digitisation of my NM176a case study. As the CRM definition has no facility to handle paradata, I will use the CRMdig ontology, which has been designed to complement CRM, providing a framework within which to document the steps of creation — the provenance — of digital objects, such as digitised things, reconstructions, or low-level data, for instance GPS tracks, laser scanning or total station output (Doerr, Stead and Theodoridou 2016).

The paragraph quoted in this example forms the basis of a "D2 Digitisation Process", and records the key acts and products of the process: the photography, the resultant dataset comprising digital images, the production of the 3D model, and some of the equipment used. However this reestablishes the perceived thin-ness of digitisation, and reinscribes its "black-boxed" nature through the inability to describe the procedures with any more granularity. Furthermore, there is little scope for narrative or reflexive information. For instance, the multiple repeats of the image alignment stage with their adjustments, tweaks or exasperated acts of "I give up; let's start again" or "I wonder if that will work?" (all inherent to the photogrammetry process) would either have to be omitted altogether and assumed as unwritten knowledge in the practices of photogrammetry, or represented as the same *D10 Software execution process* many times over.

The schema provides for a basic litany of tools, abstract processes, software packages, practitioners and generic descriptions of raw data inputs and intermediate inscriptions. For example, attempting to describe my methods of photographing the site, including the sequence and manner in which I shoot — and eschew many conventions of photogrammetric practice — reveals the lack of options for this within the main structure of the meta/paradata. The result is the need to attach a note (somewhere) using *P3 has note* or a separate report detailing my techniques of fieldwork; both of which alienate the craft and practice from the body of knowledge constructed with and by the CRM, and remove this information from the direct flows of knowledge and practice associated with this particular act of digitisation.

Hugget observes that this reflects early pre-digital recording practices — as I discussed in chapter 1 — in that relevant and important information about these processes is relegated to marginalia or word-of mouth. He writes that

> Essentially we're missing what might be characterised as the 'marginalia' of archaeological data capture – the notes, discussions, comments made by the participants during the course of data discovery, collection, and recording (Huggett 2020, p. 2)

Marginalia complement formal data, providing a voice for the practitioner, for which there is no space in formalised schemata. Furthermore, as Sara McClelland states, "marginalia disrupt and challenge assumptions about research processes, conceptual definitions, and issues of measurement and analysis" (McClelland 2016, p. 160). Huggett asserts these shortcomings, noting that "aspects of these marginalia may be captured in the more unstructured narrative forms of paradata, but only if the hurdle of capturing these assumptions and decisions is overcome in the first place." (2020, p. 2)

4.3 DISCUSSION

While much discourse on digitisation concentrates on the processes of visual or technical recording, the classification and archiving of these models is an inescapable part of the

practice, as it is this which turns them from simple digital models into complex digital objects with epistemological and affective value.

By classification (as mentioned earlier in this work) I mean the act of bringing the digitised model into some formal system or schema in order to make it a usable epistemic object, and these schemata can only be manifest within the framework of a database or archive. Databases are, for better or worse, central to the existence of digital objects, particularly in the form required for academic research. The ongoing existence of a digital object depends on its continued and sustainable residence within such a database or similar infrastructure, which requires a complex technological ecosystem in order to sustain its existence. The long term preservation of these objects is, as Gartner notes, a well established discipline, with practices that depend on "grouping data and metadata into neat packages with clear boundaries" (Gartner 2016, p. 92). This requires that they be normalised into one of these metadata schemas, which, as I have already discussed, tend to prescribe categories and attempt to apply them universally (F. Cameron and Robinson 2007, p. 167).

As we have seen in my discussions of classification systems, they marginalise rich, narrative texts and forms of knowledge in favour of structured ontologies and vocabularies, following reductive patterns of events, people, places, things and connections (as I demonstrated in the examples rendered in CIDOC-CRM framework). Much like the act of digitisation itself, the "sensual nature of material" is sanitised through its fragmentation and representation in the form of data points (Labrador 2012, p. 239).

We might call the concomitant process *ontological diffusion*: one ontology being forced onto another, or almost invisibly merging into another and subsuming it, working both ways. We are forced to classify things in a manner that schemata and computers demand of us, while also being complicit in the definition and construction of these systems in the first place. Our thinking is forced into alignment with that of the computer's. Manovich describes this as "the projection of the ontology of a computer onto culture itself" (Manovich 2002, p. 197). In fact this was observed by one of the elder gods of computer science, Edsger Dijkstra in 1975, when he wrote that "the tools we use have a profound (and devious!) influence on our thinking habits, and, therefore, on our thinking abilities" (Dijkstra 1982,

p. 129). Anecdotally, I have experienced this in my personal practice, after a long session of working with database structures and data models based on the CRM, I have caught myself looking at my cup of coffee sitting beside my laptop, and identifying it as "So. That's an E22 Human-Made object. But what's the coffee in it? Is it also E22 or an E20 Biological object?……".

4.3.1 *Narrative and Database*

In order to frame this section, I will quote Ian Hodder in saying "the authority of the text is no longer personal, but lies in adherence to abstract codes" (Hodder 1989, p. 272). Hodder in this case is lamenting the state of archaeological site reports with their rigid formality and structure, and comparing them with the richness of narrative accounts of sites, excavations and things as published in the 18th century in the journal *Archaeologia*. He considers this an opposition of science and history on the one side, and narrative, the personal and the poetic on the other (1989, p. 269). This highlights two issues; the first being agency, and that this has dispersed into institutions and disciplines, and their formal codes (I will discuss agency later in this chapter). Secondly, and most relevant to this text, is the fragmentation of knowledge and narrative into data.

New media theorist Lev Manovich positions narratives and databases in direct opposition:

> As a cultural form, database represents the world as a list of items and it refuses to order this list. In contrast, a narrative creates a cause-and-effect trajectory of seemingly unordered items (events). Therefore, database and narrative are natural enemies" (Manovich 2002, p. 199).

Within heritage and aligned fields, a significant amount of our work is constructed in the form of narratives (Hodder 1993; Joy 2009; Fagan 2010; Gerritsen and Riello 2014). Pluciennik writes that "typically, archaeologies are presented in the form of narratives understood as sequential stories" (Pluciennik 1999, p. 653), and the nature of these narratives themselves varies widely. Pollock examined archaeologists' writing practices and observed that

> Many deliberately blur the boundary between science and artistic invention, many employ a nonlinear approach to tell stories, some express a desire to share authorship of archaeological interpretation with the readers of texts, and a few experiment with new technologies to achieve these ends (Pollock 2015, p. 277).

The scales — temporal, spatial, relational and cultural — through which these narratives are worked varies. Much early archaeology tended towards the larger scale metanarrative (Hodder 1993, p. 269), discussing empires, cultures, material sequences, or the "unproblematic description of sequences in change" (Pluciennik 1999, p. 659). In contrast we find a finer, more local focus in recent approaches to object biographies and itineraries (discussed in chapter 1), operating on the scale of an individual *thing* or person, and within their own timescales, landscapes, and entanglements (Ginzburg 1980; Joy 2009).

Manovich considers the reader of a narrative as merely "traversing a database", following links between records as defined by the creator of the narrative; a narrative, he says can be understood "as the sum of multiple trajectories through a database" (Manovich 2002, p. 200). The fragmentation of a narrative text into a database, that is, its "atomisation" into metadata, can be understood as a process of "detachment" or "deracination" (Lucas 2018, p. 96).

I use the term *metadata* fairly loosely here, as the distinction between metadata and the data itself is becoming ever more indistinct. This happens as we look beyond simple, flat schemata such as *Dublin Core* or similar systems with their roots in traditional physical archives, and with their primary function being finding — towards systems such as the *CRM* which demand deracination of primary sources into fragmented taxonomia (Huggett 2023, p. 2). These new systems lean towards replication and recreation of the source data while still providing the necessary affordances for it to be found within local and global information landscapes.

Historian Lorraine Daston defines deracination loosely as facts (based on observation or statements), purged of theoretical context, and "uprooted from any ideological interests" (in Lucas 2018, p. 111); this directly addresses the idea of fragmentation, classification

and cataloguing as an *explicitly political* act, as pointed out by Poirier *et al* earlier in this chapter. Additionally, this act takes place within, to a certain extent, a *pre-figured argument*, dependent on the choice of schema and ontology. Many paths one follows through the database are already pre-set (Buccellati 2017, p. 191).

Geoffrey Bowker, working from within the field of informatics and memory practices within the sciences, observes this as not just occurring within systems, but also in the way people remember histories:

> What we do well is to disaggregate a fact about the past into a number of standard elements, and then set in train a procedure for reassembling the specific out of the general. This sets in motion a system of memory recall that is able at any given moment to create a working version of the past. What is stored in the archive is not facts, but disaggregated classifications that can at will be reassembled to take the form of facts about the world (Bowker 2005, p. 18).

Disaggregating historical knowledge into any textual form involves some level of mandatory fragmentation: as Bowker and Star suggest, "There is no way of ever getting access to the past except through classification systems of one sort or another-formal or informal, hierarchical or not" (Bowker and Star 1999, p. 41). They offer an example: "In 1640, the English revolution occurred; this led to a twenty-year period in which the English had no monarchy". The systems embedded within this statement include the segmentation of time in later narrative acounts – in the form of the Gregorian calendar, which was not in effect at the time – the classification of peoples into Irish, English, etc. – and the problem of how we might classify a monarchy (1999, p. 42).

Given our propensity for working with narratives, we might consider a thought experiment here: given a digital object with its metadata — of whichever form — could we recreate a compelling and relatively detailed narrative biography of the object — including an account of production of the digital object itself?

The idea of attempting to reconstruct a narrative from metadata is troublesome; for instance, Zhao *et al* approach the idea of building object biographies from metadata, particularly

using more restrictive metadata schemas, such as those used in libraries, and ultimately come to the conclusion that the process is severely constrained by the form of metadata (Zhao, Twidale and D. M. Nichols 2018). Furthermore, as Niccolucci *et al* observe, this approach has the potential to add additional layers of interpretive bias, as the process is "however far from simple and clean: it often involves cultural prejudices of the researcher, which may be unrelated to the object but are embedded in the interpretation" (Niccolucci, Hermon and Doerr 2015, p. 90).

As we code existing knowledge and data into ontologies and schemata such as CRM, and in due course, build databases and platforms in which to sustain this material, we find — as I mentioned earlier — that where metadata was at one point simply a means of *finding* data and things, it is now *becoming* the data. By deracinating a narrative and reconstructing and standardising it into the CRM, we are at once reconvening multiple external sources while decentering them in favour of a new configuration provided by the schema. This places the information at another layer of abstraction away from the original records. Moreover, the data itself is now entangled with the metadata schema with its inherent biases and historical encumbrances (Huggett 2023, p. 2). Hacıgüzeller writes that

> At the point of acquisition, data are often encoded using data structures that reflect both the underlying world view (the ontologies) of the acquisitor and the preexisting scientific (archaeological) traditions within which they are operating (their epistemologies). In the end, digital data structures often reinforce, or perhaps ossify, data acquisition practices, which are themselves already rooted in long project histories and archaeological traditions (and dogmas?) (Hacıgüzeller, Taylor and Perry 2021, p. 1722).

Bowker asserts that in fact, what is stored in these archives consists not of facts, but "disaggregated classifications that can at will be reassembled to take the form of facts about the world" (Bowker 2005, p. 18). Building (or re-building) a narrative from these disaggregated classifications is in effect a reversal of the digitisation process described in chapter 3— where we are taking something reduced to discrete digital steps and chunks and attempting to recreate a continuously smooth, detailed analogue surface from it.

Historian Alan Munslow calls this the "reconstructionist" approach to writing history, suggesting that sources and facts are sequenced and assembled in order to construct the events that "actually" happened in the past (Munslow 2015, p. 162). Munslow further notes that this reflects traditional modes of collection documentation, for instance those that "emphasize physical description and other 'verifiable' details such as date, maker, technique, style, etc., and one provenance statement of an object" (F. Cameron and Robinson 2007, p. 170). Within this approach, researchers, writers and curators merely fulfil the role of eliciting knowledge held within these objects and data; without creatively contributing to it (2007, p. 170).

However, whatever schema it reflects, our knowledge now inhabits a database, which, according to Manovich, affords possibilities for "multiple trajectories" through its contents. This opens up new potential for emergent knowledge discovery and production (Manovich 2002, p. 199). The database might be seen as the configuration of a "new knowledge space", which, according to Cameron and Robinson

> … enables users to link information in ways previously not possible, thereby calling into question existing documentary structures. The ability to store vast amounts of data, search, retrieve, and distribute information in space, and traverse trajectories of information in new ways sets the scene for a substantial revision of the way information is documented and linked (F. Cameron and Robinson 2007, p. 168).

Anthropologist Ruth Tringham considers Manovich's "database narratives" as the basis for small-scale, open-ended narratives, similar in scope to Ginzburg's "micro-histories" which I mentioned in Chapter 2. They, as she notes, "emerge as a result of the filtering, guidance, and"scaffolding" out of an archaeological database of media, text, and alphanumeric documentation" (Tringham 2015, p. 28). Tringham calls these *Recombinant Histories*, based on Anderson's assertion that digital technologies and databases have "enabled strategies of randomization and recombination in historical construction resulting in a profusion of increasingly volatile counternarratives and histories with multiple or uncertain endings" (Tringham 2015; Anderson 2011, p. 125).

Despite Manovich's assertion that narrative and database are mortal enemies, it seems that they are in fact complementary. Literary critic N. Katherine Hayles argues against this binary opposition, and observes that these techniques have in fact always been utilised by scholars (in Lucas 2018, p. 94). Historians and archaeologists continue to work with deracinated facts and re-embedding information in constructing their narratives (2018, p. 96).

4.3.2 *The Digital Object itself*

We might consider the digital object as comparable in status with the mould from which a plaster cast is made. It is anachronistic: it is both a product of the past, the digitisation process, and is informed by the physical thing (which may in fact no longer exist). It also looks to the future, in that it holds potential for copies — visualisations and viewings, or material embodiments in the form of 3D printed or CNC milled reproductions. It is surrounded by links and networks of metadata and paradata, and linkages to other things in the database through the use of schemata like CRM. Its structure is fluid, as "data and the objects they compose can be defined differently depending on their relational configurations to other data/objects" (Mackinnon 2023, p. 1403). One might consider the 3D model the *hypothesis of an artefact*.

The object exists, however, across multiple overlapping systems. Some — at the lowest levels — are functions of the computer and software's own ontologies (as mentioned earlier), while others occupy higher, more abstract levels — the schemata and ontologies informing the structure of the database within which the digital object exists. The object then, according to Cameron, occupies a uniquely poststructuralist/postmodernist position, presenting

> … a model of the world governed by relational connections between things. Here chronologies, historical time, and privileged narratives give way to a flattened interpretive structure, where various viewpoints or sources can be juxtaposed in space, each seen as equally valid (F. Cameron and Robinson 2007, p. 180).

These connections, viewpoints and sources reflect Manovich's "trajectories" through the database, standing in stark opposition to the schema in which the original thing may have existed. The original, physical *thing* has been classified and categorised into a collection within a traditional modernist hierarchical organisational structure. It is thereby equipped with a privileged narrative offering a "truth statement about the meaning and significance of [this] particular object" (F. Cameron and Robinson 2007, p. 180).

Similarly, as we shift our focus from the physical to the digital object, it is important, as Huggett advocates (2012, p. 543) to understand the origins of the standards within which they are created, classified and identified. The groups responsible for their creation and upkeep, their means of testing and validation, and the arguments and decisions underlying their definition are all critical to out understanding of the manner in which they archive and recreate our historical knowledge. Furthermore, as Hacıgüzeller *et al* observe,

> There is a danger that uncritical overreliance on structured data for larger disciplinary synthesis may in fact be reinforcing the structural fault lines inherent in our underlying disciplinary ontologies and epistemologies; in other words, these data may be inadvertently promoting or reinforcing forms of social injustice, colonialism, and neoliberalism (Hacıgüzeller, Taylor and Perry 2021, p. 1724).

Both cataloguing standards and the data itself have potential to propagate these biases, and Kahn notes that understanding and management of this problem within cultural heritage collections is still emergent (Kahn 2020, p. 71). There is a risk of reinscribing colonial practices within our digital data, and furthermore, dependent on the nature of the infrastructures in which these data are stored, this risk extends to a form of *data colonialism* (Couldry and Mejias 2019; Risam 2019, p. 47)

Practice

Digitisation, and by this I mean the whole process, from photography and constructing the digital model, through recontextualising it with metadata and anchoring it within a

database or archive, could be seen as a craft practice. As such it is difficult (if not impossible) to deracinate it to its monadic acts and coherently represent this within current metadata and paradata ontologies. Counter to traditional models of archiving, where the practitioner is invisible, the ideal system should make the role of the practitioner apparent, as well as their positionality. I note this here, as the practitioner involved in scanning and developing metadata in the cases of 3D digitisation, is very often the archivist as well, for 3D objects and the archives built for them — as I mentioned at the beginning of this chapter — are frequently seen as the alloyed inferiors of traditional archives and archival materials.

My earlier critical experimentation with CRM and structured data is not intended to discredit these ideas, but to draw attention to gaps and biases. Furthermore, there is a need to acknowledge that despite their flaws, these systems — in relative infancy — afford us opportunities to refigure our practices and consider mitigations and future propositions towards the interests of decolonisation.

CRM, as I discussed earlier in this chapter, is event-driven, and so reflects the idea that "historical events somehow constitute basic facts, which can be reconstructed independent of processual interpretation" (Lucas 2008, p. 60; Binford 1968). This mirrors the tendencies of culture-historic and later processual archaeology towards general syntheses of history and grand metanarratives (Mímisson and Magnússon 2014, p. 135). This approach of presenting history at large scale, coherent and complete, glosses over gaps in the record, uncertainties and unknowns. As Mímisson and Magnússon note, "it either ignored the fragmentary condition of the research material or balanced it out by means of a generalized narrative" (Mímisson and Magnússon 2014, p. 137).

As I discussed earlier in this chapter, the idea of "microhistories" or Tringham and Anderson's *Recombinant Histories* affords us scope to eschew large-scale structures and concentrate on the small-scale and local. Mímisson, and Magnússon extend this into material culture with the idea of *singularities*; which

> express the small and ordinary, the unimpressive and unattended subjects of history. They are not necessarily singular, individual, isolated or unique but

> represent a limited set of material from where the historical narrative emerges (Mímisson and Magnússon 2014, p. 139).

Singularised archaeology as a result "utterly rejects the grand narrative in its historiography as it looks inward regarding the things at hand by honouring their nature as singularities, their intimate relations and ontological constitution" (2014, p. 139). Despite being constrained — or biased — due to our dependence on schemata such as CRM or DC within digital archives, we can challenge the large scale structures and epistemologies by focusing practice at a smaller scale. To this end I will build on the suggestion I made at the end of Chapter 3, to suggest not just *slow* digitisation, but *slow, small-scale digitisation*.

Digitising material with these factors in mind offers an opportunity to transcend, in a small way, many of the encumbrances and injustices present in the organisational systems which defined many of the fields we're working in. This can apply not just to approaching the systems and the subjects with an understanding of multiple ontological frameworks, but the practitioners too, as Neha Gupta says:

> A gap exists between scholars who focus on the politics of archaeology, including the roles of gender, racialization, and Indigeneity, at the intersection of power and knowledge-making, and those who study, develop, and implement digital technologies in archaeology (Gupta, Nicholas and Blair 2022, p. 242) .

Thoughtful, practice driven digitisation offers some potential for emancipation from extant systems and epistemologies (C. L. Morgan 2012).

5

AURA, AUTHORITY AND AUTHENTICITY.

dustscéawung (Old English): /du:stʃæ:ɑwuŋg/ Noun - Contemplation of the dust; reflection on former civilizations and peoples, and on the constant state of change.

Bruce Mitchell, 1999, *A guide to Old English* p. 253

5.1 AUTHENTICITY

5.1.1 *The idea itself*

In chapter 4 I provided an overview of current discourse regarding digital objects and their archives, and the organisational systems which inform them. I then looked at the inherited biases and assumptions built into metadata schemas and formal ontologies, and potential for challenging this status. I then continued with the theme of "slow digitisation" and the rebuilding of networks and context for the digital object. Having the digital object in hand, in this chapter, I will now consider the ontological status of the object itself, and how this affects, and is affected by the multiple forms of authenticity surrounding the object. I will use Walter Benjamin's work as a starting point, and consider two primary threads of authenticity regarding physical objects, one involving provenance, and the other affect, and how they are constructed and perceived depending on the ontological situation of the object; whether it is destined for an educational or a commercial context. Following this, I will consider how these modes of authenticity map to the digital object.

In his influential work "The work of art in the age of its technical reproducibility", Walter Benjamin describes the properties or "history" of an original artwork as

> [including] changes to the physical structure of the work over time, together with any changes in ownership. Traces of the former can be detected only by chemical or physical analyses (which cannot be performed on a reproduction), while changes of ownership are part of a tradition which can be traced only from the standpoint of the original in its present location (Benjamin 2008, p. 21).

He continues, describing these elements as "authenticity", which he defines as

> … the quintessence of all that is transmissible in it from its origin on, ranging from its physical duration to the historical testimony relating to it (2008, p. 22)

Susan Pearce further characterises the multivalent nature of authenticity as such:

> The word 'authentic', over which much ink has been spilt in the recent past, carries with it not only the notion of 'real' in the forensic sense, but also the feeling of 'genuine' in the emotional sense, of sincerity, honesty and truthfulness after its own kind (S. M. Pearce 1995, p. 291)

Essentialism

There are two primary schools of thought regarding the nature of authenticity, which vary according to the *type* of thing, and the *period* in which authenticity was being considered. The *materialist* (or essentialist) approach concludes that authenticity is inherent in an object and its material fabric (H. Bell 2011, p. 225). Furthermore, the thing, site or building is considered to be authentic when it demonstrates that it is "true to its origins in terms of its date, its material, its form, its authorship, workmanship, construction, and, in many cases, its primary context and use" (Jones 2009, p. 134). This approach is prevalent in studies of heritage sites, and within fields such as tourism studies (MacCannell 1973; Jones 2009).

Both Jokilehto and Jones agree that the *Nara conference on authenticity*[1] was a turning point in recognising that this is a reductive and essentialist approach which privileged Western monuments and sites, generally with immutable, fixed structure. The acceptance that the notion of "monument" was a relatively recent product of European culture, and thus ontologically situated. As such this notion of "authenticity" could not easily be pursued in relation to other cultures. Jokilehto deploys the example of a Japanese Shinto shrine which, as an act of cultural continuity, is rebuilt from the ground up every 20 years, yet is still considered to be the same, authentic building (Jokilehto 2009, p. 128). The charter states that

> … the property should meet the test of authenticity in design, materials, workmanship, and setting; authenticity does not limit consideration to original form and structure but includes all subsequent modifications and additions, over the course of time, which in themselves possess artistic or historical values (UNESCO, 1978: 4) (Jokilehto 2019, p. 57).

This is remarkably similar to the position held by Victorian Romanticists and nostalgists such as William Morris and John Ruskin, who also recognised that the various phases of developments and modifications to monuments, buildings and sites were an inherent part of their authenticity, and should not be reversed or tampered with (Jones 2009, p. 134).

However, archaeologist Cornelius Holtorf argues that there is in fact an essential attribute embedded in an artefact through its manufacturing process; this is therefore an inherent characteristic of the object making it an authentic "object of the past" (Holtorf 2013, p. 430). Jones calls this a "dimension of nature" and observes that it is taken as having "real and immutable characteristics that can be identified and measured" (Jones 2010, p. 182). This approach appears to be favoured in discussions of heritage conservation, and policy and legislation (Su 2018, p. 920), particularly since these characteristics can be tested relatively easily through scientific processes.

1 The 1994 *Nara Document on Authenticity* was produced as the result of a conference involving UNESCO, ICCROM and ICOMOS (*The Nara Document on Authenticity (1994) - International Council on Monuments and Sites* 2023).

Constructivism

Handler argues that the entire notion of authenticity is a "cultural construct of the modern Western World", and the fact that it has been a central idea in much anthropological theory is entirely a "function of a Western ontology" (Handler 1986, p. 2). Much work regarding authenticity in heritage and similar fields reiterates an essentialist notion of origins and reproductions (Lowenthal 1992; Carter 2007; M. M. Brooks 2014). This *constructivist* approach to authenticity, on the other hand, if not disavowing the materiality of the object, at least minimises its importance, concentrating on the idea that authenticity is ontologically situated, it is a product of culture and *habitus*. Jones describes this as "a quality that is culturally constructed and varies according to who is observing the object and in what context" (Jones 2010, p. 182).

While acknowledging the dichotomies inherent in the above approaches, I believe it is productive to engage with both perspectives, as they each offer valid insights across the multiplicity of ontologies occupied by both physical things and places and digital objects. They may not always convincingly map to the digital, but inform our engagement with the life story of the object and its reproductions. It is also worth noting that both in the above approaches and in Benjamin's writings, "aura" and "authenticity" are still deeply entangled; this is appropriate, as they *are* deeply entangled within many ontologies (including those *we* inhabit), but I will need to disentangle them in order to discuss certain key aspects of each.

Bredekamp asserts that "the aura, therefore, establishes the credentials for the material and metaphysical authenticity of the work of art" (Bredekamp 2009, p. 288). I propose, for the purposes of my arguments, to disambiguate this into two forms, namely *provenential*, that is, Bredekamp's *material* authenticity, which can be thought of as Pearce's "forensic" sense; and *affective* authenticity which can be considered as Bredekamp's *metaphysical* authenticity, and Pearce's "feeling of 'genuine' ".

5.1.2 *On the relevance of authenticity in digital heritage*

Why could we consider authenticity important with respect to digital heritage? Firstly, as indicated by Siân Jones, authenticity

> …plays a significant part in many spheres of cultural practice and various aspects of our lives. Not least of these is the historic environment, where authenticity haunts the practices of preservation, curation, management and presentation enacted on monuments, buildings, places and artefacts (Jones 2010, p. 182).

Authenticity takes many complex and negotiated forms, and determines how we approach heritage objects, as either researchers or spectators (Holtorf 2013; Hampp and Schwan 2014; Groschwitz 2019). It is of particular interest and importance in that in both public and legislative approaches to heritage conservation and display, authenticity has become a synonym for value and worth. Sven Ouzman reduces this to the core problem that authenticity is a "key concept in curators' and publics' perceptions of what is *worth keeping, displaying, discarding*" (Ouzman 2006, p. 274). This is a particularly pernicious problem in the climate of reduced funding, due to global austerity moves and politicisation of heritage sites. Dubin observes that museums and heritage sites are increasingly becoming "sites of persuasion" where memory and meaning are created and argued, and polarising conflicts are playing out. Dubin refers to these "culture wars" as:

> … impassioned confrontations between groups within the same society, polarized over so-called hot button issues falling broadly within the realms of race and ethnicity; the body, sexuality, and sexual orientation; identity politics; religion; and patriotism and national identity (Dubin 2006, p. 477).

This has direct impact on the preservation and display, and conversely, the devaluation of objects and sites, either through direct political pressure or threats of defunding (Conn 2006, p. 494). In the context of digital recording, particularly in 3D, Stuart Jeffrey *et al* reconcile these complex negotiations under the term *significance*, writing that "objects, places and practices that do not meet an expert-defined threshold of significance necessarily become

insignificant within that conceptual framework" (Jeffrey et al. 2020, p. 886). Further to this is the fact that up to now, most work on authenticity within heritage has concentrated on physical objects or sites. Legislation and policy (for instance the Nara document) reflect this, despite the significant increase in heritage digitisation programs.

5.1.3 *On Pathways*

With the previous arguments on the dichotomy between the materialist and constructivist approaches to authenticity in mind, I will engage with an alternative viewpoint on this problem: that they need not be mutually exclusive; they each speak to a very real aspect of encounter with an object, and inform different characteristics which might be considered as belonging to multiple *genres of authenticity*. The objects we work with have been collected, acquired, excavated, and along with their records could be considered an *assemblage* or *archive* (Lucas 2012, p. 230). These created assemblages are then

> … themselves mobile, which means that they can be carried over into other sites or locales, such as museums or lecture halls, and work towards their creation or maintenance. (2012, p. 230).

Lucas suggests, then, that within the archive's mobility, a *bifurcation* occurs, with the possibility that it may enter one of two different disciplinary streams, namely museums or archaeology (2012, p. 245). Using this idea as a model, we could think of objects within heritage-adjacent fields as similarly mobile archives, which face more than a potential bifurcation, but in fact can enter a manifold of different functional pathways. Moreover, these pathways each either occupy or span different ontological frameworks, while also manifesting different approaches to authenticity.

For the purposes of my research, the relevant possible pathways for artefacts, *things* or *archives* include their instantiation as archaeological, ethnographic or museological objects for the purpose of collection, study and building historic and cultural narratives; as heritage objects or sites which are both instruments of education but also can be used to reinforce

political or nationalistic discourse, and as commodified objects on the art or antiquities markets. I find it productive to think of potential pathways rather than approaching these issues from *within a specific field or situation* as this foregrounds the object and its agency, as well as the ontological multiplicity of the object.

The initial nodal points for defining authenticity within these pathways are similar, involving acquisition through excavation, purchase or other means, and subsequent documentation of provenance and history. The pathways then diverge, as academic pathways through archaeology, ethnography, or museology tend to favour intrinsically driven notions of authenticity, wherein the object is made valuable to the discipline through its emplacement as an epistemic object. This appears to differ from requirements for authenticity within commercial markets where drivers are extrinsic, and often are about perceptions of originality, appropriate legal provenance — in that the object has not clearly been stolen, trafficked, or has any connections with Nazi-era appropriation — and market value. Fixed heritage (sites) on the other hand are often approached primarily from an affective direction, as "charismatic" or "spectacular" things with significant draw for tourists, and furthermore, their position may be actively constructed so as to reinforce narratives of cultural or national identity (Lixinski 2022). Publically funded collections and museums often engage with an admixture of these forms of authenticity: things in the collection are afforded financial value for insurance purposes (and maybe trade), their charismatic nature is deployed to drive public interest, while still being valued as epistemic objects.

5.1.4 *On Origins*

Walter Benjamin argued that early art was mostly in the "service of magic", that is, for religious and ritual purposes (Benjamin 2008), in its earliest forms — including probably much rock art (Whitley 2021, p. 67), religious icons and so forth. Authenticity was decoupled from both aesthetic and economic value, as these artefacts were deemed important as intermediaries between god, saints and churchgoers. They were intended to provide a link between the "viewer and the cult referent" (Ameri 2004, p. 641), and fundamentally *collapsed*

the distance between these, making the "absent referent present" (2004, p. 641). Rebecca Corrie positions this as "affordable access to the prototype" (Corrie 2021, p. 59).

Religious art in the form of icons — these being representations of saints and other religious figures — statuary and, reliquaries — which held remains or personal belongings of saints, was treasured for its ability to perform miracles and provide assistance. Mediaevalist Patrick Geary writes that "Christians came to them for assistance of all sorts: cures, protection from oppression, finding lost objects, settling disputes, and the like"(Geary 1986, p. 202). There is no doubt that this power and ability to heal was indisputably real within the ontological space of a mediaeval churchgoer. The relic's authenticity was affirmed by both its ability to perform these miracles, and formal provenance determined by the church — it actually *being of*, having *belonged to*, or having *touched* a saint or holy person. Its power — described by Lenain as "spiritual radioactivity" (Lenain 2011) — could be transferred undiluted through touch or mere proximity (D. Phillips 1997, p. 18).

Aura and *provenential authenticity* are deeply entwined within these ontological spaces where icons and relics bridged the divide between the sacred and the profane; between the power of God and the person. Their power was not necessarily dependent on any intrinsic material characteristic of the thing, but on its perceived and proven networks of connection. Beyond the spiritual connectivity attributed to these things, they acted as *numinous objects*, offering experiences involving *deep engagement or transcendence*, *empathy* and *awe* (Maines and Glynn 1993; Latham 2013, p. 4). Furthermore, in many cases these things did not have to be on display in order to perform their functions; they merely had to be *present*, whether visible to worshippers or not.

The *Quattrocento*, or transition into the early Renaissance, saw widespread adoption of techniques of reproduction for art, and fomented a shift catalysed by new permutations within power structures and social groups. According to Krzysztof Pomian, this involved humanists, antiquarians, artists and scholars, who challenged the extant power structures in which the "clergy and those in power monopolised semiophores, determined the degree of access the public had to them and used them in order to reinforce their position of domination" (Pomian 1990, p. 38). As I discussed earlier, Benjamin theorised these shifts in

the nature of art as heralding the destruction of the aura. The *exhibition value* of art was beginning to dominate. As Bredekamp writes, "While the aura had lost in terms of the numinous, the unique, and the authoritative, it now moved into the public realm, where it can be controlled and no longer experienced by the viewer as an overpowering force" (Bredekamp 2009, p. 289).

The secularisation of art in the 17th and 18th centuries brought about not just the loss of art's sacred status, but fundamental shifts in support and patronage. The emergence of a new consumer culture with resources and desire for status symbols, and an aristocracy with new tastes (and money to match) began to feed artists and a new market for commodified artworks (Gay 1996, p. 225). These objects were traded as investments, status symbols, or simply for their aesthetics. By the early 17th century, there was a significant art and antiquities market in Europe, with frequent public auctions. The first printed catalogue of such objects was produced in Holland in 1616 (Pomian 1990, p. 39). More importantly, this market saw the emergence of auctioneers, dealers and experts able to authenticate objects on sale, and developing knowledge and vocabularies for describing and classifying these objects (Pomian 1990, p. 40; Jones 2010, p. 186). The concern was not that of provenance for its own sake, but in the service of detecting forgeries, and to ensure that these objects were legitimate.[2] Within collections, the concept of the "authentic" thing was rapidly superseding the need for completeness (Hooper-Greenhill 1990, p. 57). As such, authenticity in this era was primarily in the service of the art and antiquities trade.

5.1.5 *Institutional authenticity*

Objects can be imbued with authenticity simply by their proximity to or location within an institution, the institution being a persistent authority which authenticates things, sometimes even fakes, if it has sufficient reputation (Lowenthal 2008, p. 7). This authority

2 Although there were many deceitful dealers who would pass off known copies (which in some cases they even commissioned) as authentic originals. They would fabricate a veneer of authenticity, for instance by artificially ageing a painting (Jonckheere and Vermeylen 2011; Montias 1988).

comes not just from the institution itself, but from a compound of individual factors, enumerated by Alberti as a combination of "credibility, authority, and expertise" (Alberti 2011, p. 52). These aspects can be further magnified, into, firstly, that of *individual authority*, that of the domain experts or curators working within the institution. This is complemented with the *material authority* of the institution's collections, depending on factors such as the status and completeness of their collections, their classification systems, and so on. This is a complex relationship of expert, institution and objects, as, Alberti notes, "a curator's authority is unusually closely bound with his or her object[s] of study" (2011, p. 51). Alberti, working within the context of natural history museums, observed that when publishing about a topic or specimen (or as he asserts, publishing the *specimen itself*), this both imbues the specimen with a sort of permanence, and layers authenticity and authority upon the collection and thus the institution to which it belongs (2011, p. 62). While he was discussing the case of natural history and its notion of *type specimens*, I suggest that this still holds true for ethnographic and archaeological materials. They may not have the direct visibility of the type specimen of fauna or flora with an associated name provided by its discoverer, but publication and circulation of knowledge produced with and from these things recirculates within the flows of knowledge creation and accretion of authenticity.

Discourses of authenticity

Heritage sites however tend to accrete different forms of authenticity, mainly in the form of explicitly constructed discourse. Laurajane Smith suggests that while these sites may be identifiable as being related to heritage — for instance Angkor Wat or Robben Island — they themselves are not inherently valuable, nor do they "carry a freight of innate meaning" (L. Smith 2009, p. 3). The responsibility for authenticity here shifts from either being innate or afforded by an institution, towards a constructed discourse, often driven by pressures of politics or nationalism. Bruner writes that "the more fundamental question to ask here is not if an object or site is authentic, but rather who has the authority to authenticate, which is a matter of power – or, to put it another way, who has the right to tell the story of the site" (Bruner 1994, p. 400).

Smith distils this idea into what she describes as the *authorised heritage discourse* (AHD), which

> focuses attention on aesthetically pleasing material objects, sites, places and/or landscapes that current generations 'must' care for, protect and revere so that they may be passed to nebulous future generations for their 'education', and to forge a sense of common identity based on the past (L. Smith 2009, p. 29).

The problem of authenticity here is coalescing with that of authority and constructions of myth and identity (Bruner 1994, p. 400; Bonacchi 2022, p. 95). Smith observes that "the emergence of the heritage discourse within the context of nineteenth-century nationalism has meant that the primary form of identity often associated with heritage is that of the nation"[3] (2009, p. 30), and Bonacchi reiterates this in her study of heritage discourses on social media platforms where she looks at constructions of origin and nationality myths in the wake of the Brexit movement (2022). Pickover observes this in a South African context regarding the local AHD; she writes that "the state and the ruling party lays claim, ownership and stewardship to South Africa's past and the 'liberation struggle' ", giving "special advantage to a monolithic nostalgic legacy" (Pickover 2014, p. 7).

5.1.6 *Provenential Authenticity*

Situated within this genre of authenticity are a number of individual, though entangled forms of authenticity related mostly to the origins and provenance of a thing, and its material fabric and continuity of form.

3 As I write this I am following the social media discourse around the approval of a new road tunnel under part of the Stonehenge World Heritage site. Despite strong evidence from archaeology professionals for there being little potential for damage, the issue is drawing vitriol from those who see Stonehenge as a marker of "English" identity (Pitcher 2018).

On Archaeological and Ethnographic things

The reliability of provenance and corresponding documentation has a direct bearing on the research value of the thing and its value as an "object of knowledge" (Turner 2020, p. 42). To a large extent this was not the case until the late 19th century. Gavin Lucas reiterates that in those early days of formalised archaeological research, many archaeologists did not excavate their own sites, and so they primarily worked with objects themselves, with little provenance other than word of mouth. This was a key problem for collectors, antiquarians and archaeologists of the period, as O'Connor relates,

> …the problem of false antiquities and false provenances was ever present, especially with flints and other stone tools for the early prehistoric archaeologists (O'Connor 2007: 88–9)(in Lucas 2012, p. 36).

Díaz-Andreu García indicates that the notion of "study collections" was starting to give way to the "retrieval of data through excavation" (Díaz-Andreu García 2007, p. 392). The concept of fieldwork with its associated recording practices was still emerging, exemplified by Pitt Rivers' work between 1890 and 1900 (Díaz-Andreu García 2007, p. 392; Lucas 2012, p. 36).

By the later stages of the 19th century, despite practice in the field being highly variable; on the one hand were the *dilletante*, digging for objects for their collections, and on the other, the beginnings of modern archaeological field practice (F. Petrie 1904, p. 48; Díaz-Andreu García 2007, p. 391). Archaeologists published manuals detailing approaches to context and stratigraphy, as within archaeology these aspects were — and are — critical to establishing both provenance and period. Notable is the Smithsonian Museum of Natural History's "Field Handbook" of 1863 which includes the following suggestions for an archaeological excavation:

> When a mound is opened, every particular respecting its position, size, form, and structure, should be noted down on the spot … and an accurate list should be taken of all the articles found in it. Such as are taken should be properly

> labelled, and kept by themselves, with the same care that is observed with respect to objects of natural history (Gibbs 1867, p. 12).

Within the collection, the knowledge of the archaeological *provenience* — this being the thing's precise spatial position within the surrounding material while in the ground (Renfrew and Bahn 2016, p. 50) may indicate understanding at the time of origin and location of the object *before acquisition* by the institution. This also frequently informs initial classification and storage of the object and related material. Similarly, the trajectory the thing has taken since, through excavation, collection, study, ownership, and so on — in other words its *provenance* — solidifies its overall legitimacy and authenticity, thus its value as object of study, within a particular epistemological framework (Buchanan 2016, p. 26). Noted archaeologist Flinders Petrie wrote in 1904 the pertinent truism that "recording is the absolute dividing line between plundering and scientific work, between a dealer and a scholar" (F. Petrie 1904, p. 48).

Furthermore, the lack of appropriate context has the potential to *destabilise* extant knowledge rather than contribute to a *lack* within it. Falsified objects — or context — absorbed into a system may alter perceptions and reconstructions of a culture or type. A key example of this is Chippindale and Gill's work on Cycladic figurines (Chippindale and D. W. J. Gill 2000). Of several hundred figures, *none* have been found or excavated in any archaeological context, all having been recovered from looters. This raises the very real possibility that they are all (or mostly) faked, and an entire body of knowledge built upon them is at best incomplete or inaccurate (Markaki 2018, p. 6).

Interwoven with issues of provenance and origin are ethical and legal factors. Thompson and Priest write that:

> Ideally, museums would have a complete record of provenance for every object in its collection including, the names of each owner; when, where, and from whom each owner acquired it; where each owner possessed it; transportation records (including import and export documents for international transactions);

> and its entire exhibition and publication history (Thompson and Priest 2021, p. 193).

While this is an ideal situation, it is rare, even today. Much of this may be attributed to lacunae in data collection, similarly to the case of early archaeological and ethnographic collections and their reductive classifications and focus on donor rather than origin.

As I mentioned in Chapter 2, for the purposes of considering varied ontological states of the *thing*, I will shift back and forth between treating my NM176a case study as an *individual* and treating it as part of a larger *composite* thing which includes its siblings. NM176a itself is not itself a commodified artwork or antiquity at this point in its life — however it is still prescribed financial value (in the interests of insurance and the corporatisation of museums (Caldwell 2000)). The piece is also in possession of a fairly comprehensive provenance, mostly performed in retrospect by late 20th century researchers. There is evidence effectively connecting it back to its artist, who however, remains unnamed, but was reputed for his artistic skill (Dell 1994, p. 144). Furthermore there is evidence of procurement, movements and probable display.

There is an element of uncertainty regarding the exact details of this composite thing. It is unknown exactly how many sets were produced at the time, as infrequently another set — which may or may not have been previously documented — appears on the international market. There is also no indication as to whether the artist worked alone or had apprentices or colleagues, and furthermore, little idea of how this craft practice originated. It has been speculated that these works were the product of a member of the English Naval Brigade while under siege at Eshowe in early 1879 (Fox 2005), as Fox considers them to be examples of the art of Scrimshaw, a form of craft widely practised within naval traditions, most probably beginning with whaling (Erickson Jr 1996). Despite more recent research disproving Fox's claims, the artist may have been influenced by this technique.

These sets were all procured simultaneously with some of them being displayed at the "Colonial and Indian Exhibition" of 1886[4], and followed similar pathways up to that point. Shortly after this their lives diverged as they were disposed of through donation, sale or auction to collectors and museums (Dell 1994, p. 149; Davison 2016, p. 84).

Of these, two sets and a single horn returned to Natal (NM176/NM176a and NM177) which were most probably purchased for the Natal Society collection, later to form the basis for the KwaZulu-Natal Museum (2016, p. 84). Two single horns remain in the Iziko Museums collection in Cape Town, while other single horns and sets are scattered throughout significant international collections, for instance the British Museum[5], The Flint Institute of Arts in Michigan, and the Smithsonian[6], to name just a few[7] In a compelling juxtaposition, other sets are still in (or have recently been) in circulation on the international market, for instance a set formerly held by a gallery in New York (*Jacaranda - Engraved Cow Horns* 2022), and recently sold. Interestingly, the only source of provenance is the London based dealer from which it was procured, and a reference to one of the academic papers which describes it and the others in the series (Maggs 1990).

To market

Material culture has financial value and an international market. The manner in which this material has been gathered runs the gamut from legitimate through shady to downright illegal. The trade in antiquities and archaeological materials is known for illicit procurement and trafficking (Hoving 1993; Tsirogiannis 2019). In most of the world the trade in archaeological materials is illegal, as is their uncontrolled excavation. In many cases, the act of export is illegal other than for research or display purposes.[8] Furthermore, despite widespread looting and illegal excavation, once these things are smuggled out of their country of origin

4 It is unknown whether or not NM176a was actually displayed in London.
5 Af1960,08. 1, a, b, c and Af1979,01.5234, a–b
6 83-8-1.1 and 83-8-1.2
7 Davison provides a comprehensive list of known sets and individual horns (Davison 2016, p. 100).
8 A case in point here being the current (September 2023) uproar over Lee Berger's publicity stunt involving the flight of important hominid fossils into space.

and land in a foreign country, they are effectively *laundered*. Having their problematic provenance stripped, it is then legal to resell them (Coggins 1972, p. 264; Mosna 2022).

Objects are procured, bought and sold in large quantities by major global auction houses. Lots are identified by region, culture or material, and buyers are private collectors, other auction houses or museums (Yates 2015). Archaeologist Neil Brodie attributes the financial value as a serendipitous effect of academic work carried out by scholars within the fields encompassing these objects (Brodie 2014b, p. 36). Tracing the flows of materials (many illicit) in the antiquities and art trade follows similar steps of amplification to objects within research pathways, and in fact is entwined with them. As knowledge of the objects, their peers or the cultures from which they came is produced, it feeds back into these networks, thus amplifying both knowledge and the financial value of the objects themselves, reinscribing Latour's notion of "circulating references" discussed in chapter 3. Brodie states that "it is not too much of a stretch to say that in large part the economic value of an antiquity reflects the congealed labor time of (generations of) scholars" (Brodie 2014b, p. 36). This reflects in the provenances provided by dealers and information published for the companion piece to my NM176a case study.

The art and antiquities market is complex and shadowy. Art historian Gareth Fletcher describes it as a "uniquely opaque industry" (Fletcher 2020a, p. 124), with the market circulating not just objects but information and status. Regulation and oversight is minimal, and unethical and illegal acquisitions abound. Large institutions (*especially* large institutions?) such as New York's Metropolitan Museum still partake in questionable deals and shady connections (Muscarella 2000; Thompson 2016).

At the most basic level, provenance is considered to be traceable authorship (Dutton 2003, p. 1), and the ability to *trace* the chain of custody of the work from the artist's studio to its current situation (Carter 2007, p. 77), or in the case of antiquities, to trace them back to the point of encounter or excavation. Documentation (of some sort) is critical to legal circulation within the market, however it is often shallow, minimal, or sometimes completely fabricated (Muscarella 2013, p. 837). Philippe de Montebello, former director of

the Metropolitan Museum of Art[9], argues that recent regulation in the form of guidelines for ethical procurement, international conventions, and criminal cases has driven the antiquities market underground, and thus "valuable provenance information" that was once disclosed by dealers and collectors "on the ground" is now being suppressed (De Montebello 2012, p. 69). Modern looters frequently photograph objects during excavation — in the ground — as proof of their authenticity to potential buyers (Yates 2015, p. 77). Post-recovery, many of these photographs and archives have been instrumental in locating find-spots for seized illegally obtained objects; the most notable being the archives of dealers (and competitors) Giacomo Medici and Gainfranco Becchina, comprising a total of some 12 000 photographs of looted objects, both post-excavation and in the ground (D. W. Gill and Tsirogiannis 2011; Yates 2015, p. 77).

Other than outright lack of provenance, often the listed provenance of a thing may indicate an existing gap, for instance, "Prior to 1996, provenance not yet documented" (Thompson 2023); this serves also to highlight the fact that frequently work on determining provenance is performed retrospectively, often alongside object biographies or forensic provenance studies (Joy 2009; Pollard, Bray and Gosden 2014). Furthermore, the *silences* in the provenential record are as telling as the *verbiage*.

In the mid to late 1980s, conman John Drewe convinced an artist (John Myatt) to paint both copies and new works in the style of notable artists, including Klee, Matisse and Chagall. He artificially aged and patinated the works, and forged provenance for them by infiltrating the archives of institutions such as the V&A museum, and altering records to authenticate his counterfeit works (Holtorf and Schadla-Hall 1999, p. 232; Mass 2020, p. 70). In many cases, the only authenticating documents (other than bills of sale) were (and still are) catalogues of exhibitions and auctions. Archivist Rodney Carter observes that

> Artistic provenance relies heavily, if not exclusively, on archival material to trace out the complex history of transactions and movements across time and

9 Which, along with the Getty, has been implicated in cases of antiquities trafficking (directly and through donations) for a number of years, and is ongoing Felch and Frammolino (2011); Thompson (2016); Hoving (1993); Brodie (2014b).

> geography. Documents used to establish the provenance of a work of art include inventories of artists' studios and of art collections, invoices, correspondence, certificates of authenticity, and auction and exhibition catalogues (Carter 2007, p. 77).

Drewe infiltrated and corrupted this chain of provenance, by forging replacement pages and entries for various catalogues of past exhibitions, adding his pieces, and then replacing the original catalogues in the archives of the relevant institutions (Museum 2023). This provided the appropriate evidence when auctioneers requested more information on the works he had put into circulation (Carter 2007, p. 84). Art historian Gareth Fletcher suggests that this is relatively common, stating that "the forgery or contamination of documents within these resources is a pernicious and unique form of intellectual corruption which researchers must constantly bear in mind" (Fletcher 2020b, p. 127).

Aside from authenticity issues, detailed post-facto provenance research is key in arguments for repatriation of contemporary and colonial-era stolen artworks and artefacts, and restitution of Nazi-era looted works.[10] A further form of authentication within the art market — closely related to the idea of institutional authenticity discussed earlier — is that of *connoisseurship*, or the "knowing eye" (Sutton 2004). The expert, being intimately familiar with the work of an artist, can judge its authenticity by looking at form, technique, habits and materials. This mode of authentication has deep roots in the early European art market, where, for instance, in the Netherlands these experts were known as *kenners*, or "knowers" (Marchi and Miegroet 1994).

5.2 ON AURA AND ONTOLOGIES

At this point I will take a slightly different approach to looking at aura, using the lens of ontologies and alterities to explore what aura might be and how we engage with it. This aligns with my earlier idea of pathways of authenticity — a thing experiences and evokes different forms of authenticity as it is situated within different ontologies throughout its

10 Although, cynically, often this is due to concerns about legal rights and image, rather than ethics.

life (some being contemporary and overlapping). I also use this approach to highlight some of the problems in working with such a polysemic thing, and that engaging with the auratic aspect of a thing allows one to begin to reconcile the idea of *semantic ascent* as described by Lucas, which he describes as "crossing the ontological divide" between the world and talking about the world (Lucas 2012, p. 237).

In the case of this research I am examining things and places which have been de- and re-contextualised in collections or museums, with some of them having been digitally recorded or reproduced in ostensibly mimetic forms. As such, it is convenient to consider these acts as a shift in ontological situation throughout their existence, and therefore constructions of authenticity and aura are entirely dependent on this changing ontological context.

Siân Jones writes that one of the primary threads through many of the recent heritage charters (for instance the Nara document, which I mentioned in chapter 4), is that

> … authenticity is not inherent in objects, buildings, places, or indeed cultural practices. Rather, it is a quality that is culturally constructed and varies according to who is observing an object and in what context (Jones 2009, p. 135).

The materialist and constructivist approaches to authenticity discussed earlier have one notable shortcoming, according to Jones, and that is that neither attempts to explain authenticity in the context of how people experience the historic environment, and why some things are "more powerful loci of authenticity than others" (Jones 2009, p. 136). This may be a consequence of the indifference with which affect and emotion have long been treated in academic studies of heritage and history (L. Smith and Campbell 2015, p. 447). Some of this is attributable to the prevalence of *quantitatively* led research on affect for the purposes of visitor metrics at tourist sites and museums (Poria, Reichel and Biran 2006), and that much of the *qualitative* work on this front is from the field of tourism studies (Silverman 2015; Rickly-Boyd 2012).

Smith and Campbell suggest that the *Authorised Heritage Discourse* has

> …also played an important role in maintaining negative attitudes to emotion in heritage. This mentality is overly concerned with expert judgments on the significance of the past, and is based on technical and aesthetic forms of expert knowledge and the mobilization of their practitioners, such as archeologists, art historians, architects, and historians, whose "value free" knowledge can be used to arbitrate over and govern how the past should be understood (L. Smith and Campbell 2015, p. 448).

Historian Abby Smith, speaking about archival material, suggests that in this context, Benjamin's aura might be explained as *experiential or affective authenticity* (A. Smith 2003, p. 173) (emphasis mine). The term itself is contentious, as Benjamin himself never adequately defined it, and yet, as Carolin Duttlinger notes, it has become a "common theoretical currency across the arts and humanities" (Duttlinger 2008, p. 79). Benjamin had an enigmatic relationship with this term through much of his work (Hansen 2008), and even his formative essay *The work of art in the age of its technological reproducibility*, which is always presented as the mainstay of the concept, does not definitively define the term.

Benjamin argues that

> … what withers in the age of the technological reproducibility of the work of art is the latter's aura. This process is symptomatic; its significance extends far beyond the realm of art (Benjamin 2008, p. 22).

He continues,

> It might be stated as a general formula that the technology of reproduction detaches the reproduced object from the sphere of tradition. By replicating the work many times over, it substitutes a mass existence for a unique existence. And in permitting the reproduction to reach the recipient in his or her own situation, it actualizes that which is reproduced (2008, p. 22).

Aura remains undefined by Benjamin until *after* the fact of reproduction. Something, he argues, is missing from the reproduction, which is now "soulless"; the term describes an

"elusive phenomenon from the perspective of its disappearance" (Duttlinger 2008, p. 81). Discussions of aura frequently situate it within constructions of authenticity discussed earlier, particularly within discourses of heritage sites and experience of museums and galleries (Jones 2009; Ameri 2004). Interestingly, Kenderdine and Yip suggest that in fact what Benjamin identified was not permanent loss of aura through reproduction, but in fact a state of *crisis* resulting from accelerated technological change (Kenderdine and Yip 2018, p. 275).

It is not explicitly an identifiable quality in and of itself, but an ineffable *something* that is lost in recording and reproduction of a thing. Benjamin does consider two key factors within the loss of aura in reproduction: the replacement of the singular original object with a multitude of reproductions (or the potential for their existence), and that it is severed from its historic and spatial context, by being represented in a different space. I will return to these definitions later in this section (and in the meantime I may be accused, as are many others, of a reductive reading of Benjamin's aura). Much ink has been spilled arguing for various generalised definitions of aura, and what this loss means in the context of digitisation (Malina 1990; De Mul 2009; D. Davis 1995). There is no point in relitigating those arguments, but I will look at some approaches to aura used specifically in heritage-adjacent domains.

Art historians Anthony Hughes and Erich Ranfft succinctly describe aura as "that nimbus of admiration and awe that psychologically distanced it from the spectator and made it seem an object of wonder" (Hughes and Ranfft 1997, p. 2). Duttlinger constructs the use of the term in literary, visual and cultural studies as a "contemplative experience" (Duttlinger 2008).

What all these characterisations of aura have in common over and above Benjamin's is that they describe sensorial and affective responses to the embodied experience of interacting with a thing or place. Shanks offers an example, noting that "tourists cluster around the *Mona Lisa* in the Louvre because of the singularity of the painting achieved through its associations and evocations" (Shanks 1998, p. 20). He argues that aura is constructed by the accretion of events and associations around a thing, stating that, in fact, "aura refers to the life of things" (1998, p. 20).

Holtorf notes that the constructivist approach to authenticity tends to ignore the materiality of the object while focussing entirely upon the associations and networks constructed around the object (Holtorf 2013, p. 428). In response, he offers the concept of *pastness*, which weaves together aspects of both cultural production and materiality, and thus "emancipates archaeological authenticity from the object's inherent material substance" (2013, p. 431). Pastness has the capacity to determine the experience and affective response to an object or place, and, according to Holtorf, has certain requirements in order to do this. Firstly, it requires *material clues*, such as decay, patina, and signs of age. Historian David Lowenthal writes that "wear and tear confirms as well as adorns antiquity" (Lowenthal 1985, p. 152). The traces of use and wear acquired by objects throughout their life add to their "allure" (Ouzman 2006, p. 279).

Secondly, pastness requires *correspondence with the expectations of the audience* — it needs to align with assumptions carried by the observer's ontology. Lowenthal observes that

> To be credible historical witnesses, antiquities must to some extent conform with modern stereotypes; unless medieval structures are castellated, New England Colonial farmhouses furnished with candlesticks and spinning-wheels, Gothic churches fitted with encaustic tiles and canopied sedilia, they fall short of current expectations as relics (1985, p. 354).

Finally, pastness requires a *plausible and meaningful narrative* linking history with the present. Duval *et al*, discussing replicas of rock art sites (notably Chauvet cave in France), propose that the objects formalise a "material, intergenerational communication with a distant past, becoming part of a long, civilizational space-time continuum" (Duval et al. 2019, p. 3). This is also a core principle in canonising sites and objects of national heritage (McGhie 2009; Pickover 2014).

The creation and maintenance of both tangible and intangible networks involving things, people and places is central to experiential and auratic authenticity, (Jones 2009, p. 142), and the affective responses to the aura of a thing, Shanks argues, are not the result of any inherent properties of the thing itself, but a product of an individual's subjective experience

and engagement with the object (1998, p. 20). Similarly, Cameron and Gatewood discuss "numinous experiences", observing that these experiences can be emotional and affective, and potentially provide a deeper, more meaningful connection with a place or period (C. M. Cameron and Gatewood 2003). Rachel Maines and James Glynn coined the term in their 1993 work on museum collections titled "Numinous objects", and they describe these as objects which have psychological rather than material significance, almost as if they are inhabited by a *numen*[11] or "spirit that calls forth in many of us a reaction of awe and reverence" (Maines and Glynn 1993, p. 9).

Likewise, the museum holding such objects has been compared with a temple or other sacred space. Arjun Appadurai relates the museum as "a sacred place, a place of icons, silence, transcendental experiences, a church for those whom a Christian god has failed or become unavailable" (Appadurai 2020, p. 47). Art historian Carol Duncan extrapolates from this and argues that in fact a museum is a ceremonial monument, much like the influences for traditional museum architecture — "classical temples, medieval cathedrals, Renaissance palaces—the museum is a complex experience involving architecture, programmed displays of art objects, and highly rationalized installation practices" (Duncan 2012, p. 280). Jillian Rickly-Boyd links the aura with more formal constructivist authenticity by arguing that "while the authenticity of the object/site is a result of its embodiment in a tradition of which tourism is a ritual; the authenticity of the experience is a part of an engagement with aura" (Rickly-Boyd 2012, p. 272). Part of the engagement with sites, places and spaces, in this context, is the ritual performance of travel, approach, entry and embodiment within the space (Rickly-Boyd 2012, p. 278; Ameri 2004; Gurian 1999, p. 165); these are critical to affective engagement and what Nelson Graburn calls "reverential experiences" with things and places (Graburn 1977, p. 3).

My case study of the Scotston rock art site, even before being recorded or reproduced in any form exhibits Benjamin's key marker of being spatially and temporally severed from its original context — including the ontology of its creators. Spatially the painted imagery

11 A Roman Pagan term.

itself is *still where it has always been*, yet the landscape around it has changed radically since the artists worked there, given that the imagery would most probably have been painted at various points within the last 3000 years or so (Mazel and Watchman 2003). As Chippindale and Nash write, "these are pictures which do remain fixed in place, but the contexts of those places are not fixed" (G. Nash and Chippindale 2004, p. 9). Moreover, we have no direct, primary access to many of these contexts or the ontological framework within which the original artists worked. We can refer to recent research, for instance the work of David Lewis-Williams and Thomas Dowson (Lewis-Williams and Dowson 1990), but this is extrapolated (by contemporary, White South Africans) from a combination of currently existing cultures and 19th century sources (Deacon 1996). However, working from this research, this site would most probably have had some affective and probable ritual dimension within the artists' ontological space, embodying elements of both aura and authenticity for them, as many situations within the landscape which contain rock art have "ritual and legendary significance" (Deacon 1988, p. 148).

The site, as my short biography in chapter 2 notes, has long been a cultural nexus. The site saw many different individuals, groups and cultures moving through and past (and still does, thanks to the existence of the N3 motorway). San people, travellers, transport riders, tourists, Boer and British soldiers, Zulu *Impi* and the occasional archaeologist, anthropologist and art history student have passed this place, embedded within varied ontological situations. The reasons for colonial travellers being drawn to this site are manifold, and the 1903 railway guide *Natal province : descriptive guide and official hand-book* hints at what may be found:

> To the left of the [railway] line great isolated mountain masses are visible, each one standing like a palace of mystery, with the summits swarthed in clouds, and kloofs dark with impenetrable forests, amidst whose almost untrodden solitudes are Bushmen's caves, containing on their rocky walls curious representations of beasts and birds (Harrison and Ingram 1903, p. 215).

Much as many objects in ethnographic museums, the site, as one of many in the Maloti-Drakensberg to which the guide was referring, may have been being presented as illustrative of the "savage sublime" (Appadurai 2020). Sites such as this, where ontologies meet and

overlap, are sites of friction, and the graffiti[12] over the main panel of art attests to this. Furthermore, these places could be seen as profoundly *destabilising* to individual or cultural ontological security, with the existence of such sites being conceived of as a threat to the worldview of the colonists (Nolan 2019). George Stow conceded that rock art could very well be considered to be a "title deed" to the land itself (Stow 1905, p. 5).

Missionaries Thomas Arbousset and François Daumas observed in 1864 that rock art sites were "directly connected with anti-colonial violence", and that the paintings were implicated in power struggles both internally and externally, with farmers and settlers (Arbousset and Daumas 1864, p. 252; Dreyer 2001; Weiss 2005, p. 58). Weiss writes that the "materiality of these rock art sites was very much at the interstices of colonial and autocthonous regimes of power, and the colonial appropriation of such physical landmarks could not have been read as anything other than a modes [sic] of power taking" (Weiss 2005, p. 58). Annie Coombes considers trophy art as "signifier of capture or conquest" of a culture, the defacement or destruction of a site may itself reflect the *eradication* of the culture itself (Coombes 1994, p. 197). Such trophies exist in abundance in European museums (Dell 1994, pp. 342–), and this practice may be reflected to some extent in early removals of rock art from sites and shelters, as noted by Weiss (Weiss 2005, p. 58). Bushmen were considered "vermin" by colonists of the time, and concerted efforts were made to eradicate them and their culture (King 2019, p. 155; Jeursen 1995, p. 121).

Travel through an unknown landscape takes place in a state of ontological liminality. Many 19th century travellers would have broken their journey at Van Reenen, which as the crow files lies approximately halfway between the port city of Durban and the Reef — Johannesburg. Whitridge and Williamson argue that graffiti is often created by people in a transient phase, and is concentrated in abandoned, abject and interstitial spaces (Whitridge 2021, p. 341). Ouzman calls these "borderlands of place and identity" (Ouzman 2010, p. 4), and so Scotston may have formed the ideal canvas for the statements and reactions resulting from ensuing instability experienced by weary travellers.

12 Which, over the last 150 years, has been laid down in such density that it almost completely obscures the original art.

At some rock art sites one may observe modern graffiti outlining or drawing attention to the existing artwork without covering or damaging the work itself; suggesting an initial engagement driven by curiosity. Names have been painted or carved away from the main panel at Scotson, notably Gibson's 1873 carving, Preller's 1924 carving on a boulder in front of the main panel, and an intricately drawn collection of motifs and text stating "Ladysmith Boy Scouts 6.10.21", either drawn with a piece of charcoal or candle soot, far to the left of the main panel. Later graffiti started explicitly defacing and covering the work, for instance Maggs' mention of the name "Preggie" on the interior overhang, directly obscuring a small antelope, the remnants of a polychrome eland, and an number of human figures in various positions. Later phases of graffiti were subsequent responses to extant marks, as few paintings were visible due to weathering and subsequent defacement. Whitridge observes similar phases in both current graffiti practices in urban areas and defacement of rock art, early phases being curiosity, then defacement, and responses to extant imagery (Whitridge 2021, p. 342).

A traveller named Allderman wrote of this site, in 1921:

> Saturday we spent at the Bushman's Cave. There are splendid examples of their art, and some of the paintings are in a perfect state of preservation (…) One could not help contrasting the refinement of an early art with the vulgar taste of those vandals who even here could not refrain from printing their names upon the rocks" (Allderman 1921, p. 41).

Jalmar and Ione Rudner observed the state of vandalism of rock art sites during their research in the 1970s:

> The vandals were there before the time of Stow. They have scrawled and scratched their names over and around the pictures, splashed them with paint or tried to chip them off. Careless and uncaring farmers have walled in large painted shelters for use as kraals and the greasy bodies of the animals rubbing against the rock faces besmear and smudge the paintings. Heat and smoke from fires of shepherds and campers damage and obliterate the pictures. Thieves

> attempt to chisel or blast the paintings and engravings from the rocks, only to destroy them. Hundreds of our engravings and paintings are in museums in Europe, most of them removed in the last century (J. Rudner and I. Rudner 1970, p. 261).

There are currently few motifs still visible at the Scotston site without either a trained eye or digital enhancement, and historic reports (mentioned above and in chapter 2) indicate that by the late 1800s, this was already the case; yet, the site remained popular with travellers up to the opening of the N3 highway in 1974. It is also only 10 minutes walk from the Green Lantern Inn, which has been the only hotel in the town of Van Reenen since 1892.

Observing the site as a researcher, the stark ontological differences come into play immediately on entering the area. Seated at an outside table at the small tea-room which serves travellers brave enough to pull off the highway at this particular spot, with a cup of coffee and a slice of quiche, one can look over a rocky spur no more than 200 metres away, knowing that the site is immediately below this. The noise of the highway, carrying heavily laden trucks over the pass is constant. Walking across the top of the spur, then turning right down a faintly visible path leads into a small natural rock "tunnel", opening into a massive overhang, with much graffiti, an 1873 engraving of the name "Gibson", and one or two faintly visible paintings, including a seated figure, which was described by Maggs (1982)), a small antelope, a number of large, barely visible polychrome eland, and an alite. Walking further out, ones first encounter is with the massive panel covered in graffiti, with no immediate sign of any art. The approach to the site, and specifically this panel could not have been choreographed any more competently in a museum or church. It is unknown whether or not the original artists would have approached in this direction or from along the small stream which flows through the Northern end of the site (this seems more likely). Even before understanding the density of paintings on this main panel (mostly exposed through later digital enhancement), it projects an affective experience; a sense of awe and wonder, one of Graburn's "reverential experiences".

I have loosely mapped my own experience of the affective and auratic at this place with the aid of the above theoretical constructs, however we have to look at current research to

locate this site within the affective — and no doubt spiritual — landscape of the bushmen. Cipolla warns that we need to populate such ontologies with the involvement of indigenous cultures, so we "do not depend upon Western translations of Indigenous perspectives into archaeological theory" (Cipolla 2020b, p. 160). Alberti echoes this, saying:

> The politics of anthropology's ontological turn is confusing enough in the context of ethnographic studies of subaltern communities in the present. But it is that much more perplexing in the context of archaeological studies of the material remains of former communities who are no longer around to ontologically self-determine themselves (Fowles and Alberti 2021, p. 2).

Ontologically, to me, this is a *rock art site*, and so can only be interpreted by me as such, with the appropriate vocabulary, tools and knowledge available to me in that role. Holbraad and Pedersen offer a similar example of ontological multiplicity in the form of the site of *Uluru* in central Australia. The *Uluru* used by Aboriginal cultures as a focus of ritual and myth is ontologically a completely different thing to the *Ayers Rock* experienced by tourists to the area (Holbraad and Pedersen 2017, p. 40).

However the ontologies occupied by the artists who no doubt painted the panels at Scotson have been rigorously examined through a long history of engagement with descendant communities, most notably being the linguists and ethnographers Wilhelm Bleek and Lucy Lloyd, who worked in the mid to late 1800s (Deacon 1996, p. 93). More recent work, however, by for instance anthropologist Mathias Guenther and archaeologists David Lewis-Williams and Thomas Dowson have looked at bushman spiritual practices and ontologies (Guenther 2015; Lewis-Williams and Dowson 1990).

Guenther observes that they experience three ontological states: the *world-beyond* where mythological beings dwell, interpreted by Lewis-Williams and Dowson as being located directly behind the painted rock face (Lewis-Williams and Dowson 1990); the *here-and-now* and the *betwixt-between*, the liminal world of ritual (2015, p. 278). The constant ontological flux situates the bushman worldview firmly within the new animistic world-oriented ontological frameworks described by Descola, and to some extent de Castro (De

Castro 2015), with a commingling and metamorphosis between animal and human, plant and human, as well as inanimate objects and natural things (Guenther 2015, p. 283).

5.3 DIGITAL AUTHENTICITY

As mentioned earlier in this chapter, the physical object is afforded authenticity through a combination of pathways of provenance and institutional authority. The digital object, being a derivative translation of the original relies initially on this authenticity to establish its position as epistemic object; however, there are two additional factors contributing to its overall status as a digital object.

Firstly, the digital object is afforded additional authenticity through its entanglement with the processes and machinery of technology. Fiona Cameron states that the "imprints of authority stamped on the object are evident in the use of the camera and programming languages in shaping and manipulating it, its message and meaning" (F. Cameron 2007, p. 68). Garstki suggests that this is in part due to the development of more convenient graphical user interfaces for computer software, in contrast to earlier text-based command line interfaces. He argues that this has stripped the processes of any transparency, the so-called *black boxing* I discussed in chapter 2 (Garstki 2017, p. 740). This has in turn further distanced the user from the digital data, shifting responsibility for authenticity and objectivity to the *technology itself* (Garstki 2017, p. 740; Huggett 2004, p. 85). This shift is often reinforced through the excessive deployment of technical terminology when discussing digital objects, and mirrors the epistemologies within which these technologies grew: colonial control, the military-industrial complex, and more recently, the computer industry (I discussed these origins in greater detail in chapter 3).

Secondly, when discussing the concept of the *black box*, I considered how to make the process more transparent through close examination of each step in the process. The sum of these links in the chain of operations articulates a specific *distance* between the original and the digital object. Mapping and recording the links traversing this distance, in the form of a narrative or descriptive *chaîne opératoire* (reduced to paradata) allows us to have, if not a metric, at least some understanding of the translations happening along this chain, from

physical thing to digital object. The practices of casting discussed in chapter 2 anticipated this, relying on traces of the process remaining on the surface of the finished product (the seam lines) to determine the distance between the original and a particular instantiation. Michael Shanks notes that scholarly digital objects tend to "remain closer to the data" (Shanks and Webmoor 2013, p. 96) — or, in fact, *need to* in order to prove their epistemic value and authenticity to other users of the data.

Missing links in the documentation of the chain, or silences in the paradata are as troublesome as silences in the narrative of provenance of physical things, as they allow speculation and doubt to creep in and undermine the authenticity of the digital object. In some ways, this is a case of provenance at multiple scales; the provenance of the original, the provenance of the digital object (as inherited from the physical), and small-scale provenance of each aspect of the digital model itself. The ability to follow each link, or trace each individual 3D point in the model back to its *point de capiton*, would allow us to (theoretically) pin[13] it back to the original within its non-digital ontology and thus ensure repeatability. Sven Havemann suggests, the ability to *redo* the process and recreate the model at a later stage is the only way to ensure intellectual transparency (Havemann 2016, p. 159). Again, we return to Latour's assertion, as I mentioned in chapter 3, that the succession of stages *must be traceable* and the chain of processes *must remain reversible* for the sequence to continue producing "truth" — as he states: "truth-value circulates here like electricity through a wire, so long as this circuit is not interrupted"(Latour 1999, p. 69).

The card catalogues and accession registers of yore were a direct indicator of provenential authenticity regarding museum objects. We have taken it up to now that digital metadata performs the same function. However, given digitisation as practice, with decisions and consequences and potential acts of interpretation in the process, paradata (which is treated as different, somehow, from metadata) is converging with metadata as marker of authenticity of the digital object.

13 Technically many SfM photogrammetry applications allow this, but there are no usable tools outside of the model creation workflow, ie. In visualisation, 3D archives, etc.

5.4 AURA AND DIGITAL SPACE

Jones *et al* suggest that a more worthwhile approach to aura or affective authenticity, is to consider how people *experience* authenticity of digital models rather than fixating on *forensic* authenticity and provenance (Jones, Jeffrey et al. 2018). They propose aura as a "specific aspect of authenticity related to biographical uniqueness" and the "thrill of proximity" (2018, p. 336). As discussed earlier, the aura is very much about presence, and the understanding of pastness, both of which, arguably, are lacking in a traditional visualisation of a digital object involving the mapping of Euclidean space to Cartesian, the flattening of narrative to metadata and the disavowal of materiality.

Historian Abby Smith wrote that, during digitisation,

> Anything that is intrinsic to the physical presence is lost. Digital representations are nowadays much preferred for research purposes, in part because they tend to lose less information than other forms of surrogacy. Indeed, there are many features important to research and enjoyment that are added through digitization. But there is something irreducible about an encounter with the real thing, and that is what constitutes the experiential and affective authenticity of the artifact (A. Smith 2003, p. 177).

Aura and experience of a digital object seems to be less about the digital object and more related to *constructions of digital space* in which the object is embedded. Digital objects are overwhelmingly presented in visualisations as isolated and unrepresentative of any familiar world. The object is presented as it exists within its own digital ontological non-space, universal yet completely unfamiliar to us.[14] Flynn describes this space as deployed in virtual heritage as the "embalming of the idea of space as the emptiness between three-dimensional solids, devoid of the realm of thoughts, feelings and experiences" (B. Flynn 2007, p. 353). The isolation of the object in its space is reminiscent too, of having it displayed, quarantined,

14 This is reminiscent of museum photography where objects are photographed against flat backgrounds, and any pesky references to the real world are removed.

in its own glass case; not just protecting it but also notionally enhancing its perceived value and importance. Further to this, it lacks the impact of presence; of standing in the presence of the original, and often, breaks anthropocentric convention in how one is allowed (or encouraged) to view the digital phantom. Louise Minkin describes how

> The phenomenological facts of viewing have shifted, the "cameras" here are infinite and removed from our body position. Pan, scan, traverse and zoom can be initiated from any point. The model is constantly refigured, rotated and scaled. A consistent model viewed from one angle may explode into incoherence from another (Minkin 2016, p. 118).

The ability to view the thing from angles, directions and positions inaccessible, dangerous or impossible in the real world might be useful at times. Mol sees this as offering us possibilites for withdrawal from anthropocentric perspectives (and thus shifting outside of normalised Western ontologies) (Mol 2020, p. 68) but this shatters the familiarity of our anthropocentric viewpoints, particularly for monuments and sites within the landscape. Morgan reiterates this based on experience of her reconstruction of the Çatalhöyük site in the online *Second Life* platform, emphasising the need for some sort of embodied representation of a user within the space, rather than this "dehumanised" view (C. Morgan 2019, p. 328).

It is useful to be able to, for instance, rotate a thing such as the NM176a horns, look closely at the engravings, and zoom in and out, which would be impossible and destructive to the fragile originals. However, the referenced 3D models of the Scotson site become almost impossible to read as a rock shelter or physical space due to their fragmentary and diaphonous nature and the viewpoint having no "ground level" reference from which to orient oneself as the viewer. Nancarrow calls this effect the "digital uncanny", noting the need for visual cues and "realism" over "accuracy" in producing models (Nancarrow 2019). Huggett quotes Donna Haraway's notion of the "god trick", which "distances the observer and 'sees everything from nowhere', providing the illusion of infinite vision" (Haraway 1988, p. 581; Huggett 2015, p. 92).

Meaning and affective experience of a thing, according to both Garstki and Holtorf, comes from a viewer's expectations, and the networks accreted around it; how old it is, how it was used and by whom (Holtorf 2013; Garstki 2017, p. 729). The reduction of this thing and experience of it to nothing more than a *visual simulation* disrupts the connection to material evidence, and thus to history, according to Flynn (B. Flynn 2007, p. 350).

5.5 DISCUSSION

5.5.1 *The state of the copy*

I have avoided up to now discussing *what to call* the digital model — not the digital object with its metadata, paradata, and recontextualisation, but the 3D model itself. Is it a copy, a replica, a surrogate, a proxy, a digital original? The difficulty of selecting an appropriate naming protocol for an object which is ostensibly a digital replica of a physical object suggests that the conceptual frameworks commonly utilised within these fields have not yet caught up with the nature of the technologies and the modalities within which they are deployed. As a result of these inadequacies — both ontological and epistemological — any discussion of the nature of the digital model or object tends to revert to equivalences; that is, the endless comparison and contrasting of this digital form with the original physical form from which it was copied, in an attempt to anchor what is essentially an ethereal, floating signifier somewhere, whether it be in the physical realm or the digital milieu. We also have to be aware that we are working within (even while theorising across these multiple disciplines) long congealed ontologies with their biases, assumptions and fixities well established by now. Salmond notes that:

> Analytics for talking about digital technologies derive from centuries-old debates on the status — ontological, theological, and political— of things like images, records, and surrogates as well as the repetition and imitation he discusses. Relational contrasts between digital and analog modes of transmission invoke scales of time and space, conjuring degrees of distance and abstraction from an original source (in Boellstorff et al. 2016, p. 401).

Yuk Hui argues that "as digital objects have emerged as a consequence of historical and technological development, so have they also inherited certain metaphysical presuppositions" (Hui 2016, p. 3). First and foremost of these is that a copy is seen as inferior to the original; Foster and Curtis observe that "replication is often regarded as pejorative" (S. M. Foster and Curtis 2016). Originals and copies (invariably in the form of casts) were confidently displayed side by side in many museums until the early 1900s (S. Foster 2022), however Fyfe notes that since then, the rift between original and copy has manifested as a function of "Western cultural rules", where they are purposely kept apart so as not to upset institutional claims on authority (Fyfe 2015, p. 48).

The idea of the "replica" and inferences of inferiority to originals led to casts and other copies falling out of favour or being relegated to their own spaces, for instance the cast courts in the V&A museum were explicitly constructed to control and corral the cast reproductions, and ensure that they do not escape and corrupt the "genuine" objects in the museum. Similarly, digitisation is sometimes seen through the same lens, given the infinite reproducibility of the digital object. Witcomb notes that this is considered, again, as a challenge to institutional authority (Witcomb 2007, p. 35). Cameron goes so far as to call the digital object a "terrorist", as it is perceived to undermine traditional museum culture and practices of defining "object value and meaning, in particular the concepts material authenticity, originality and aura" (F. Cameron and Kenderdine 2007, p. 51).

In contrast, though, Latour and Lowe offer the opinion that

> …the word "copy" need not be derogatory; indeed, it comes from the same root as "copious," and thus designates a source of abundance. A copy, then, is simply a proof of fecundity (Latour and Lowe 2011, p. 278).

The digital object as translation of the original, additionally, validates and solidifies the status of the original by ensuring its survival (M. Falser 2017, p. 290), although this may depend on the quality of the translation itself, as Latour and Lowe state, "a badly reproduced original, we will argue, risks disappearing, while a well-copied original may enhance its originality and continue to trigger new copies" (Latour and Lowe 2011, p. 278). Similarly

to the publication of a specimen discussed by Alberti earlier, the translation can both reinforce the status of the original as well as that of the institution. However, the digital object also needs an ecosystem for ongoing survival. Archives and databases are required in order to provide a sustainable repository, the provision of which can further contribute to reinforcing the status and authority of the institution, despite the ongoing maintenance and funding of the ecosystem often being seen as a liability.

5.5.2 *Modulation of the copy*

The digital object is a product of Didi-Huberman's *empreinte* or imprint (as I discussed in chapter 3). It is, to return to the plaster cast analogy, the *mould* rather than the *cast*. It can (within reason) produce an infinite number of copies of itself. It (as I have already mentioned), is nothing but potential until it is interrogated. Clemens and Nash argue that its ontological status only becomes stable or knowable when it is visualised, modified or otherwise displayed:

> Any given element or assemblage (a web page, an image, a sound, an animation, a status update, a tweet) is only 'produced' at the time it is modulated into a corresponding display state: at all other times it exists as unmodulated digital data with no clear ontological state (Clemens and A. Nash 2015, p. 17)

Jeffrey argues that the sense of pastness is enough for a digital object to reclaim some of its aura, and that a move towards solidifying this might be the "closing of the circle", in a further translation of the 3D model back into physical form through 3D printing or CNC machining (Jeffrey 2015, p. 151). This also reinforces the 3D model's position as the "mould", versus the final *thing* itself.

It might be then, that the digital object and its visualisation, are ontologically two different creatures; one which is informed primarily by extant systems and pathways of provenance and authenticity, and the other which is informed by external engagement and affect.

5.5.3 *The undermining of digital authenticity*

Recent (late 2022) developments in AI (so-called "artificial intelligence") and ML (machine learning) have resulted in numerous developments with potential for impact on the field of digital recording, archiving and modelling. Augmentations to the photogrammetry process are being developed, such as NeRF (Neural Radiance Fields) which can reconstruct a 3D scene, similarly to photogrammetry, from photographs of the scene. However, where photogrammetry would either fail or produce an incomplete model, NeRF "learns to predict" the structure of an object, and infers the geometry of objects that are not visible in all images. As a result, the veracity of the model with respect to the original is unknown in many cases, or less than accurate (Condorelli et al. 2021).

Similarly, there are tools for generation of imagery or models from text prompts, using systems such as *Midjourney* for producing images, and *3Dfy*[15] for producing 3D models. The systems are trained using existing corporae of 3D models, usually scraped off websites and archives without any permissions — for instance *ObjeVerse*[16] — a corpus of 800 000 3D objects with human-made annotations describing what the model contains. Apart from being completely opaque, both regarding process, and training corpus, these tools can produce objects that do not exist, but can appear plausibly real. Digital archaeologist Pablo Resco discusses this with reference to digital images produced by Midjourney or Stable Diffusion; markers of their output are vagueness and a "dreamlike" quality (their output is often compared with hallucinations), and "absurd products in terms of their flagrant lack of rigor but with impressive viral potential" (Resco 2023).[17] Further to this, as they are not *generating* anything from first principles, intelligence or skill, they are simply reproducing the most statistically probable combinations of things in their training dataset, and therefore they reflect the bias inherent in this corpus (Huggett 2021, p. 430).

15 https://3dfy.ai
16 https://objaverse.allenai.org
17 Los fakes históricos son, de este modo, productos absurdos en cuanto a su flagrante falta de rigor pero con un potencial viral impresionante.

As such these technologies are beyond the scope of this research, I am just flagging them here as an area of concern regarding, firstly, veracity and acknowledgement of uncertainty. If there is not enough data to produce certain parts of the model, then this should be acknowledged, rather than inferring or guessing the missing data. Secondly, there exists the problem of transparency. Much of how AI/ML works is incompletely understood, consisting of multiple layers of impenetrable and unknowable *black boxes*. Additionally, the datasets on which they were trained are generally not released nor documented in any significant manner. These systems therefore reinscribe and amplify bias, both in favour of colonial systems and populations, and the global North in general (McQuillan 2022, p. 64). Moreover, the environmental impact of these systems in terms of their carbon emissions and power usage is extreme (also further impacting the global South) (McQuillan 2022, p. 22). Digital archaeologist L.M. Dennis suggests that

> The use of a digital tool that cannot be understood by the user, or a digital method whose analytic processes cannot be explained by the user, is an inherently unethical choice (Dennis 2020, p. 215).

The notion of authenticity regarding digitised copies of objects on the arts or antiquities market is a moot point, as the object itself is the primary carrier of value. Digitised copies may be used for documentation purposes, but beyond that they have little value in this pathway.

The short-lived fad of NFTs (non fungible tokens) which were propagandised as being revolutionary for the authentication and documentation of digital and digitised art and objects was an attempt to provide digital copies with tangible economic value. However, the concept was created in an attempt to produce artificial scarcity from a form which is known for its generous multiplicity, as digital objects can be duplicated an infinite number of times with no loss in quality. The concept of the NFT *blockchain* was to provide an immutable provenential record of transactions involving the artwork, while ignoring the artwork itself. There was no direct, immutable link between the digital artwork or object and its corresponding transactions on the blockchain (basically a large "digital till roll"). Given the URL, anyone could download the "original" artwork off the web server on which

it was stored. In fact, simply viewing the sale listing on a site such as “OpenSea” (a large NFT broker), would download the original work to your web browser. In short, NFTs were/are an ill-conceived solution to a misunderstood problem.

CONCLUSION

In this work I began with the observation from discourse and my personal practice, that the process of digitisation is perceived as being paper-thin, with consequent implications of objectivity. I argue that this is due to lack of engagement with the practice itself, and furthermore, is the result of black-boxing of complex algorithmic and mechanical processes. I set out to unpack these processes, and consider how we might understand and record them. I consider this important in order that we have a more nuanced comprehension of the digital objects created through the processes, and understand how to more effectively *use* them as epistemic objects within scholarly research and education.

In chapter 1 I looked at the origins of classification systems within museums and collections, as they are used to order and study ethnographic and archaeological objects and antiquities in general. These systems originated within the Enlightenment period, and were refashioned within the colonial project as well as playing a significant role in its execution. They are critical to the making of epistemic objects, and also inform current systems, which form the basis for consolidation of digital objects. I then explored the concept of *ontology* used within anthropology and archaeology as a model or vocabulary with which to describe and document a world or worldview, and how it relates to the construction of the concept from the field of knowledge organisation. I suggested that we might temporarily align these two models in order to reconcile our approaches to describing physical *things* — artefacts — and their reflection in the digital domain. I characterised the differing approaches to ontology from these disparate fields as *natural* and *artificial* ontologies — bearing in mind that all descriptive ontologies are in fact constructed.

In chapter 2 I introduced my methodologies and case studies. I took two key approaches to observation of things and their digitisation, spanning a range of scales. At a large — macro — scale, I introduced Kopytoff's concept of an *object biography*, and its complication in the

form of the *object itinerary* in order to observe a thing over the course of its lifespan. I used this approach to identify points of inflection throughout an object's life and its entanglement with places, people and other things in order to determine what sort of ontological space it occupied at the time, and the nature of epistemological commitments suggested by this ontology. At a smaller — micro — scale, I discussed the use of the *chaîne opératoire* approach. This methodology is more usually deployed in the context of the manufacture of material culture — most commonly lithics or ceramics — however I introduce precedent for its use in examining more modern technical processes. Using this to look inside the black boxes of digitisation, I then discussed how we might map and understand the ontological shifts and translations happening here, between the physical thing and its instantiation as digital object. I then introduce my two case studies from my personal practice, and — at macro scale — describe their life stories and subsequent ontological transpositions along this path. My first exemplar - a set of engraved and painted cattle horns has a provenance reaching back to the late 1880s, and has been extensively researched in more recent years. This case study provided multiple opportunities. Firstly, as impetus to consider the nature of the disciplines and epistemological foci through which it has passed in the last 140-ish years. Secondly, it allowed me to explore the possibilities for post-digitisation manipulation of the digital model. My second exemplar, a graffitied rock art site in KwaZulu-Natal was instrumental as a pivot on which to hinge my examination of the multiple ontological states of a place as a *thing* with its own life, influenced by Ginsberg's idea of *microhistories*.

In chapter 3 I began with a look at early practices of three-dimensional recording and copying, positioning plaster casting as performed from the first century BCE through the nineteenth century and on a smaller scale into the current era, as the natural predecessor to three-dimensional digitisation. I examine compelling intersections between these practices, and how they shed light on the processes of digitisation. I then describe the conceptual acts of digitisation, and the nature of the translations from the physical into digital form, followed by a detailed unpacking of both the history and techne of digital imaging and photogrammetry, and their epistemological roots within technologies of surveillance and control. Following this, I focused on the micro-scale, and described the *chaîne opératoire* of the photogrammetric digitisation of my first exemplar. I examined the translations and

ontological shifts happening at each link in this chain, and what emerged was that we see an increased visibility of practice and craft within these processes, made visible through this tightly focused scrutiny. This led me to consider how understanding of the thing itself was enhanced by digitisation. The existence of these practices and their associated communities of practice suggests the need to focus on small-scale, thoughtful process in digitisation.

Chapter 4 began with a review of common motives within current discourses of heritage digitisation. The common tropes which I examine can be summed up as firstly, *access and democratisation*, or the idea that with the pervasiveness of the Internet, digitising things and making them available online can improve access for researchers, and empower the public audience — particularly in the global South — by allowing them to view things which may be geographically distant or not on display. Secondly, *new forms of research* presents the idea that having things in digital form allows new and creative ways of interacting with and analysing them, and provides the potential for innovative, recombinant outputs. Finally, the need for *preservation* suggests that, given ongoing geopolitical instability and climate change, digitising heritage objects provides an avenue for their ongoing digital preservation in the face of imminent destruction.

I problematised the myths and issues inherent to these tropes, and how the practicalities and politics of each may impact the ongoing preservation of the *digital object* itself. Parallel with these motives for digitisation is the issue of the *audiences* for these digitised objects, which I then discussed, and looked at the ways in which meaning is made from the object by connecting it with or wrapping it within metadata, constructed within standardised classification schemata and ontologies. At this point I drew on my case studies, and used some examples from their biographies in order to illustrate how translations occur between our narratives — object biographies — and formal schemata, using the CIDOC-CRM heritage-aligned ontology. I explained how these systems have trouble relating nuance and uncertainty, and fragment and normalise narratives in the interests of universality and standardisation. Narratives are the basis for our work within numerous heritage-aligned fields such as art history and archaeology, and so I then considered the act of reproducing rich narratives from metadata constructed through deracination and reduction of knowledge. I

argued that, despite shortcomings, these systems do offer the potential for new, recombinant histories and narratives to be constructed by following different trajectories through the data. I concluded this chapter by constructing the digital object as being comparable with the mould from which plaster casts are made, neither the original, nor the copy. It offers potential for an infinite number of copies, surrounded by networks of data which facilitate its epistemic nature. By leveraging these objects, copies, and data to construct small scale, *singularised* narratives — rather than overarching metanarratives — we can in some way challenge the biases and structures which inform the legacy schemata and systems in which we work.

In chapter 5 I stepped back to the macro scale, and inspected the ontological status of the thing itself, and how this is entangled with multiple modes and concepts of authenticity. Furthermore, authenticity itself has numerous constructions, which I discussed and disambiguated into two modes. Firstly, *affective* authenticity, being embodied, material and emotional, reflecting Benjamin's *aura*, and secondly, *provenential*, relating to the provenance and documentation trail of the thing. I argued that the differing ontological states of a thing through its life manifest different balances of these forms, shifting not just temporally, but dependent on its path as epistemic object or commodified antiquity. I asserted the importance of understanding these issues where digitisation happens, as this informs both what gets recorded, and how we approach and use the subsequent digital object.

IMPLICATIONS OF THIS RESEARCH

As I discussed in chapter 4, mass digitisation projects tend to focus on metrics and deliverables — throughput, quality, scale, expenditure and other markers of neoliberal academia and corporatised heritage. Furthermore, many of these projects, being funded or entirely performed from within the Global North, have their outlets in repositories and archives based there, in a form of what media theorists Nick Couldry and Ulises Mejias call *data colonialism* (Couldry and Mejias 2019). They also frequently focus on large-scale themes and metanarratives of primary interest to theorists and practitioners in the region, rather than locally relevant issues.

I offer small-scale, local, "slow digitisation" not as a replacement for large-scale mass digitisation, but as a complementary approach, offering different affordances. There is still scope for such small-scale approaches to contribute to these larger projects and aggregations, that is, assuming we can at some point overcome resistance to the use (and re-use) of other practitioners' models and data. Focusing on digitisation at a smaller scale, particularly within a South African context, affords opportunities towards both knowledge production and capacity building within heritage-aligned fields. By focusing on individual *things* rather than entire collections, the digitisation process becomes an act of learning *from* and *with* the thing. The knowledge gained here contributes to the body of knowledge accreted around the thing, increasing its value as an epistemic object. At the same time this ensures that the resulting digital object remains within a local context with its local relationships intact, rather than being a fungible data-point in a large-scale, potentially global, database.

The hazards of data colonialism may involve the storage of digital things in a European or American oriented project database, or merely the fact of a database being physically hosted in another country (for instance the Metsemegologolo project database is currently hosted in Frankfurt, as this was the more affordable option). This highlights the need to not just store these things locally, but also to curate, display and work with them in a local context. Adherence to a core set of standards would still allow them to be accessed and shared in a global context, but emphasising small-scale, local use reintegrates the digital object in its local webs and networks of meaning and relevance — for instance, the location of the Scotston site is of little relevance elsewhere in the world, but any South African who has travelled between KwaZulu-Natal and Gauteng by road will immediately be aware of Van Reenen. In order for this to be practical and sustainable, there is then clearly a need for the appropriate skills and tools to be developed for and within the local context. Accessible and affordable tools for both production and storage/curation/visualisation — preferably in the form of freely available and modifiable open-source software — are vital to such a project.

Working at this small scale teases out personal practice in acts of digitisation and digitalisation, and exposes communities of practice and individual agency. Recording these practices in the form of personal *chaînes opératoire*, and incorporating these into the networks of

knowledge and documentation in which the digital object is imbricated, affords us the multiple opportunities. Firstly, is the ability to expose something of the inner workings of the *black-boxes* which delineate much of the equipment and software used in digitisation. This allows us to begin to demystify the technologies involved and trace their origins and burdens. Secondly, within heritage-aligned fields, a significant set of critical skills and domain knowledges are learned through involvement in communities of practice, both in-person and online. Documentation of these practices has potential to be valuable in teaching and contributing to these communities, including those of technical digitisation, micro-histories, object biographies and itineraries, and material culture studies. There is also potential to contribute to open-source development of relevant tools – as such domain-specific practitioner input to these software projects is rare. In conclusion, I suggest that the conversation contrasting the physical thing and the digital object across a continuum of physical/virtual is unproductive. There are indeed factors of materiality, physicality, and phenomenology which affect our engagement with things as epistemic affordances, however these are overridden by the encumbrances inherent in the systems within which they are classified and studied. These schemata and systems are products of enlightenment era thought, and appropriated and solidified by the colonial project. Their origins are still reflected within digital classification and archiving, and acknowledging this is a small, yet important step when considering methodologies and approaches to digitisation.

FUTURE DIRECTIONS

This research has exposed a number of potentially productive threads for future research, both from theoretical and practical perspectives. Firstly, as I mentioned in chapter 2, I have not fully unpacked the systems within which things are classified as epistemic objects. This would involve an examination of my earlier-mentioned concept of *artificial ontologies* and the decisions informing their creation — essentially a historiography of schemata. This would be built upon existing work dealing with pre- and early- digital systems, such as that by Bowker and Star (Bowker and Star 1999).

Secondly, and similarly, I intend to follow the technologies of digitisation themselves (and their antecedents), much as I did in chapter 3 regarding the origins of photogrammetry.

Many of these technologies have roots deep within processes and industries of surveillance, war, and colonialism. Lisa Parks and her work on satellites (Parks 2005) or Goodman and Lawless on the video tape recorder (Goodman and Lawless 1994) provide compelling models for this approach.

On the practical and technical front, I have identified two further continuations of this research. A significant barrier to effective use of schemata such as CRM is the sheer workload of understanding the standard and deracinating and disambiguating narrative passages while constructing metadata. Zhao *et al* have unsuccessfully attempted to perform this in the reverse direction, by (re)producing narratives from formalised metadata (Zhao, Twidale and D. M. Nichols 2018). Encouraged by work by digital archaeologist Shawn Graham (*Shawn Graham* 2023), I am considering a re-evaluation of so-called "AI", or large language models. Rather than using publicly trained models such as "ChatGPT" trained on unknown, uncontrolled and generalised datasets, a locally-run model, trained *exclusively* on data from a carefully selected, local (and legally obtained!) corpus might prove useful for creation of metadata from narratives and other knowledge. This may also be incorporated with Named-Entity recognition for extracting references from said narratives.

A further direction of practical research is based on the idea of "everting the archive". As I have discussed, a digital object requires a complex ecosystem for its use and continued existence, in the form of servers, databases and archival platforms. As a response to this, and considering different approaches to the "low-resource" problem as outlined by Hussein Suleman (Suleman 2019), I envision what might be called a "robust digital object". This object — a 3D model or other digitisation — exists enwrapped in all the neccessary knowledge, narrative and data required to contextualise it and use it productively as an epistemic object. The object would not require a remote, internet connected database to sustain it, and it could be "checked out" (in perpetuity) like a library book, and used offline. Furthermore, it could possibly even be returned with new knowledge attached to it, in a sort of digital bowdlerism. This may offer some insight towards the multiple problems — discussed above — of local production, accessibility and maintenance of digitised things.

As a final thought; equipment, software and techniques for 3D digitisation are constantly evolving. This may allow us to produce models faster, or with higher precision, or with less involvement and skill from the practitioner, and it is convenient to lean into popular discourses of technological accelerationism, with implications that current techniques and their products have been superseded and made obsolete. I argue that this does not necessarily invalidate these earlier models and work. Knowledge has been created through engagement with the *thing* while producing the model, and we understand that the model is not a replacement for this, and is not the endpoint of the thing's life, but another nodal point in its life along with new, "better" models and data.

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