School of Design and the Built Environment

No Direction Home: Photogrammetry and the Post-natural World

Gregor MacGregor

0000-0001-6971-0164

This thesis is presented for the Degree of

Doctor of Philosophy

of

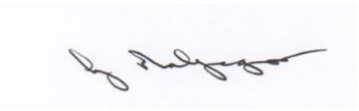
Curtin University

January 2023

Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other qualification in any university.

Signature: 

Date: 19th January 2023

……

ACKNOWLEDGMENTS

I would like to start by acknowledging my appreciation for my supervisors, Dr Qassim Saad and Dr Andrew Hutchison, whose support throughout the process was invaluable. Their knowledge and experience helped me navigate the various stages that one inevitably encounters along the way. Their counsel and passion for the project helped me to maintain momentum, especially during the final stages of the project. I would also like to express my gratitude for my co-supervisor Dr Michael Gray, whose support, as both a practicing photographer and an academic, was a huge benefit to me from the proposal stage through to the final editing process .

Without access to the Western Australian Museum collection, it is impossible to imagine how the practice-led component of my research would have materialised. This was due to the generosity of Mara Pritchard, head of media resources, who introduced me to Clay Bryce, senior project officer at the WA Museum. The generosity and curiosity they showed towards the research was vital and, without it, the journey would have taken a completely different path. It is important to also mention the Hub for Immersive Visualisation and eResearch (HIVE) at Curtin University and Associate Professor Andrew Woods, who allowed me to participate in their meteorite project. This enabled me to continue my practice-led research when access to the WA Museum was curtailed due to Covid lockdowns and resulted in the *Temporal Undulations: Topography of a Meteorite* series.

This PhD owes its beginning to the encouragement and support of the staff in the photography department at the School of the Built Environment and Design, Curtin University, namely, Dr Toni Wilkinson and Dr Michael Gray and, of course, Eddie Resera. I could not imagine starting this process without their kindness and support. Finally, my wife, Catriona whose patience and support exceeded my expectations, I sincerely thank you.

Abstract

This practice-led research project examines the role of optical technologies in constructing a narrative for a post-natural word. The research investigates the aesthetic potential for the computational photographic technique of photogrammetry to create a visual inventory that maps out a nature in crisis.

The creative output, *No Direction Home*, aims to generate phenomenological experiences that re-construct a new narrative that sits outside of the scientific discourse on climate change. This has been achieved by using photogrammetry, the process of triangulating multiple photographs to create a three-dimensional object. This method has then been applied to the cataloguing of artefacts from the natural world in the Western Australian Museum collection. The purpose is to replicate the inventorial role of the photographic image in cataloguing collections, and to acknowledge the role of institutions such as museums in our understanding of the world.

The research highlights the role the photographic image has played in exacerbating the view of the world as something separate from humanity, and the potential for new optical technologies to construct a new narrative that immerses the viewer in the image to overcome our inherent anthropocentric bias, thus transitioning the image from an objective image of observed reality to one that is an immersive phenomenological experience.

TABLE OF CONTENTS

Declaration ii
Acknowledgments iii
Abstract iv
List of Figures viii

Chapter 01 Introduction & Exegesis structure……..……..1

1.1 An overview of the research project
1.2 Key issues
1.3 Main objective
1.4 Aims
1.5 Research questions
1.6 Objectives
1.7 Project
1.7.1 After Nature
1.7.2 Digital Uncanny: digitising a post-natural world
1.7.3 Temporal Undulations
1.8 Exegesis structure
1.9 Conclusion

Chapter 02 Methodology: Digitising nature…….…….…….16

2.1 Introduction
2.2 Framing practice-led research
2.3 Method/Photogrammetry
2.4 Mapping out a new digital reality with Metashape
2.4.1 Hardware Build
2.4.2 Photographic workflow
2.4.3 Metashape workflow
2.4.4 Digital visualisation
2.4.5 Stereolithographic 3D printing
2.4.6 Digital Animation

2.5 Conclusion

Chapter 03 Situating concepts I: Nature of the object……..…40

3.1 Introduction
3.2 Situating Creative Outcomes
3.3 The photographic image: A modern necromancy
3.4 The digitised photographic image: Constructed realities
3.5 Museums: Digitising the Object
3.6 Phenomenological perception of photogrammetry
3.6.1 Intertwining the subject-object and the culture-nature divide
3.7 Ponty's "*The Visible and the Invisible"*
3.8 Perception of reality in a post-anthropocentric world
3.9 Conclusion

Chapter 04 Situating concepts II: The subject-object & human- nature divide……..……..63

4.1 Introduction
4.2 The Anthropocene: an epoch for the age of humans
4.2.1 Post nature
4.2.2 Anthropocene
4.2.3 Sixth mass extinction
4.3 Hyperobjects
4.4 Moving beyond the entropic vortex of the Anthropocene
4.5 Conclusion

Chapter 05 Situating Practice: *After-Nature*……..…….. 79

5.1 Introduction
5.2 Photography: A medium for the exactitude of science
5.3 Sublimating the museum experience
5.3.1 Anthropomorphising of Jimmy the chimp

5.4 Mapping the impossible document
5.5 The aura of the digital object
5.6 Conclusion

Chapter 06 Creative outcomes: *No Direction Home,* final portfolio.…107

6. 1 Introduction
6.2 *After-Nature*: Digital artefacts for a post-natural world
6.3 *Death Mask of a Chimpanzee: Extinction*
6.4 *Temporal undulations: Topography of a Meteorite*
6.5 *Digital Uncanny*
6.6 Conclusion

Chapter 07 Conclusion……..132

7.1 Introduction
7.2 The Chiasm: Intertwining
7.3 A new narrative
7.4 Optical technologies
7.5 A digital world
7.6 Re-constructing the image

References…….……...…..141

Appendix …….……..…..147

List of Figures

Figure 1. Screenshot of image alignment for meteorite. Image by Gregor MacGregor 4
Figure 2. Location and workflow set up at WA Museum. Image by Gregor MacGregor. 6
Figure 3. Prototype cabinet for Death Mask of a Chimpanzee and various 3D prints. Image by Gregor MacGregor. 19
Figure 4. Yosemite. Stereograph. Image by Watkins. C. (1878-1881). Dimensions unavailable (Exception to ©. Section: ss40, 103C. Exception: Research or study. 22
Figure 5. Brewster's refracting Stereoscope. 1840's. Dimensions Unknown. Exception to ©. Section: ss40, 103C. Exception: Research or study. 23
Figure 6. Great buddha's of Bamiyan, 2004. Photograph and 3-d re-construction. Images by Remondino©. Exception to ©. Section: ss40, 103C. Exception: Research or study. 24
Figure 7. United States Air Force, 1930. Mosaic mapping, Langley field. Virginia. Photographer unknown. (Exception to©. Section ss40, 103C. Exception: Research or study.) 25
Figure 8. Matterport screenshot, test. Image by Gregor MacGregor. 2021 27
Figure 9. Location set, Welshpool. WA museum storage facility. Image by Gregor MacGregor. 2020. 27
Figure 10. Performance comparison of photogrammetry results in OBJ file format. Reproduced from Setiyade, Mukhtar & Cahjadi.(2012). Exception to ©. Section ss40, 103C. Exception: Research or study. 32
Figure 11. Point cloud, Screenshot. Image by Gregor MacGregor, 2021. 36
Figure 12. Mesh model, screenshot. Image by Gregor MacGregor, 2021. 36
Figure 13. Dense point cloud, screenshot. Image by Gregor MacGregor, 2021. 36
Figure 14. Image Alignment screenshot. Image by Gregor MacGregor, 2021. 36
Figure 15. Meteorite 3D print (SLA). Reset residency, PCP. Image by Gregor MacGregor, 2021. 37
Figure 16. SLA printing in progress. Image by Gregor MacGregor, 2021. 38
Figure 17. Preparing OBJ file for 3-D printing. Image by Gregor MacGregor, 2021. 38
Figure 18. Finished 3-d print. Image by Gregor MacGregor, 2021. 38
Figure 19. Print after curing process. Image by Gregor Macgregor, 2021. 38
Figure 20. Plate IV. Articles of China. Salted print from paper negative. Dimensions Unknown. William Fox Talbot, 1844. 48
Figure 21. The Great Wave, Sete. Albumen silver, wet plate Collodian. Dimensions: 33.7cm x 41.4cm. Gustave Le Gray, 1858. Reproduced from the MOMA collection. (Exception to ©. Section: ss40, 103C. Exception: Research or study). 50
Figure 22. The Rhein II. Photographic print on paper (1564cm x 3083cm). Andreas Gursky, 1999. reproduced from Tate gallery. 49
Figure 23. Black Box of vision: a hypothetical design for the visual mind. Reproduced from Mirrors in Mind, Richard Gregory, 1997. (Exception to ©. Section ss40, 103C. Exception: Research or study). 56
Figure 24. Death Mask of a Chimpanzee. Video still, showing front of mask. Image by Gregor MacGregor, 2021. 59
Figure 25. Death Mask of a Chimpanzee. Video still showing inverted mask. Image by Gregor MacGregor, 2021. 59
Figure 26. The Hollow face. Reproduced form Mirrors in Mind. Richard Gregory, 1997. (Exception to ©. Section: ss40, 103C. Exception: Research or study. 58

Figure 27. Temporal Undulations: Topography of a Meteorite. Installation shot. Image by Gregor MacGregor, 2022. 71
Figure 28. Digital Uncanny, third milestone pre-submission. Augmented reality screenshot. Image by Gregor MacGregor, 2022. 76
Figure 29. Digital Uncanny, third milestone pre-submission. Augmented reality screenshot. Image by Justin Owen©, reproduced with permission. 76
Figure 30. Digital Uncanny. Third milestone pre-submission. Augmented reality screenshot. Image by Gregor MacGregor, 2022. 77
Figure 31. Articles of Bones. photographic print (100cm x 150cm). image by Gregor MacGregor, 2020. 82
Figure 32. William Fox Talbot, 1844. Plate IV, Articles of Glass. Collodion print, dimensions unknown from The Pencil of Nature. De Capo press, New York. (Exception to ©. Section: ss40, 103C. Exception: Research or study). 82
Figure 33. Left hand side: Fox Talbot, 1844. Reproduced from the Pencil of Nature. Right hand side, Gregor MacGregor. 2022. reproduced from After-Nature. (Exception to©. Section: ss40, 103C. Exception: Research or study. 83
Figure 34. On Exactitude in Science. A Universal History of Infamy. Borges, J, L. 1946. Reproduced as a facsimile of Fox Talbots letter to the readers in Pencil of Nature. (Exception to ©. Section ss40, 103C. Exception: Research or study.).....85
Figure 35. Proof pages from After-Nature. Reset Residency, installation at Perth Centre for Photography. Image by Gregor MacGregor, 2021. 87
Figure 36. Olafur Eliasson, The Weather Project, 2003. Monofrequency lights, projection foil, haze machines, mirror foil, aluminium, and scaffolding. 26.7m x 22.3m x 155.4m. Installation in Turbine Hall, Tate Modern, London. Photo: Studio Olafur Eliasson,© Olafur 89
Figure 37. Death Mask of a Chimpanzee: Extinction. Photographic print 100cm x 150cm. Image by Gregor MacGregor, 2022 92
Figure 38. Death Mask of a Chimpanzee: Extinction. 3d Print (SLA), 25cm x 15cm. Acrylic box and plinth 30cm x 30 cm x 120cm. Light and Shadow exhibition. Image by Gregor MacGregor, 2020. 93
Figure 39. Argentiere Glacier No.1. C-type photographic print, 44.2cm x 80cm. Reproduced from holdsworth.works.archive.image © Dan Holdsworth, 2016. (Exception to ©. Section:ss40. 103C. Exception: Research or Study). 95
Figure 40. Temporal Undulations: Topography of a Meteorite. Photographic print, 100cm x 120cm. Contemporary landscape in Photography, award winning entry, Perth Centre for Photography. Image by Gregor MacGregor, 2022. 97
Figure 41. monolith, The Face of Half Dome Rock. Photographic Print. ©Adams estate. Image by Ansell Adams, 1927. (Exception to ©. Section: ss40, 103C. Exception: Research or study). 100
Figure 42. Temporal Undulations. Photographic print, 100cm x 150cm. Image by Gregor MacGregor, 2022. 100
Figure 43. Temporal Undulations: Topography of a Meteorite. 3D Print (SLA), and digital animation, Reset residency. Image by Gregor MacGregor, 2021. 100
Figure 44. Factum Foundation, 2019. Digital reconstruction of the sacred cave of Kumukuwaka. https://www.factumfoundation.org/pag/1289/the-sacred-cave-of-kamukuwaku (accessed: 31/05/21). ©Factum Foundation. (Exceptionto ©. Section ss40, 103C. Exception: Research.....102

Figure 45. Digital Uncanny, Starfish Diptych. Photographic Print, 100cm x 100cm. Image by Gregor MacGregor, 2022. 106
Figure 46. Digital Uncanny, Augmented reality Starfish. Image by Gregor McGregor, 2022. 106
Figure 47. After-Nature. Baboon. Photographic print, 100cm x 150cm. Image by Gregor MacGregor, 2021. 109
Figure 48. After-Nature: Blue whale on pallet. Photographic print. Image by Gregor MacGregor, 2020. 113
Figure 49. After-Nature: Chimpanzee wrapped in plastic. Photographic print. Image by by Gregor Macgregor, 2020. 113
Figure 50. After-Nature: Table of birds. Photographic print. Image by Gregor MacGregor, 2020. 113
Figure 51. After-Nature: Primate feet and silver tape. Photographic print. Image by Gregor MacGregor, 2020. 113
Figure 52. After-Nature: Python in glass box. Photographic print. Image by Gregor MacGregor, 2020 113
Figure 53. After-Nature: Dolphin in plastic wrap. Photographic print. Image by Gregor MacGregor, 2020. 113
Figure 54. After-Nature: Articles of bones. Photographic print, 100cm x 150cm. Image by Gregor MacGregor, 2020. 114
Figure 55. After-Nature: Albino Raven. Photographic print. Image by Gregor MacGregor. .115
Figure 56. After-Nature: Bird in box. Photographic print. Image by Gregor MacGregor. 115
Figure 57. After-Nature: Shells in a cigarette packet. Photographic print. Image by Gregor MacGregor. 115
Figure 58. After-Nature: Shells in boxes. photographic print. Image by Gregor MacGregor, 2020. 115
Figure 59. After-Nature: Shells in matcboxes. Photographic print. Image by Gregor MacGregor, 2020. 115
Figure 60. After-Nature: Seagulls eggs in tray. Photographic print. Image by Gregor MacGregor, 2020. 115
Figure 61. Pencil of Nature. William Fox Talbot. 1844. 116
Figure 62. After-Nature (A forgery of sorts). Image by Gregor MacGregor. 116
Figure 63. Death Maskof a Chimpanzee: Extinction. Photographic print, 100cm x 150cm. Image by Gregor MacGregor. 118
Figure 64. Death Mask of a Chimpanzee:Extinction. 3D print, 25cm x 15cm. Image by Gregor MacGregor. 119
Figure 65. Death Maskof a Chimpanzee. 3D print with reflection. Image by Gregor MacGregor. 119
Figure 66. Death Mask of a Chimpanzee: Extinction. Still from digital animation. Image by Gregor MacGregor. 120
Figure 67. Temporal Undulations: Topography of a Meteorite. Typological grid. Photographic print, 120cm x 100cm. Image by Gregor MacGregor. 122
Figure 68. Temporal Undulations: Topography of a Meteorite. 3D print, 20cm x 15cm. Image by Gregor MacGregor, 2022. 123
Figure 69. Temporal Undulations: Topography of a Meteorite. Still from digital Animation, full render. Image by Gregor MacGregor. 124

Figure 70. Temporal Undulations: Topography of a Meteorite. Still from digital animation, digital mesh. Image by Gregor MacGregor.....124
Figure 71. Digital Uncanny: Sea Urchin. Photographic print, 100cm x 100cm. Image by Gregor MacGregor, 2022. 126
Figure 72. Digital Uncanny: Sea Urchin, texture map, 100cm x 100cm. Image by Gregor MacGregor. 126
Figure 73. Digital Uncanny: Sea Urcin. QR code. Image by Gregor MacGregor. 127
Figure 74. Digital Uncanny: Sea Urchin. Augmented reality. Image by Gregor MacGregor, 2022. 127
Figure 75. Digital Uncanny: Hawk. Photographic print, 100cm x 100cm. Image by Gregor MacGregor. 128
Figure 76. Digital Uncanny: Hawk. Texture map. Photographic print, 100cm x 100cm. Image by Gregor MacGregor. 128
Figure 77. Digital Uncanny: Hawk. Augmented reality. Image by Gregor MacGregor. 129
Figure 78. Digital Uncanny: Hawk. QR code. Image by Gregor MacGregor. 129
Figure 79. Digital Uncanny: Coral. Photographic print, 100cm x 100cm. Image by Gregor MacGregor. 130
Figure 80. Digital Uncanny: Coral. Texture map. Photographic print, 100cm x 100cm. Image by Gregor MacGregor. 130
Figure 81. Digital Uncanny: Coral. QR code. Image by Gregor MacGregor. 131
Figure 82. Digital Uncanny: Coral. Augmented reality. Image by Gregor MacGregor, 2022.131

Chapter 01 Introduction & Exegesis structure……1

1.1 An overview of the research project

1.2 Key issues

1.3 Main objective

1.4 Aims

1.5 Research questions

1.6 Objectives

1.7 Project

1.7.1 *After Nature*

1.7.2 *Digital Uncann*y: Digitising a post-natural world

1.7.3 *Temporal Undulations*

1.8 Exegesis structure

1.9 Conclusion

1.1 An overview of the research project

As a practice-led research project, the outcome of this enquiry is to create a series of artworks entitled *No Direction Home* that is supported by a theoretical analysis. The creative series is a combination of photographs, three-dimensional sculptural pieces, digital animations, and immersive mixed-reality experiences. The primary creative method that the research employs is digital photogrammetry, a process that stitches multiple, overlapping photographs together to generate a photorealistic three-dimensional object. Photogrammetry is normally applied in disciplines such as geology and archaeology and, as such, is regarded as a visual instrument for scientific measurement. However, as my background is in photography, my approach considers this process from a photographic perspective, as an expansion of the photographic image in the post-photographic era. Consequently, the theory that informs the practice-led research is of a non-empirical nature. This is a phenomenologically based inquiry into how emergent (visual) representational technologies may provide new insights into the perception of an increasingly digitised world.

Digital technologies are changing the way in which we take, view, and perceive images, thus challenging our perception of the image as object. My research investigates how this changes our relationship with the subject-object divide. Using imaging technologies such as multi-image photogrammetry, we are now creating three-dimensional objects as opposed to two-dimensional images. This creates new ways in which the viewer can experience the image, which are more immersive and emotive and yet to be fully realised, beyond serving as a visual record of objects. By aligning critical discourse on perception and nature as well as exploring the creative potential of digital photogrammetry, I aim to create multiple embodied experiences that challenge the viewer's anthropocentric bias with the aim of questioning the viewer's preconceptions on the subject-object divide and exploring the potential for narrowing the culture-nature divide.

As these visual technologies are becoming more experiential and interactive, moving away from visual observation, the theoretical component of the research will incorporate an analysis of the phenomenological discourse on technology and perception. Specifically, I refer to Heidegger's (1927/1977) philosophy on technologies

and Merleau-Ponty's (1948/2014) discourse on perception, moving the focus away from the role of empirical observation and opening up greater creative potential for the practice-led component. As photogrammetry is becoming an increasingly prevalent visual technology that is employed to generate photorealistic objects, and as digital assets are becoming incorporated into our digital experiences, that is, the metaverse, the research also incorporates the object-oriented ontologies (OOO) of Harman (2017), Morton (2013), and Hui (2016).

1.2 Key issues

Technology has changed the ways in which we, as subjects, can create, view, and ultimately experience images. As images become increasingly realistic, correspondingly, our perception of the image as object changes. As technology becomes more immersive, the boundaries between the natural and digital worlds will blur, challenging the dichotomy between subject and object. Through my research I examine the ways in which we can adapt this change.

As we go from one climate crises to another, it is becoming increasingly clear that our relationship with the natural world is fundamentally flawed. Humans are altering the environment at a rate never seen. It is becoming increasingly problematic to physically experience the natural world because our very presence is causing more problems than solutions. This research looks at how digital photogrammetry can challenge the culture-nature divide by examining how we can potentially modify our perception of the natural world through the visual applications of digital technologies.

The natural sciences and institutions such as museums, particularly in western societies, are strongly connected to the traditional epistemological theories of Kant and Descartes (Grayling, 2019). However contemporary (continental) philosophies have largely disputed these points of view. This questioning of Cartesian dualism first appears in the theories of the phenomenologists, specifically Merleau-Ponty's (1945) ideas on perception. Merleau-Ponty argues that placing the body (subject) into the experience of perceiving the object creates what is known as an embodied experience, potentially narrowing the subject-object divide. Merleau-Ponty's discourse on perception creates a starting point; however, to synthesise this discourse around

digital technology and the natural world, I also integrate the ideas of the object-oriented ontology (OOO) by theorists such as Harman (2018). The OOO theorists argue that the notion of an embodied experience still creates an anthropocentric bias with which we perceive the world around us. If we view the world from an anthropocentric point of view, we will always see the natural world as something 'other', something separate from us.

Through the application of these theories in my practice-led research, my aim is to create non-empirical experiences that explore new ways to understand our relationship with the natural world around us, and to investigate how technology and the digital image can immerse us, the subject, into a world that has up until now largely been viewed or experienced as something separate from the human. Another purpose of my installations is to question the impact that our anthropocentric bias has had on the natural world, the environment, and if it is possible that technology, through creative practice, can alter our bias and change how we perceive and understand the natural world.

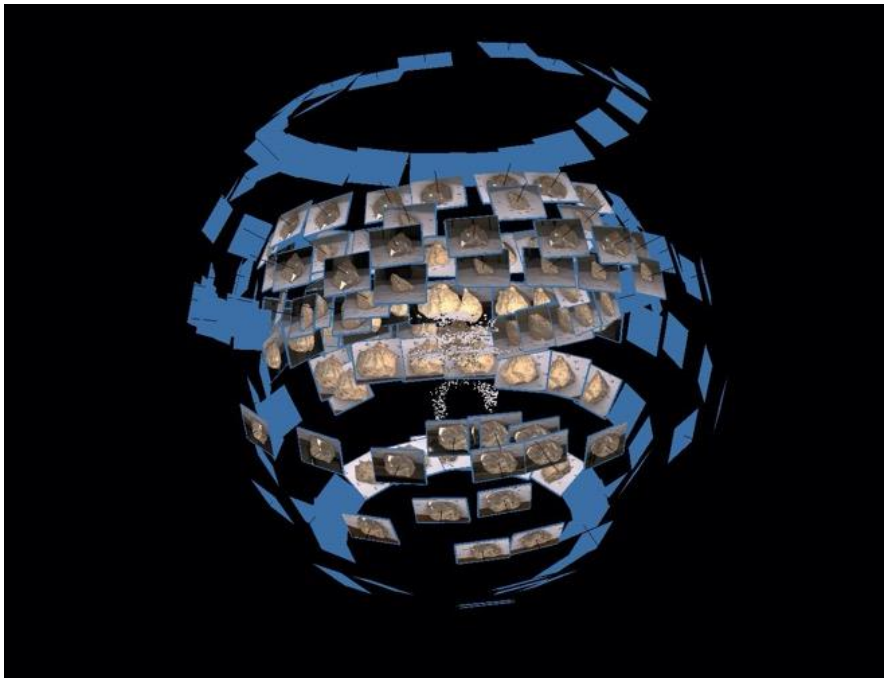


Figure 1. Screenshot of image alignment for meteorite. Image by Gregor MacGregor

1.3 Main objectives

The research investigates the role that three-dimensional technologies, such as photogrammetry, can have in altering our perception of the object. Digital multi-image photogrammetry (see Figure 1) is a process that has become affordable thanks to digital cameras. Increasingly powerful computers, smartphones, and open-source software are relatively accessible to non-professional photogrammetry operators, such as geologists and archaeologists. Digitising museum collections is already a well-established practice; however, this is mostly limited to two-dimensional photography. Photogrammetry can provide further benefits, offering both scientific advantages and novel interactions for the non-scientific observer. When a high-resolution digital camera is applied, photogrammetry can produce three-dimensional objects that are submillimetre accurate, while also generating photorealistic textures. The primary advantage of this process is that it is non-destructive, the same as taking a photograph; however, the digital object can be measured and handled, maintaining the integrity of the original artefact. The latter is significant because as museum collections get older, the original artefacts will become increasingly irreplaceable. My research privileges the creative possibilities of this technology over its scientific ones, and focusses on how this technology can be used to engage the viewer/subject to re-engage them with the natural world. The practical phase of my research largely took place within the storage facilities of the Western Australian Museum (henceforth WA Museum). Figure 2 shows an example of the work environment, which illustrates that this setup can be applied in multiple situations. Access to the WA Museum provided me with the raw data (photographic images) for exploring the creative possibilities, the results of which will be explicated in Chapter Five, Situating practice: *After-Nature.*

Relating the process employed by natural history museums to the subject they deal with has allowed me to further align my research with existing academic discourse on the culture-nature and subject-object divides. The natural sciences and (western) society have been grounded in traditional views on the subject and the object since the times of Kant and Descartes. We, humans, observe the object and we gain

Figure 2. Location and workflow set up at WA Museum. Image by Gregor MacGregor.

knowledge through what we observe/perceive; however, modern philosophy has been questioning this relationship between subject and object (Haila, 2000). The continental philosophers from the phenomenologists to the speculative realists have moved away from this Cartesian/anthropocentric point of view; however the Cartesian views still persist (Ben-Zeev, 1989). My research, therefore, asks if the immersive nature of digital technologies can alter the anthropocentric bias that is inherent to the subject-object and culture-nature divides. Through investigating the creative potential of photogrammetry within museum design, I aim to allow the viewer/subject to experience their relationship with the object. This practice-led research is supported by theoretical discussion of the work of Merleau-Ponty (1945), Morton (2014), and Harman (2018)

In further research, I draw on and intertwine the phenomenological theories of Merleau-Ponty regarding perception of the image as object, technology, and nature, together with current environmental philosophies, specifically McKibben's (1989), Vogel's (2016), and Harman's (2018) object-oriented ontology, which moves away from the anthropocentric bias and traditional Cartesian philosophies that have created the current human-nature divide. I apply phenomenological theories on the embodied experience to my practice-led research. Phenomenology is the study of our structures of consciousness/experiences from the first-person point of view, namely the ways in which we experience things; it can be seen as a disciplinary field within philosophy or as a movement within the history of philosophy (Cerbone, 2006). Phenomenology marks a significant move away from the established philosophies of Kant and Descartes, whose frameworks for gathering knowledge are still embedded in the epistemological approaches of western societies.

My research approaches phenomenology as a disciplinary field within philosophy, privileging the theories of Merleau-Ponty and his text *Phenomenology of Perception* (1945). The research aims to develop an intersection or, as Merleau-Ponty describes it, a chiasm (1968), between phenomenology and speculative realism.

1.4 Aims

The research aims to:

- Articulate aspects of the Anthropocene in ways that sit outside of scientific and mass-mediated discourses.

- Investigate the potential of emergent visual technologies with regards to phenomenologically informed visual mediums and, in doing so, create new visual outcomes that evoke a sense of the scale of human-altered nature.

- Further academic and art-based enquiries into the space between culture and nature in ways that examine discourse around the Anthropocene.

In this context, the space between nature and culture is aligned with the space between the perceiving subject and the world prior to perception. As the practical component of the research is primarily concerned with visual phenomena, the project is grounded in lens-based visual mediums as a way of arriving at new understandings. In this regard, a practice-led methodology is employed, which is articulated further in the methods section to follow.

To achieve the aims mentioned above, I have blended critical analysis with a creative practice that borrows from the traditions of museum display and their epistemological need to collect and catalogue objects from the world around us.

1.5 Research questions

The research seeks to answer the following primary questions:

- Can an enhanced appreciation of the Anthropocene be arrived at through creative outcomes that conflate the human-nature divide with phenomenological inquiries into the subject-object divide?

- In what ways will emerging three-dimensional technologies challenge our perception of the subject-object divide and our relationship with the natural world?

In addition, the research addresses the following secondary questions:

- Can museums apply imaging technology to move beyond their epistemological role of re-presenting historic realities of the natural world?

- How will digital technology change our perception of the photographic image?

- Will generating digital simulations of the natural world affect the ways in which we experience the ‘real’ natural world?

1.6 Objectives

The significance of this research is directly linked to its aims. The research to date has identified limitations of science and the mass media in communicating the existence and effects of the Anthropocene era (Crutzen, 2016). Further, this directs the research towards questioning the ever-evolving space between the 'natural world' and humanity. The subsequent outputs can be discussed in numerous terms beyond the Anthropocene and nature-culture divide. These terms are primarily aligned with phenomenology, lens-based technology, and current discourses on environmental issues around the Anthropocene. By incorporating aspects of traditional phenomenological discourse on perception (Merleau-Ponty, 1948) in the creative work, the research seeks to continue the debate on the subject-object divide. In addition, the subject matter draws on contemporary environmental philosophical ideas about human impact on the biosphere (Morton, 2014; McKibben, 1989; Harman, 2018).

Furthermore, my research investigates the applications of photogrammetry within museums and the possibilities for deepening our relationship with the natural world in an increasingly virtual one (Carey, 2012, Markowitz et al., 2018). This deeper relationship will be achieved through visual experiences exploring ways in which photogrammetry can engage the viewer as subject and intertwining these outcomes with a theoretical investigation. In this regard, the research is significant as it aims to provide affective new insights into emerging technology.

1.7 Project

At the core of my research is an exploration of the ways in which our perception of the photograph has changed since photography firmly established itself in modern discourse, and within the post-photographic era (Ritchen, 2009). As digital technology has become more accessible, the applications and uses of the photographic image have expanded. One of these applications is digital photogrammetry. This is the process of using multiple, traditional two-dimensional photographic images of an object to generate a three-dimensional model. Whilst photogrammetry is not a new technique, the introduction of digital cameras along

with access to powerful computers have opened up possibilities for the applications of photogrammetry. Traditionally photogrammetry is the process of making measurements through the analysis of overlapping photographs (McCarthy, 2014) as shown in Figure 2. It was originally used as a method to generate maps with a three-dimensional, stereoscopic depth to them; however, digital technology has made it possible to combine large groups of images, rather than just pairs of photographs. Digital photography has allowed much larger data sets to be used to reconstruct complex three-dimensional models. As a result, multi-image photogrammetry, with its relative speed and the low cost of the digital hardware and software, has been adopted for archaeology and cultural heritage imaging (McCarthy, 2014). In archaeology, multi-image photogrammetry is seen as a non-invasive method of measuring and researching the data, rather than potentially damaging the original artefact.

1.7.1 *After-Nature*

After-Nature was intended to be the first of a triptych that eventually became the series *No Direction Home.* It incorporates photographs, three-dimensional prints, and digital animations aiming to articulate aspects of the Anthropocene in ways that sit outside of scientific and mass-mediated discourse. The photographic prints represent both the beginning of the era of the *technical image* [emphasis added] (Flusser, 1983), and how digital technologies can potentially alter our perception of the photographic image from the depiction of reality to the projection of a concept.

1.7.2 *Digital Uncanny*

The diptychs in *Digital Uncanny* are part of a series that explore how expanded photographic techniques can generate an altered experience, compared to the traditional photographic image, by using photogrammetry to generate 3D facsimiles of the original object.

One of the images is a photographic image of the 3D print, stripped of any pretense at reality, and the other is a computer-generated map of the photographs that the software requires to allow us (humans) a realistic perception of the object (nature).
Digital Uncanny is aimed at questioning the empirical role of collecting objects from the natural world and the impact this has had on the human-nature divide. As such, the work is additionally intended to question our relationship with a nature that no longer exists.

1.7.3 *Temporal Undulations*

Temporal Undulations is intended as a multi-media piece that includes photographic prints, a 3D print, and a digital animation. It explores the expanded role of photography in a post-photographic era and acts as a metaphor for the theories of Morton who states, “Hyperobjects are time-stretched to such a vast extent that they become impossible to hold in mind” (Morton, 2013, p. 58)

Temporal Undulations is a reference to Morton’s description of objects as they appear in time and space. He uses meteorites as an example and states that the temporal nature of these objects makes them physically unknowable. In his texts *Dark Ecology* (2016) and *Hyperobjects* (2013), Morton argues that our traditional (empirical) approach to understanding our place in the world is inadequate, exacerbating the human-nature divide, and that humans fail to fully understand concepts such as time, space, and climate. As such, *Temporal Undulations* is intended to work as a metaphor, exploring our relationship with a nature that no longer exists.

1.8 Exegesis structure

The structure of this exegesis is intended to lay out a conceptual framework that both informs and is intertwined with the practice-led research. The concepts initially appear to be separate to each other; however, they are intended to show a philosophical evolution of our anthropocentric perception of the world around us (nature), one that is beyond empirical observation. Initially discussed in separate sections, the creative work and discourse will intersect in the analysis of the creative outcomes of this

research and, in accordance with practice-led methodologies, the discourse and creative output will be cross referenced throughout the exegesis.

As such, the structure will firstly introduce the research, lay out the methodological process, situate and analyse the conceptual discourse, before situating the creative output, and then concluding. In the exegesis, I will be referring to the Constructive design research (CDR) model defined by Koskinen and Krogh (2015). Although similar to Research through Design (RtD), CDR requires methodological and theoretical flexibility from the researcher, and necessitates this by shaping the research via three different contexts, namely, the lab, the field, and the showroom (Bang et al., 2012). The 'lab' approach can be described as having a theoretical design process where variations of the design object are tested in a controlled setting, and subsequently using the results to generate new design knowledge and theory (Wensveen, 2018). The 'field' is defined by design that is examined within its natural setting; lacking the controls of a lab setting, it is driven by examining how people create meaning with the design artefact within its natural environment (Wensveen, 2018). My research can be perceived as a blend of all three approaches. The lab investigates digital programs, such as Metashape, within a digital environment, resulting in the three-dimensional imagery. The field refers to the period of taking photographic images within the warehouse of the WA Museum in Welshpool, resulting in an interrogation of the epistemological role of photography. The research subsequently pivots to the showroom approach, generating prototypes that are intended to be displayed within gallery, exhibition, and showroom-like spaces, as opposed to in books and scientific papers.

Chapter One - Introduction & Exegesis structure

The initial chapter is intended to act as an introduction to the research project, outlining the primary questions and aims, and laying out the overall structure of the exegesis.

Chapter Two – Methodology: Digitising nature

This chapter will primarily introduce the methodologies and methods that guide both the exegesis and creative output, such as the application of a methodology based on

a constructive design research model (Binder & Brandt et al, 2012; Koskinen & Krogh, 2015. Vaughan, 2017) that aims to produce knowledge through prototyping and experimentation. Complementing this method is a cyclical flow of action-reflection-action derived from practice-led fine art methodologies (Gray & Pirie, 1995, Crouch & Pearce, 2012). This more experimental design-led research (Vaughan, 2017) allows new outcomes for visualisation within a photogrammetry practice. This process, whereby hyper-realistic three-dimensional experiences are created through the digital blending of multiple two-dimensional photographic images, will also be documented and analysed in this chapter. As photogrammetry is heavily employed in natural history museum displays, there is a link between the process and the subject matter that provides provenance for the project's significance.

Chapter Three – Situating concepts I: Nature of the object

This chapter will establish the framework for the application of the critical discourse that situates the theoretical analysis of Merleau-Ponty's *Phenomenology of Perception* (1945) in relation to my research and how this understanding can be applied to what Flusser (1983/2000) describes as the technical image. This framework questions whether imagery is moving beyond the representational, back towards a less anthropocentric image, an image not made by hand (Levi Strauss, 2020), thus blending photogrammetry into the discourse on the post-photographic image.

Chapter Four – Situating concepts II: The human-nature divide in the age of humans

The purpose of this chapter is to examine the role that emerging optical technologies, specifically photogrammetry, have on our understanding of the natural world, given that the Metaverse is appearing almost as rapidly as the natural world is disappearing. The concepts examined in this chapter relate to the current discourses on Nature[1]. Environmentalists such as Vogel (2016) argue that our anthropocentric view of the natural world has created a schism between humans/culture and nature. This anthropocentric view has its base in the western empirical methodologies that have

[1] In a post-natural world, Nature is that part of the world, which is separate from human society. McKibben (1989) argues that this no longer exists.

underscored the natural sciences from the previous two centuries, a period that has arguably seen the rise of the Anthropocene and, consequently, climate change.

The research will align with the contemporary definitions of nature and post-nature within the discourse of Bill McKibben's *The End Of Nature* (1989). For introductory purposes, McKibbin argues that Nature (N), defined as the realm separate from human society, no longer exists; he posits a world where humans have altered every aspect of the natural world. This marks the beginning of the debate as to whether we are still in the Holocene epoch or are we in, as Crutzen (2016) suggests, the Anthropocene epoch (the age of humans); this definition will be explored in more detail later. McKibbin's definition is opposed to nature (n), which refers to the natural world of which humans are a part. Humanity's understanding of the natural world is often argued to be framed within our own social construction: we know nature through our scientific/empirical study of nature. This position is valid up to a certain point; however, ontologically this has a finite point and I will argue that a more phenomenological approach to perceiving nature may narrow the divide created through more traditional Cartesian methods. Allowing for a phenomenological approach that includes a more biological way of seeing the natural world, restricted by the limitations of human perception, and a psychological one that permits subjective reflections (Synder, 1996).

If we take McKibben's (1989) view that Nature no longer exists due to humans having affected/changed every aspect of the natural world, by definition we are in a post-Natural world. In this regard, he argues that rather than nature being a social construction, human actions have physically de-constructed nature, as evidenced by climate change and the depletion of the ozone layer. If we accept that Nature no longer exists, then the "environment" that we inhabit is that of a post-Natural world. Vogel (p.43) argues that previous environmental philosophy created a dualism between nature and humans. To close/narrow this human-nature divide, we must accept that humans and the environment cannot be separated: that they are "intertwined".

Chapter Five –Situating practice: *After-Nature*

The objectives of this chapter are to place the creative outcomes into an art/design practice that, whilst grounded in the photographic medium, looks to emerging optical technologies and the impact that they have on the perception of the image. The chapter combines the creative practice with the concepts and discourse in Chapters Three and Four, and analyses how the work expresses the aims and objectives of the research. This chapter also includes a selection of case studies that illustrate real-world applications of emerging optical technologies and situate my own creative outcomes within current practices.

Chapter Six- Creative outcomes: *No Direction Home,* final portfolio*.*

This chapter will lay out a visual representation of the practice-led component of my research, as it was presented in the third milestone pre-submission, and in my solo exhibition at Perth Centre for Photography. Each section represents a separate stage of my practice-led research, from the photographic image as a visual inventory to the digital image mapping of a world that no longer exists.

Chapter Seven – Conclusion

In the concluding chapter, new interpretations will be discussed by combining the methodologies and discourses that have been examined in the previous chapters. To achieve the research aims and objectives, a phenomenological interpretation of the experiences attained by creatively experimenting with the photogrammetric image will be applied to our understanding of the natural world.

Chapter 02 Methodology: Digitising nature…….16

2.1 Introduction

2.2 Framing practice-led research

2.3 Method/Photogrammetry: To draw and measure light

2.4 Mapping out a new digital reality with Metashape

2.4.1 Hardware build

2.4.2 Photographic Workflow

2.4.3 Metashape workflow

2.4.4 Digital Visualisation

2.4.5 Stereolithographic 3D Printing

2.4.6 Digital Animation

2.5 Conclusion

2.1 Introduction

The first part of this chapter introduces the applied methodologies that have framed the structure of the research. I will also outline the methods that defined the practical outcomes. Whilst the primary methodology follows the constructive design research (CDR) model outlined by Binder and Brandt, et al (2012), I also incorporate elements of practice-led research for fine art outlined by Gray and Pirie (1995), as well as Crouch and Pearce (2012). This allows for a more experimental, creative approach to the otherwise scientific/technical imaging process of photogrammetry, which will be discussed in the second part of this chapter.

Photogrammetry is an imaging technique that uses photographic data to generate three-dimensional objects and space. It is used in the fields of museology, geology, and archaeology. As such, it is primarily seen as a scientific method for visually inspecting and measuring without damaging the original artefact. However, my background is within the commercial and academic field of photography, so to establish a point of difference for the use of photogrammetry in my research, I approach photogrammetry from a creative-photographic perspective. Hence, I have chosen the CDR model to allow for an experimental deconstruction of the process, with the intention to explore how digital technologies have altered and expanded the role of the photographic image.

Whilst the creative output is broadly presented in chronological order, with each output incorporating discourse that in turn influences the next installation, I have maintained an open, experimental, reflexive, reflective, practice-based methodology. This approach is intended to generate a cyclical, nonlinear discourse that creates experiences for the viewer that sit outside the traditional scientific experiences of museums, and for a post-empirical world. As these ideas and discoveries have unfolded throughout the different stages of the research, I use this exegesis as an opportunity to revisit and reinterpret the previous installations. As an example, the first installation, *After-Nature*, was intended to be a traditional photographic series influenced by William Henry Fox Talbot's *The Pencil of Nature* (1844). However, as the research evolved through practice and contextual analysis, computer generated maps replaced the inventorial mode of photographic image.

This approach has resulted in a body of creative work that can be either experienced as individual works or as a whole, in that each installation represents a departure from the image as a purely representational document into an increasingly digital and immersive experience. Nevertheless, the works are all intertwined visually through the process of photogrammetry and contextually as critical discourse, with concepts ranging from the phenomenological theories of perception by Merleau-Ponty to Hui's ontology for digital objects influencing the overall creative output.

This chapter frames the methodological structure that has been applied to the research to gain new insights and knowledge through creative practice/design. I will also introduce the process of photogrammetry as it has been utilised in the practice-based research, and in a way that is grounded within the photographic medium, moving away from the indexicality of the inventorial image, as referenced in Talbot's *The Pencil of Nature* (1844), and towards a more immersive digital experience.

2.2 Framing practice-based research

This research project applies a practice-led methodology that incorporates aspects of a constructive design research model, providing a framework that aims to produce knowledge through prototyping and exploration of the possible through making (Binder & Brandt et al. p,101 2017). Specifically, constructive design research is a variation on research through design (RtD), which is a methodology where design practice and artefact production becomes the process for generating knowledge (Wensveen, 2018). In the exegesis, I will be referring to the constructive design research (CDR) model as defined by Koskinen and Krogh (2015). Like RtD, CDR requires methodological and theoretical flexibility from the researcher, shaping the research via three different contexts, namely, the lab, the field, and the showroom (Bang et al., 2012). The definitions of the 'lab', 'field', and 'showroom' have been outlined in the previous chapter. As they pertain to my research, I would define the lab as digital technology, the field as the locations where the original objects have been digitised, and the showroom as the gallery space. Specifically, digital technology relates to the use of a purpose-built computer (see Section 2.2.); the location has largely been at multiple sites within the WA Museum storage facility (see Chapter 3, Section 4). The

gallery or showroom broadly covers the presentation of the creative output (Chapters 5 and 6). This was conceived to be presented in various exhibitions throughout the research stage. This approach allowed for a process of action/reflection/action, which was integral to the research, to generate experimental outcomes that sit outside of both traditional photographic and photogrammetric expectations.

One of the earliest examples of what is regarded as Construction Through Design (CTD) can be seen in the *Presence Project,* which was developed in the 1990s in the Royal College of Art's Computer-Related Design program. One of the project's key statements was that "each step of the process, from the materials to our presentation, was designed to disrupt expectations about user research and allow new possibilities to emerge" (Gaver & Hook, 2017, p. 20-27). This approach allowed them to focus on the unexpected outcomes rather than the technology itself, permitting the designers to develop new workflows of the technology and explore ways to create a "research that has to negotiate the boundaries between research, practice, and art" (Koskinen & Krogh, 2015, p. 126).

Figure 3. Prototype cabinet for Death Mask of a Chimpanzee and various 3D prints. Image by Gregor MacGregor.

Correspondingly, in Binder and Brandt's article "Design (Research) Practice" (2017, p.101), they use the example of doctoral student Hansen's research to illustrate how CTD can be applied within PhD research. Hansen, an experienced ceramic designer, was exploring the differences between traditional design workflows that generate a finished design as well as including artefacts or prototypes that inform the research. He termed these artefacts/prototypes "epistemic artifacts", objects that generate new knowledge and generate new questions, and lead to the generation of new experiments, thus supporting a more disruptive dialogue between research programs and experiments (Hansen, 2010).

My research, to date, can be perceived as a blend of all three approaches. The lab investigates the digital programs, such as Metashape, within a digital environment, resulting in the three-dimensional imagery. The field refers to the period of taking photographic images within the warehouse of the WA Museum in Welshpool, resulting in an interrogation of the epistemological role of photography. The research subsequently pivots to the showroom approach, generating prototypes that are intended to be displayed within gallery, exhibition, and showroom-like spaces, as opposed to in books and scientific papers. The research encompasses a more critical and speculative approach to design research; the intention is to ask new and relevant questions, to design for debate, where the purpose of the design is to detach from established practices (Wensveen, 2018). An example of this methodology can be seen with a three-dimensional print that was used for an exhibit in the *Light and Shadow* exhibition (see Figure 2). Rather than being a literal interpretation of the original artefact, the print was intended to represent the changing perception of the photographic image and serve as a metaphor for extinction. The work aims to examine Hayles' (1996) argument that simulation technologies can extend our interactions into the artificial world, thereby reminding the viewer that our interactions with the natural world are constructed.

From a critical discourse point of view, CTD aligns itself with the notion of being inspired by post-Cartesian philosophies, in that design is not epistemologically accountable, for it does not require the same empirical systems that science does (Koskinen & Krogh, 2015). As such, this methodology intersects with the key concepts of the research, the purpose of which is to create visual experiences that transcend

the viewer's understanding of nature and climate that have traditionally been informed by a scientific point of view. The application of CTD methodology aims to disrupt the viewer's expectations and to engage them in the current debate around the natural world in new ways. These ideas underpin an article I wrote for *Cumulus Roma 2020-21* (temporarily postponed due to Covid), which was accepted for both publication and online presentation, titled "Three-dimensional Technologies: Digitising Nature". The article specifically analyses the role of natural history museums in adopting photogrammetric technology to digitise their collections. The article intersects with my final exegesis by aligning critical discourse on perception and nature with the creative potential of digital photogrammetry. Through this research, I aim to create multiple embodied experiences that challenge the viewer's anthropocentric bias and enable them to question their preconceptions around the subject-object divide, and to explore the potential for these experiences to be used for narrowing the culture-nature divide.

By drawing on interpretations derived from both fine-art practices and design-led research (Gray & Pirie, 1995; Crouch & Pearce, 2012; Vaughan, 2017), I frame my application of practice led research (PLR) as addressing two important postulates that are articulated when arriving at new knowledge; firstly, that the act of making/reflection can direct the research in unforeseen ways; and secondly, that the 'creative practitioner' has access to knowledge that the 'editor researcher' may not.

2.3 Method – photogrammetry: To draw and measure the light

In terms of practical methods, the primary technique applied in the creative component is photogrammetry, a process that has been adopted by geologists, archaeologists, and more recently in digitising museum collections. The initial phase of the practice-led research involved photographing objects of the natural world accessed from the WA Museum's warehouse in Welshpool. To date, this has amounted to 13,000 images that form the raw data used in producing a body of work that explores the creative possibilities of photogrammetry. The significance of these images will be discussed later in the "Creative outcomes to date" section. Through a process of experimentation, the objective is to generate a series of experiences that challenge the relationship between the subject-object and create new understandings of the culture-nature divide that lie outside of the established epistemological expectations.

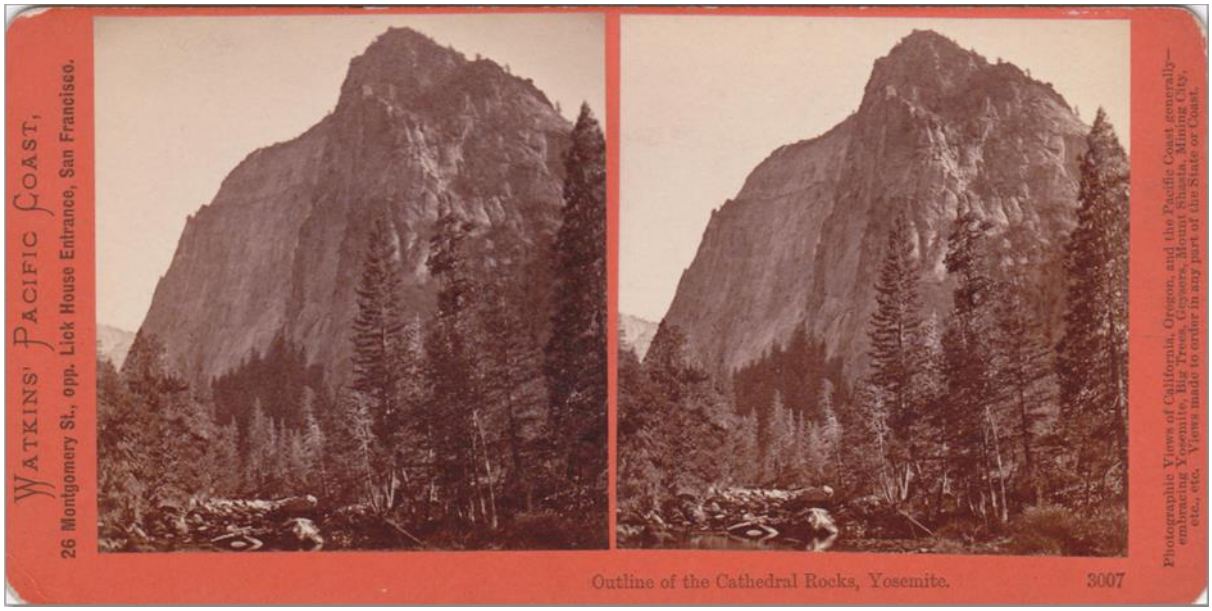


Figure 4. Yosemite. Stereograph. Image by Watkins. C. (1878-1881). Dimensions unavailable (Exception to ©. Section: ss40, 103C. Exception: Research or study.

Photogrammetry, or the use of composite photographs to measure depth and space, has been applied since the early days of photography. In 1840, the French geodesist Dominique Arago advocated for photogrammetry using the daguerreotype, an early form of photography that produced a one-off image and was, therefore, expensive (Newhall, 2006, p. 27). With the invention of the negative process, namely, the calotype (Talbot, 1844), commercial applications rapidly expanded with what are now known as stereographs. An early renowned practitioner was the American photographer Carlton E. Watkins (1829–1916) (see Figure 4, whose images were popular and required specialised viewing devices (see Figure 5), the Oculus Rift of its day. Combined with the ability of the photograph to accurately reproduce an image, photogrammetry quickly became the primary technique in map making. For example, World War One created a demand for ever-increasingly detailed maps (Collier, 2002, p. 155).

We can see in Figure 7 an image of a technique called mosaic mapping. This technique, which is applied to multiple photographs taken from overlapping angles, allows for aerial mapping where measurements of depth can be taken. With digital technology and photography, further applications become possible, the most prominent being Google Earth's Universal Texture, which will be discussed later in this

chapter. This application for mapping topographies and creating maps with increasingly photorealistic textures is significant in that photogrammetry is a recurring motif throughout the practice-based component of the research.

Photogrammetry is often used in the field of archaeology to preserve and restore sites and objects of cultural significance. It is seen as a non-invasive method of accurately measuring artefacts so that the resulting data can be used rather than the original objects. The use of found images from the Internet for the purpose of archaeological preservation/reconstruction is a new application within photogrammetry, only made possible in the digital era. One of the first applications of this method was the reconstruction of the Buddhas of Bamiyan (Grun, Remondino & Zhang, 2004) (see Figure 6). After the Buddhas were destroyed by the Taliban in 2001, the process of how to reconstruct them by generating an accurate three-dimensional model was

Figure 5. Brewster's refracting Stereoscope. 1840's. Dimensions Unknown. Exception to ©. Section: ss40, 103C. Exception: Research or study.

initiated. Using found photographs on the Internet, which were originally taken by tourists, to generate enough detail to recreate the original Buddhas is something that may be explored in my future research (Figure 6).

Museums are increasingly incorporating digital visualisation techniques, such as photogrammetry, into their displays as a way of preserving artefacts. However, they are also increasingly being applied to enhance the viewer's experience, allowing the viewer to interact and study a digital image of the original object. Geismar's article (2015) considers the most effective method for reproducing a digital Māori cloak, which is to be displayed within a museum collection, and how the reproduction can best represent the artefact's cultural significance. Geismar argues that digital photography incorporating photogrammetry is the most effective method for recreating a three-dimensional model that is characteristic of normal representational conventions (Geismar, 2015). Current opinion is that three-dimensional images can create a more engaging experience for the viewer compared to viewing the 'real' object (Younan & Gill, 2013). Whilst new optical technologies can create a more engaging and immersive experience for the viewer, this leads to questions of whether they can replace the original. For instance, do they become their own pure simulacrum? In my creative practice, this consideration has resulted in a series of ironic museum displays in the form of three-dimensional prints covered in photographic skins that question the representation's relation to the original artefact.

Digital software can extract three-dimensional shapes from photographs, generating objects that are something other than photographic images. Whilst photogrammetry is not necessarily a new technique, the introduction of digital cameras and the

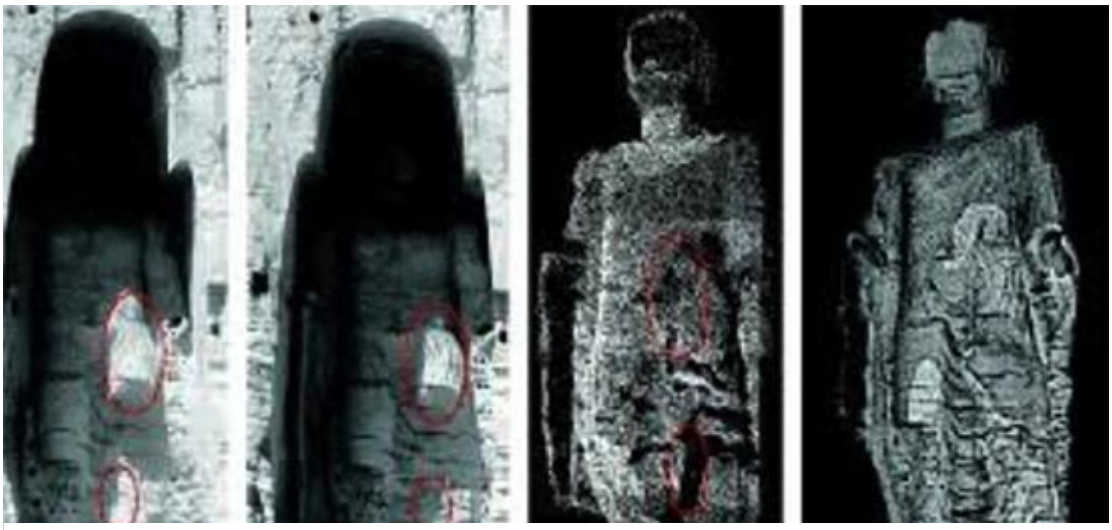


Figure 6. Great buddha's of Bamiyan, 2004. Photograph and 3-d re-construction. Images by Remondino©. Exception to ©. Section: ss40, 103C. Exception: Research or study.

accessibility of powerful computers have opened up possibilities for the applications of photogrammetry.

Digital cameras have allowed much larger data sets to be used to reconstruct complex three-dimensional models. As a result, multi-image photogrammetry, with its relative speed, together with the low cost of the digital technologies, has been adopted by archaeology and cultural heritage imaging (McCarthy, 2014). In archaeology and museums, multi-image photogrammetry is seen as a non-invasive method of measuring and researching the data rather than potentially damaging the original artefact. For example, the Smithsonian is currently digitizing twelve percent of their overall collection; this equates to approximately nineteen million objects, and they have to date digitized over five million artefacts (Smithsonian, 2018). The Smithsonian is thereby aiming to increase the accessibility of their collection through digital platforms to give researchers from around the world the ability to expand human

Figure 7. United States Air Force, 1930. Mosaic mapping, Langley field. Virginia. Photographer unknown. (Exception to©. Section ss40, 103C. Exception: Research or study.)

knowledge. With 155 million objects in the Smithsonian's entire collection, one must acknowledge that the technology will evolve throughout the process. Some of the objects will deteriorate beyond any scientific usefulness. Even the world in which these objects originated will change, leaving only a digital copy that will sit outside of humanity's collective memory, further raising the question of what becomes of these digital objects when we no longer recognize the world from which they have originated.

2.4 Mapping out a new digital reality with Metashape

This section aims to illustrate the decisions and workflow in the practical component of the research, starting with the hardware and software that were utilized, allowing for an experimental approach that could be applied to multiple scenarios. As mentioned, the bulk of the photogrammetry image capture was achieved within the WA Museum's collections facility in Welshpool, Western Australia. To minimize disruption within the facility, it was important to adapt to whatever the location required. Each scenario raised different issues with regards to the environment, quality of the light, etc., and the artefacts themselves were fragile; therefore, I had to scan the objects up close or in situ. This determined the workflow and equipment that I applied. Drawing on my photographic experience allowed me to overcome any issues and maintain a consistent result even when the location and scenario changed (see Figure 9). Whilst it was important to maintain a creative/experimental approach in the practice-based component, a workflow that delivered consistent three-dimensional models was still required. This was to allow for a deconstruction of the process that explored the changing relationship between the photographic image, the physical three-dimensional print, and the digital image as object, either as animation or augmented reality object. As such, I have split the discussion of workflow into separate sections, starting with the hardware, computer, and photographic equipment, and then moving on to the software, Metashape, three-dimensional printing, and the digital platform, Sketchfab.

Figure 8. Location set, Welshpool. WA museum storage facility. Image by Gregor MacGregor. 2020.

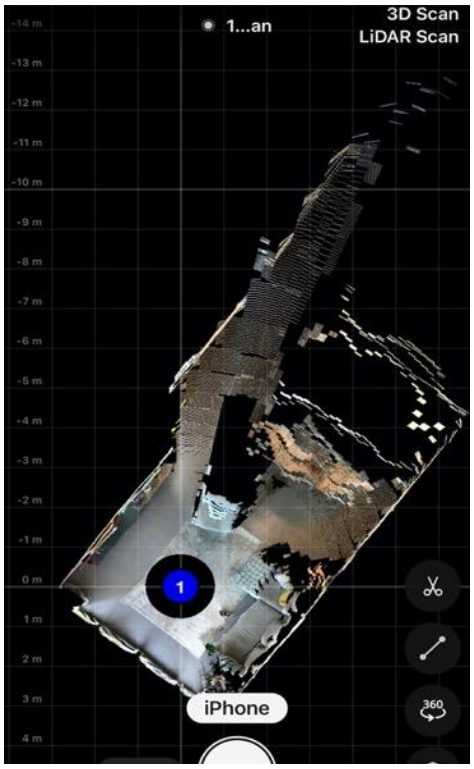


Figure 9. Matterport screenshot, test. Image by Gregor MacGregor. 2021

2.4.1 Computer build

Whilst digital photogrammetry is relatively accessible, smartphone apps such as Matterport can allow anyone with a smartphone to generate a photorealistic reproduction of a space (see Figure 8). To generate a model with a mesh that can be submillimeter accurate and viewed over multiple platforms still requires powerful computers that can process and triangulate raw photographic data. This essentially requires a purpose-built unit with the graphics capabilities to triangulate many hundreds to thousands of photographic images per model, in consultation with specialists that build media workstations for Hollywood computer-generated imagery.

The main components to allow for the calculations are the graphics card(s), and for photogrammetry, it was decided to use two eVGA GeForce GTX1080Ti Nvidia cards, the most powerful cards at the time. Memory and storage need to be substantial: for the research, 15,000 raw photographic images were used, so the storage was 2TB and memory was 4 x 32GB: essentially as much as the budget would allow. The most important component was the graphics cards; however, the Central Processing Unit (CPU) still requires as many cores as possible to allow for the computer to make its

calculations as fast as possible. A test using a laptop took several days to generate one model. Therefore, as many cores as the budget would allow for this build of the CPU were used: AMD Ryzen Threadripper x 16 cores.

Whilst this was not intended to be a scientifically based research project, it was important to follow a best-practice model of the workflow to allow for accurate and detailed three-dimensional reconstructions of the real-world objects. This created maximum opportunities for exploring the creative possibilities within 3D printing and mixed reality (XR) platforms, generating visual experiences for the viewer that sit outside of the traditional photographic discourse. As such, building a high-performance computer purpose-built for photogrammetric calculations was a crucial part of developing the workflow. Whilst computers are available at Curtin University, including access to 'Magnus' at the Pawsey Supercomputer Centre, they do require users to book in for available timeslots. Unfettered access to a high-performance computer was necessary to allow for a creative experimental process that align with a CTD practice, allowing for catastrophic failures and epistemic artefacts (Hansen, 2010), in order to generate non-empirical outcomes that sit outside traditional experiences.

2.4.2 Photography

With my background in photography, this aspect of the workflow should have been the most straightforward; however, photogrammetry does present a unique set of technical issues. Due to the nature of the environment in which the objects were being photographed, consistency and adaptability were key to maintaining uniformity between the different locations and surfaces of the real-world objects. Initial testing was required on location before an appropriate workflow was established, and tripods, dolly tracks, and a variety of lighting rigs were investigated before a final workflow was established that could be applied to multiple situations. As such, a digital DSLR camera with an attached light rig was determined to be the equipment that provided the best photographic outcomes and was the most portable system. The following section will outline the specific hardware and the rationale for the decisions.

As with traditional photography, resolution is a critical component in the outcome of the image. In photogrammetry, the more 2D visual information one can produce from the start will result in greater detail in the final 3D rendered object. Whilst it is possible

to create photorealistic objects with smartphones and smaller point-and-shoot cameras, the final mesh model lacks detail and you do not have ability to manually override the camera settings. For the research, it was decided to use a digital single lens reflex camera (DSLR); this gave me multiple advantages, which I will outline below.

The DSLR that was used for the research was a Canon 5D Mark II. In terms of resolution (image sharpness), this camera has a CMOS Sensor type, which is regarded as a full-size sensor (equivalent, in analogue photography terms, to 35 mm film), i.e., 36 x 24 mm. The larger the sensor, the more information is captured: in this case, 22 megapixels. Larger sensors are available; however, the compromise is portability. As mentioned above, tripods and dolly tracks were tested but, as can be seen in Figure 10, space was sometimes at a premium, and hand-holding the camera created the most freedom whilst taking the images. A permanent workstation would have allowed for a more technical approach; however, some objects were too large or fragile to be transported to other locations. Other factors that were influential in choosing this camera included the ability to take images in RAW, which is an unprocessed, uncompressed file and, therefore, is the largest file that a camera can produce (as opposed to a jpeg file, which is processed, and therefore is much smaller, producing less information).

It is worth outlining the camera settings and reasons for them, as they all played a part in creating the highest resolution possible with the camera. Firstly, I will explain ISO rating, which relates to the sensitivity to light that the sensor requires during the exposure. The Canon 5D has a range of between 100 and 6400; the higher the setting, the less light is required to render an exposure useful for darker lighting scenarios; however, it results in a much lower resolution within the image. As artificial flash lighting was used, an ISO of 100 was applied for the duration of the research as this always allows for maximum detail in the final exposed image.

Consistency with the photographic images allows the photogrammetry software the best possibility of extracting the necessary information when aligning the images combined with the flash unit, and required the aperture to be set at a constant F16. This gave a large depth of field (DoF) throughout all the images. Having large or great

DoF means the plane of focus is spread over a significant portion of the image, from the foreground to the background. With more of the image in focus, the software has more sharp pixels with which to render a solid 3D reconstruction.

Finally, the lens choice was narrowed down to a fixed length 100 mm macro lens. Macro lenses generally are the sharpest lenses in the manufacturer's range, and they give the flexibility to photograph smaller objects, such as seashells. Tests were done with a variety of lenses, and it was found that variable focus length lenses interfered with the image alignment during the photogrammetry process; the distortion between the different focal lengths affected the software's calculations.

As with photography, lighting was critical to creating the best quality images to be used in the photogrammetry process, and here I was able to draw on my photographic experience. As the storage facility had different lighting within the various locations, using the available light was not an option, and colour temperature varied greatly, which resulted in a variety of colour casts that required postproduction to correct. Similarly, the quality of the light would require constant changing of ISO and DoF settings. The most portable solution was to use a Flash Speedlight, which is a very compact camera flash that fits straight onto the camera via the hot shoe, usually situated on top of the body. This has the benefit of being extremely lightweight, having a consistent colour temperature (approximately 5500K); however, its compact size meant that the light source was small and relatively hard, resulting in specular highlights that could be viewed in the final rendered object. These highlights move across the object as the camera moves around the object, and the effect could still be seen in some hard shiny subjects, such as the eyes. Studio soft boxes were also tested with consistent results, powerful enough to give aperture options of f22 and greater, resulting in large DoF and soft enough to deliver even shadowless light without hard highlights. Whilst the recharge times were considerably faster than the speedlight, the lighting rig was not portable and had to be reset for every exposure, which was impractical and took up too much time and space. Another issue with the soft boxes was aligning the lights with the camera, as shadows could be baked onto the texture, which created visual artefacts that interfered with the image alignment in the photogrammetry calculations. The final lighting rig that offered the most practical solution was the studio ring flash, which could be attached to the camera for maximum

portability; it also utilised a lithium rechargeable battery pack, which allowed for continuous exposures for approximately four hours before the battery had to be changed and also for the use of a full frost diffusion gel, a soft enough light source that could be used on a variety of objects without creating problematic highlights and shadows.

2.4.3 Metashape

It was impossible to determine exactly why different focal lengths would affect the calculations in the photogrammetry because the software used in the research was Metashape (formerly Agisoft). Metashape is what is known as a black-box program. The internal structure or code cannot be observed; therefore, conclusions drawn from any tests are limited. Despite this limitation, Metashape was the option that offered the best creative outcomes. This section will outline the reasons for using this software and the optimum workflow that resulted in useable reconstructions. At the start of the research project, Metashape was the best practice for any professional practitioner involved in photogrammetry, from archaeology to video-game design. This area of image creation is, however, a dynamic environment and since then, other options have appeared on the market such as Meshroom and RealityCapture.

The newer programs have been developed for easier workflows and lower entry level costs; however, based on comparative studies (Setiyadi, Mukhtar, & Cahyadi, 2021) (see Figure 10), even though Metashape is more expensive and computer-intensive, it still provides the most accurate mesh models (OBJ files). The OBJ files provide the framework that the photographic textures can be wrapped around. Most programs will generate an accurate texture of the object, which can be used for digital screens. However, without an accurate mesh model, there is not enough accurate information for three-dimensional printing, limiting an important creative option in generating experiences for the viewer that sit outside traditional photographic discourse.

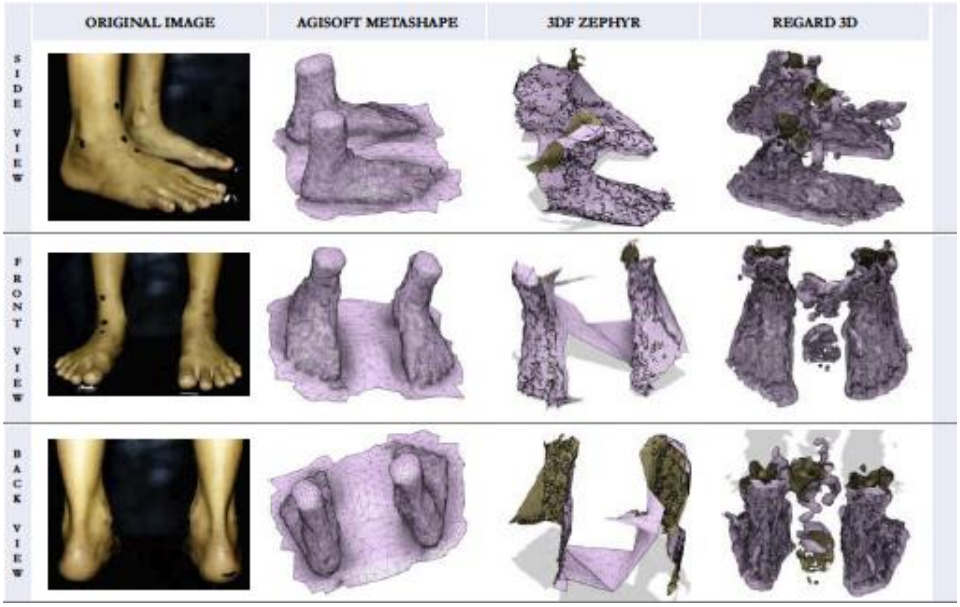


Figure 8. Performance comparison of photogrammetry results in OBJ file format. Reproduced from Setiyade, Mukhtar & Cahjadi.(2012). Exception to ©. Section ss40, 103C. Exception: Research or study.

Therefore, it was decided to continue with Metashape, which still provides the most accurate outputs allowing for the maximum creative options; the downside to using this software is primarily its cost. In addition, the time taken for the algorithmic calculations for most working pipelines can be prohibitive, although having the computer specifications set up to handle photogrammetry contributed to alleviating this issue. Metashape also appeared to have issues with photo alignment (Figure10) and chunk alignments[2]. I will discuss the workflow pipeline required to overcome these issues with reference to a step-by-step outline for the *Temporal Undulations* (meteorite) installation.

The initial workflow (settings) that were applied to maximise the outcomes were provided by the supplier (Metashape, 2020). These settings provided a starting point for creating an appropriate pipeline to generate accurate digital objects, and enabled the software to calculate the reconstruction process via the following stages (see Figures11-14):

[2] Chunk alignment: When photographing an object, as opposed to a location, both the top of the object and the bottom are scanned separately; the software aligns both chunks automatically. However, background information regularly made alignment impossible. Manually aligning the chunks also proved to be not straightforward and quite often left a zip line (similar to a moulding mark) on the 3D prints.

- Point clouds – The collection of points placed within a three-dimensional coordinate system; these are the points obtained from the process of matching points from the photographic images.
- Dense point clouds – The total number of coordinates generated within the defined three-dimensional space.
- Mesh Generation – The creation of the 3D model but without the texture; a compacted (solid) surface of the point clouds.
- Texture Generation – The 3D model with the baked-on photorealistic texture; the software generates a map from the aligned photographic data.

To achieve maximum photographic alignment in one chunk, masking the photographic information was required before following the above-mentioned pipeline (workflow). This was achieved for the *Temporal Undulations* model by masking each individual photograph before the image alignment was attempted, where 100% alignment was achieved (see Figure 14). The time taken to mask approximately 350 photographs (separating the meteorite from all background information, leaving only the information from the meteorite for the calculations) would be prohibitively time consuming for most workflow pipelines. Automating the masking workflow was an option; however, for complicated geometries and multiple chunks, multiple manually applied masks would still be required.

As previously mentioned, the main reason for using Metashape was because it generated the most accurate OBJ file, which allows for a more accurate final render with photographic textures, and for the object to be accurately depicted in a 3D print (see Figure 15). This expanded the opportunities to creatively explore how to present the imagery in multiple media, including the photographic, the physical, and the digital, which were applied in the installations *Temporal Undulations: Topography of a Meteorite* and *Death Mask of a Chimpanzee: Extinction.* For the creative outcomes, see Chapter 5; this section primarily discusses the practical applications that were explored and the reasons for them. The photogrammetric method has been discussed above. At this point, it is important to reiterate that this research investigates the changing role that technology has played in the photographic image. All the outcomes

have only incorporated photographs as the raw input/data. It was therefore important that 3D modelling manipulation was not utilised, even in viewer experiences that could be regarded as 'photographic', including the 3D prints.

2.4.5 SLA stereolithographic 3D printing

3D printing offers up a range of options nowadays, from desktop printers for rapid prototyping to industrial style printers printing in a variety of materials. After testing printers that use fused deposition modelling (FDM) technology, the most common commercially available printer on the market today, ultimately the decision was made to use stereolithography (SLA) printers. This is one of the earliest technologies that was used in 3D printing dating back to the 1980s. SLA does not use the more common method of material extrusion, building up the object layer by layer, as seen in FDM. SLA printing uses a photopolymerisation process that cures resin, layer by layer forming a solid object that creates a much more highly detailed print, with a resolution of 25 microns (as opposed to FDM printers, which can only print at a resolution of 50 microns). Whilst the SLA process requires more steps for curing the resin, the fact that it used resin rather than thermoplastic filament determined the decision to proceed with SLA. Apart from the greater resolution, the resin allowed for a finished print that was clear, allowing the viewer to see through the object, an experience not usually associated with photography. This stripped-down object allowed the viewer to experience the image/object devoid of any pretence of reality whilst still maintaining a physical presence, one that is submillimetre accurate.

2.4.6 Digital animation

Rudimentary animations were incorporated into the installations. They were essentially turntable-style animations to create visual experiences that sit outside of the traditional photographic discourse. This was achieved by using the basic animations tools in Metashape and final renders and times produced in Adobe Premier Pro. For *Death Mask of a Chimpanzee,* a turntable animation was used to emulate Richard Gregory's visual experiment, *Chaplin's half mask*, exploring concepts of perceptual bias. In *Temporal Undulations*, the viewer travels both around and through

the meteorite, which acts as a visual metaphor for the unknowable, a reference to Morton's *Hyperobjects.*

2.5 Conclusion

Using an ongoing application of PBR, the research intends to generate a series of installations examining the changing role of the photographic image through the emerging techniques of digital multi-image photogrammetry. Whilst photogrammetry begins with photography, the process creates objects that are not related to traditional photographic discourse, such as those involving time and memory. It still maintains a sense of indexicality between the image and the referent, creating on object/image that can possess a truthfulness that maintains a link between the original and the reproduction. It is photogrammetry's ability to generate three-dimensional objects that fundamentally alters our perception of the image/object, which is at the core of the research. This has generated opportunities for further exploration into the role of the photographic image in a post-photographic world, which is discussed in more detail in Chapter Six

In this regard, the research employs a methodology structured around a constructive design research model (Brandt et al., 2012; Koskinen et al., 2011, Vaughan, 2017). This methodology is intended to produce knowledge through prototyping; it produces work that relies on established workflows from museum practices to create outcomes outside the expected commercial applications. An example of work production that relies on established professional workflows is the use of 3D printing to create outcomes outside of those expected applications. Complementing these commercially based methods is the cyclical flow of action-reflection-action derived from practice-led fine-art methodologies (Gray & Pirie, 1995 Crouch & Pearce 2012). The intention here is to deconstruct the workflow to discover outcomes that would otherwise not be included in the final visualisations.

Photogrammetric 3D Reconstruction

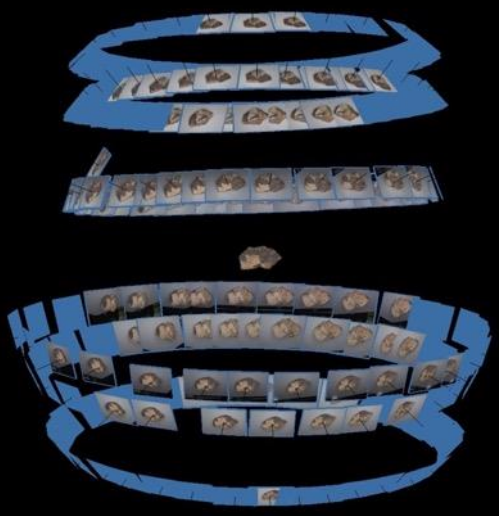


Figure 11. Image Alignment screenshot. Image by Gregor MacGregor, 2021.

Figure 12. Point cloud, Screenshot. Image by Gregor MacGregor, 2021.

Figure 9. Dense point cloud, screenshot. Image by Gregor MacGregor, 2021.

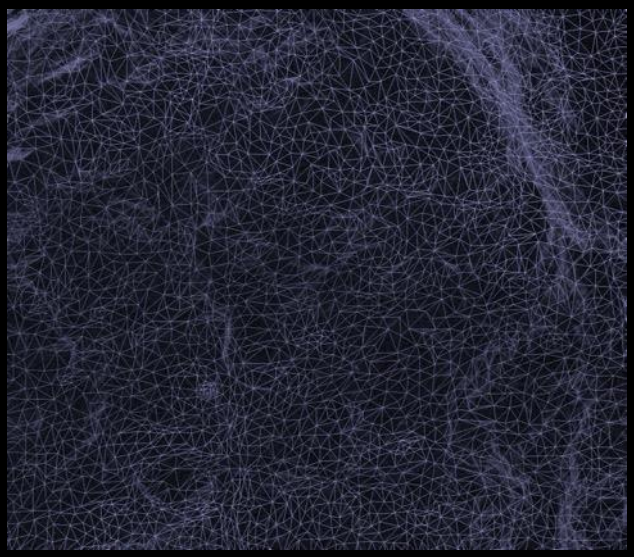


Figure 14. Mesh model, screenshot. Image by Gregor MacGregor, 2021.

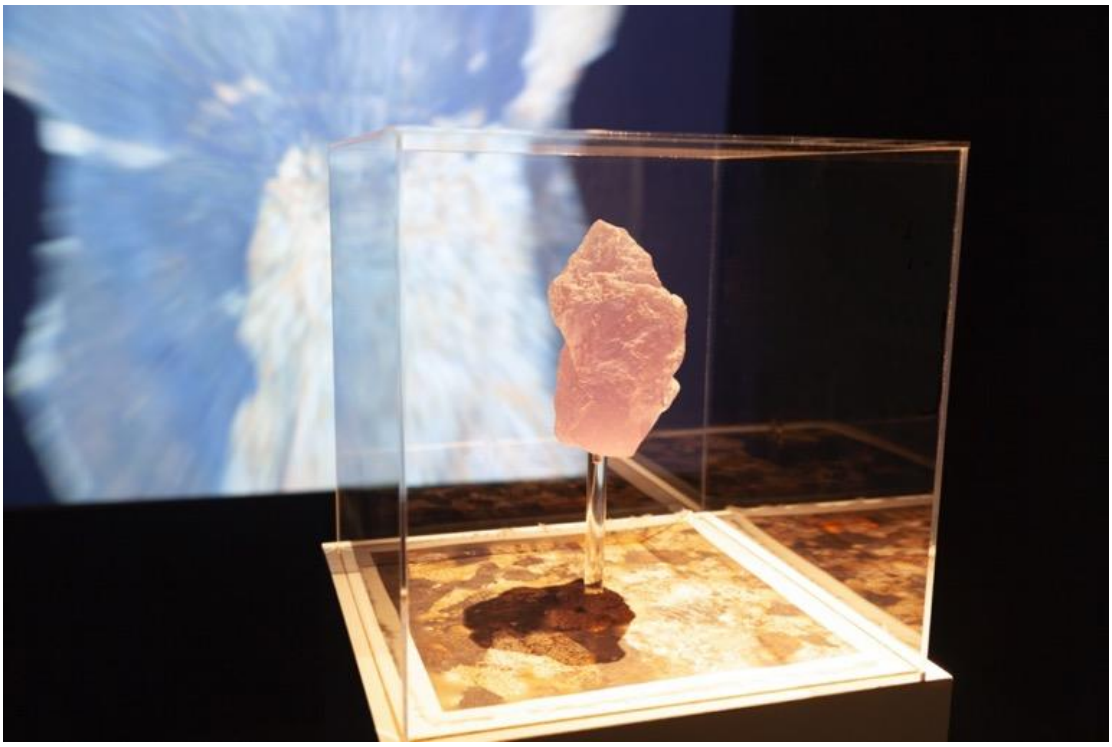


Figure 10. Meteorite 3D print (SLA). Reset residency, PCP. Image by Gregor MacGregor, 2021.

It should be noted that the blending of CDR and practice-led fine art methodologies, together with photogrammetry, was an intentional decision made at the start of the research. This decision allows for a more experimental approach to what is broadly a scientific process, one that already has a set of predefined outcomes within the fields of geology, archaeology, and museology. The blended model is intended to give the researcher the opportunity to discover creative possibilities outside traditional expectations whilst maintaining a structure that stops the research from becoming a purely personal endeavour. Ultimately, the aim is to generate a visual body of work that engages a public audience, and that introduces them to discourse situated around the Anthropocene. This has resulted in a series of installations that is discussed in more detail in Chapters Five and Six; these can be viewed as single installations or collectively, conceptually intertwined with each other. The concept of intertwining the installations is intended to align with Merleau-Ponty's theories of the chiasm*:*

> Chiasm (chiasma) by which announces itself to me as being appears in the eyes of the others to be only "states of consciousness". But, like the chiasm of the eyes, this one is also what makes us belong to the same world- a world

Stereolithographic 3D Printing Process

Figure 16. Preparing OBJ file for 3-D printing. Image by Gregor MacGregor, 2021.

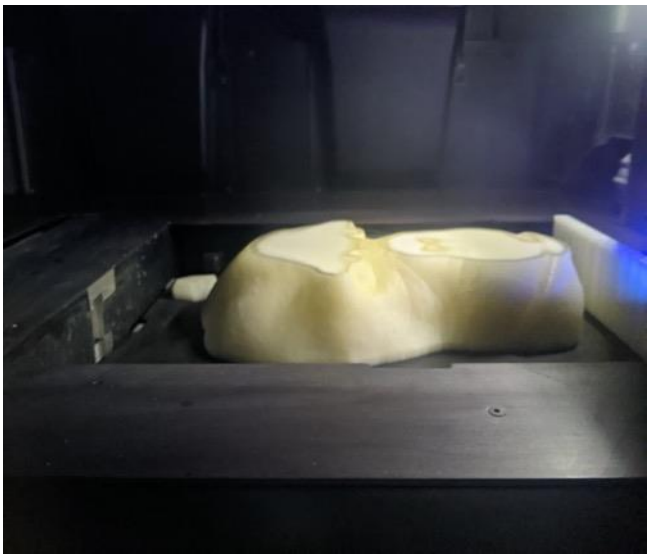


Figure17. SLA printing in progress. Image by Gregor MacGregor, 2021.

Figure 11. Finished 3-d print. Image by Gregor MacGregor, 2021.

Figure 12. Print after curing process. Image by Gregor Macgregor, 2021.

> that is not projective but forms its unity across incompossibilities such as that of my world and the world of the other.
> (Merleau-Ponty, 1945. P 265).

The chiasm of the eyes refers to the optic nerves that travel from both eyes to the part of the brain that interprets the information. The chiasm is where the nerve intertwines (crosses over) combining the information from each individual eye. In *Phenomenology of Perception*, Merleau-Ponty also writes: “Though perception brings together our sensory experiences into a single world, it does not do so in the way that scientific colligation gathers together objects or phenomena, but in the way that binocular vision grasps one sole object” (1945, p. 226).

The intention of the installations is to create an embodied experience in which, once intertwined, enables the viewer an overarching view of the Anthropocene that sits outside of scientific discourse. It is a response to a broader debate that is not intended to undermine the science but sit alongside it, engaging the viewer emotionally, not just intellectually.

This chapter has introduced the methods that have been applied to frame the creative outcomes and, consequently, the exegesis. This methodological structure has generated the body of work that has used the method of photogrammetry, as well as explicating it and outlining the technical steps that have been applied to the photogrammetry process, whilst exploring the non-empirical possibilities of what is largely a scientific technique.

The next two chapters situate the conceptual discourse that both informs and is informed by the creative research, through a critical interpretation of existing theoretical knowledge, thus providing a conceptual outline that offers a framework for underpinning the practice-based research. The purpose of having separate chapters is to distinguish between the discourse around nature and the discourse on perception before intertwining them in a subsequent chapter.

Chapter 03 Situating concepts I: Nature of the object……40

3.1 Introduction

3.2 Situating Creative Outcomes

3.3 The photographic image: A modern necromancy

3.4 The Digitised photographic image: Constructed realities

3.5 Museums: Digitising the Object

3.6 Phenomenological perception of photogrammetry

3.6.1 Intertwining the subject-object and the culture-nature divide

3.7 Ponty's "*The Visible and the Invisible"*

3.8 Perception of reality in a post-anthropocentric world

3.9 Conclusion

3.1 Introduction

This chapter explains the theoretical framework that has both influenced and been influenced by the creative output of this research. While my photographic background was the initial spur that led this investigation to the technique of photogrammetry, it is the text-based investigation, outlined in this chapter, that has informed the practice-based research.

The concepts discussed in this chapter have been drawn from a variety of sources including historical, philosophical, psychological, and museological texts. Analysis of these texts both informs and influences the creative output component of the research, which, in this chapter, relates to the first two installations:

- *After-Nature: Digital Artefacts for a Post-natural World*
- *Death Mask of a Chimpanzee: Extinction*

As such, the chapter has been broken down into sections that are intended to follow the chronological development of the engagement between the creative output and the contextual discourse incorporated into the research. The concepts are intended to follow the cyclical process of my practice-based research, as discussed in Chapter Two, insofar that this process follows the steps of practice-reflection-practice (Crouch & Pearce, 2012). The sections cover the following areas:

1. The historical context of the photographic image as authentic copy – Using William Henry Fox Talbot's *The Pencil of Nature* as a metaphorical starting point.
2. Digitising the Object – The role of museums in cataloguing the original objects.
3. Phenomenology – How a phenomenological analysis of perception relates to the digital image/object.
4. Gestalt psychology – The influence of Richard Gregory's visual experiments questioning our anthropocentric bias.

It is important to clarify that while these concepts have been separated into discrete sections for the purpose of this chapter, in practice, they provide a conceptual framework that both informs and is informed by the creative outcomes. For example, the reference to Talbot's *The Pencil of Nature* (1844) originally came after a period of scanning objects at the WA Museum's storage facility. This resulted in a photographic series based on Talbot's idea of using the photograph as a visual inventory of objects, which then led to a series of texture maps, eventually influenced by Hui's *On the Existence of Digital Objects* (2016), as will be discussed in Chapter Four, and Borges' *"On Exactitude in Science*" (1946). The inclusion of texture maps was an intentional decision to allow for a more creative experimental approach using digital photogrammetry, separating the research from being a technique that is largely seen as a scientific process applied in the fields of geology and archaeology.

Specifically, this chapter introduces the contextual framework that informs the first two installations, mentioned above, which in turn forms the beginning of *No Direction Home: Photogrammetry and the Post-natural World*. This discussion is intended to frame the creative body of work, as described in Chapter Six, which aims to generate a series of embodied experiences that examine the prospect of the Anthropocene and a post-natural world outside of traditional empirical analysis, and the role of the photographic image in an increasingly digitised environment, an environment that is progressively dominating the visual landscape.

3.2 Situating Creative outcomes

At the beginning of the research my position could be interpreted as relegating the significance of empirical observation; however, as the research progressed, it evolved into a methodology that merged both empirical observation and the embodied experience. Further, throughout the creative component of the research, it has been important to gauge viewer interaction with the imagery via a series of what are referred to as installations, such as the PCP residency (Appendix, p.151), third milestone and solo exhibition. The purpose of these installations was not to generate quantifiable results from which to gauge the viewers reaction but to develop aesthetic concerns in regard to the order in which the works are viewed. It is also important to differentiate between these progressive installations as opposed to specific installation artworks.

Originally, the work was intended to be seen as four separate series however they evolved into an intertwining body of work, to be seen as steps or instalments progressing from the photographic print that can be seen as a book to an increasingly digitised image.

As digital technologies have expanded, so have the uses of the photographic image. Techniques such as photogrammetry allow the viewer to experience the photograph in new ways, such as augmented reality or as three-dimensional objects within physical or digital spaces. The photographic image can no longer be seen as a two-dimensional document of a moment in time: photographs can now also align with some of the practices of installation art. In this research, three-dimensional prints and augmented images that can be experienced through smartphone devices have been incorporated into the creative outcomes. Viewing the image via a digital device that places the image into the physical space enables the viewer to interact with the image as if it were a physical object, creating an experience that transcends the traditional static experience (Bishop, 2005). The final installation/instalment of artworks, discussed in Chapter Six, becomes an immersive participation that sits in the realm of installation art, whereas the three-dimensional prints are situated within a more traditional sculptural role. Conversely, as each instalment moves further from the traditional role of the photographic image, the embodied experience of the viewer changes, becoming less indexical and more subjective (Bishop, 2005. p.57).

This research is premised on understanding that digital technology has created a paradigm shift within photographic practice. Initially, the digital turn was seen as heralding the death of photography; however, the photographic medium can be seen as entering what Baker (2005, p.6) describes as an expanded field of practice. In *After-Nature* (the first installation/instalment of artworks, discussed in Chapter Six) the intention is to both acknowledge the historical role of the camera as an invention of the optical/empirical age and also ask the viewer to metaphorically map out a new way of analysing photography. Photogrammetry, whilst created from the photograph, moves away from the referentiality and temporality of traditional photography into a non-narrative application of the medium, allowing the viewer a more embodied experience. To accept that photography has developed into more spatial applications (Baker, 2005. p.18) such as three-dimensional digital animations and augmented

reality, is not to deny the analogue photograph's role in creating a visual inventory over the last 150 years. The camera itself is an invention of the industrial age, sitting alongside the microscope and telescope as instruments that were, and are, important tools for empirical observation. However, digital technologies have created a paradigm shift that has expanded the role of photography.

It is important to note that the four creative series produced for this research are not intended to defend an anti-empirical position. Conversely, the digitisation of the image generates a more phenomenological response that is intended to align with a post-empirical position. This research takes the position that empiricism is grounded in the approach that knowledge and understanding of the world around us are based largely on visual observation, and digital visual technologies are constantly challenging the link between the indexical and the referent. In a post-empirical world, this research is intended to question how we perceive the image and how the photographic image is interpreted. It is to this point that the phenomenological theories of Merleau-Ponty are introduced into the critical discourse within the research. Merleau-Ponty argues that our perception of the world is intertwined with our experience of both the visible and the invisible, that the subject and object intertwine to create meaning and understanding of the world (1968, p.209). This phenomenological approach discussed in Chapter 3 aligns with the post empirical; however, the research is intended as an evolution rather than an argument against a knowledge system grounded in visual observations.

The creative output, as presented later in the exegesis, is experienced in four separate stages, or via four individual installations exploring multiple interconnected themes. Photography has an ambiguous position as a visual medium in that it fits into the scientific, design, and fine-art practices. Broadly, the creative works can be perceived as belonging to a fine-art context, whilst acknowledging the scientific and design histories of photography. This was achieved through referring the works of Fox Talbot in *After-Nature* and applying design techniques such as typological grids in the third installation *Temporal Undulations: Topographies of a Meteorite* (see Chapter Six). Fox Talbot in 1885 was the first photographer to dicuss photographies role as a scientific tool and also its creative potential.

Using the changing role of photography in the digital age, the multiple series challenge the viewer to engage with the works on a variety of levels. With the first series. *After-Nature,* an ironic forgery of Fox Talbot's *Pencil of Nature* (1844), the viewer is reminded of photography's role as a document or visual inventory of artifacts from our environment. However, the inclusion of photogrammetry texture maps act as a metaphor for a world that no longer exists. The maps' tattered remnants of a photographic reality offers no guidance to navigate a world that is continually changing. *Death mask of a Chimpanzee* uses a Richard Gregory optical illusion to show how our visual perception can be tricked whilst also evoking a sense of grief over the potential for a mass extinction event. *Temporal Undulations* acts as a visualisation of Timothy Morton's *Hyper-objects* (2013*)* and, finally, *Digital Uncanny* offers the viewer an augmented visual experience via smartphones. This is a relatively new application that allows the viewer to interact with an image that is both familiar and unfamiliar (see definition of Freuds uncanny, p.123-124).

In the creative works, texture maps are a recurring motif, acting as a metaphor for the ruination of the natural world, and invoking Borge's parable *On Exactitude in Science* (Chapter 5, p.85). These texture maps are computer-generated maps of the original artifacts. The fact that they are computer-generated is intended to create a "deanthropmorphised gaze,' reminding the viewer that the thing that the object is representing will outlive us (Miller, 2020. p.73). Miller also argues that this type of apocalyptic imagery of the anthropocene can challenge the role of the image, its meaning, memories, and histories potentially transgressing traditional binary relationships such as nature/culture (p.67-68).

The effect of the creative works is to intertwine multiple concepts that both examine the relationship between the object and subject, and culture and nature. This intertwining of concepts and techniques creates a variety of visual experiences that allow the viewer to engage with the image through the smartphone and augmented reality. The intention is not to generate a collective outcome but to give the viewers an individual embodied experience that evokes a phenomenological response: one that intertwines the familiar and the unfamiliar, the empirical and non-empirical, the visible and the invisible. This intertwining is a concept that Merleau-Ponty discusses in *The Visible and the Invisible* (1968, p.130), where he explores the idea that the

viewer/subject and the object are interdependent. Our perception of the visible world is always perceived from a subjective perspective; therefore, the viewer's presence plays a part in the creation of meaning and understanding. Consequently, there is a point at which the subject and object intertwine, to arrive at what Merleau-Ponty refers to as the Chiasm (1968, p.133) providing us with a theoretical framework that questions the role of subjectivity in defining our understanding of the world around us.

The purpose of the series of creative artworks is to examine how digital technologies affect the viewer's perceptual response to the image as it becomes increasingly digitised. Digital technologies would appear to be in a constant state of change and, therefore, how we define the works is somewhat ambiguous. This visual application was originally labelled "new digital media"; however, during the research period I have tended to move towards Langdon's (2014, p.30) view, defining digital technologies as digital art due to the increasing levels of viewer interaction and differentiating itself from more linear media, such as cinema or analogue photography. The interactive nature of digital art creates a participation with the artworks that appeals to the viewer enabling a fluid narrative that the viewer navigates on their terms (Langdon, 2014. p.28). Langdon states that digital art aligns with Merleau-Ponty's discourse on the embodied experience, in that the viewer's perception of the artwork relies on their own response and engagement rather than the history or the artist's motive, which in turn underpins the theoretical discourse discussed in the next two chapters.

3.3 The photographic image: A modern necromancy

> One might generalize by saying: the technique of reproduction detaches the reproduced object from the domain of tradition. By making many reproductions it substitutes a plurality of copies for a unique existence. (Benjamin, 1968, p. 221)

Even today, in the era of the digital photograph, the theories of the role of the photograph as a means of representation and as a platform that both informs and creates meaning of the world around us are grounded in the origins of early photography. The way in which photography has structured and informed modern epistemologies and histories can be traced back to the original teleology found in the

work of Louis Daguerre (1787–1851) and William Henry Fox Talbot (1800–1877) (Freeman, 2013, p. 96). To connect the photomechanical age of reproduction to the age of digital reproduction, the research starts from the beginning with an analysis of Talbot's *The Pencil of Nature* (1844).

The Pencil of Nature (PoN) Is regarded as the first commercially published book to be illustrated using photographs. Outlining the calotype process that Talbot had invented, the original intention of the book was to demonstrate the potential applications of this process, as the concept of photomechanical copies was still very new. The calotype, or photogenic drawing, used sensitised paper in conjunction with the camera was used to make a negative for the first time. It was the negative that allowed Talbot to reproduce the original image in its thousands (Newhall, 2012, p. 43), a key moment heralding the age of (photo)mechanical reproduction, demonstrating the role of the photographic image and the copying process in conjunction with collecting, constructing, and transferring meaning between the original/object and the viewer/subject (Freeman, 2013 p. 93).

As will be explicated in Chapter Five, the first part of the installation is a series of photographs of the WA Museum's collection taken at the Welshpool storage facility (see Figure. 34). This photographic series was inspired by Talbot's use of photography as a visual inventory of objects. The series evolved after a period of photogrammetrically scanning a variety of objects within the storage facility. It was felt that a photographic series would be a good starting point from which to deconstruct the increasingly digitised nature of the image, as well as illustrate Talbot's original teleology of the photographic image as a process of 'copying' Nature. In PoN, we can see some of the first examples of what can be described as the "inventorial photograph" (Roberts, 2004. p. 10), such as Plate II, *Articles of China* (Figure 20). Sekula regarded this mode as symbolising a "new legalistic truth" (1986, p. 345), the truth of an indexical rather than textual inventory. This is also something that Talbot himself alluded to in PoN:

> One advantage of the discovery of the Photographic Art will be, that it will [sic] enable us to introduce to our pictures a multitude of minute details which add the truth and reality of the representation, but which no artist would take the trouble to copy faithfully from nature. (Talbot, 1844. n.p.)

In *Articles of China* and Talbot's other inventorial images, we can also begin to see how that which was originally intended as a documentation of his private collection intersects with the emerging modern museum displays of the era (Roberts, 2004 p. 11). In the modernist era, PoN can be seen as the beginning of the symbiotic relationship between 'the Museum' and 'the Photograph'. This 'museological dimension' was not lost on Talbot, who saw PoN and the photograph as a new medium that constituted a portable cabinet, or what Malraux (1947) termed *musée imaginaire*, translated as the museum without walls. Malraux's thesis relies heavily on the specificity of the photograph as a document of truth, that is, on its ability to copy and therefore represent the original artefact.

The intention of this section is to draw out connections between PoN, the

Figure 13. Plate IV. Articles of China. Salted print from paper negative. Dimensions Unknown. William Fox Talbot, 1844.

photographic image, and its role in collecting information, specifically in relation to museum collections. These connections relate to why techniques such as photogrammetry hold a place in creating new ways of experiencing artefacts from the world around us, whilst borrowing from the tradition of the photographic image as an indexical representation of the real. However, in the digital era, our relationship with the photograph has somewhat changed. The purpose of the next section is to examine those changes and how or if they have altered the viewer's perception of the image.

3.3 The digitised photographic image: Constructed realities

> We first arrive at science as research when and only when truth has Been transformed into the certainty of representation. What it is to be is for the first time defined as the objectiveness of representing, and the truth is first defined as the certainty of representing… (Heidegger, 1977. p. 127)

The previous section established the role of the photographic image as an indexical representation of reality and truth, conveying a sense of the past whilst creating the context of the thing/object that has been photographed. The indexical quality was largely seen as an integral part of the photographic image, that is, as an authentic copy of the original artefact, for the first 150 years since the invention of photography. Digital technologies have fundamentally altered this point of view (Lister, 2013, p. 8); however, it is important to acknowledge that the veracity of the image has always been in question (Figure 21). This section is intended to explicate this point from a historical context and establish the idea that the digital image, while borrowing from traditional photography's values, can generate new embodied experiences that expand on the role of the photograph.

The photographic image is associated with being a flattened moment in time, representing a frozen memory, adding to an ever-expanding archive that acts as a visual marker of linear time. Prior to the photographic image, the idea of image as representation was more mimetic; however, with the invention of photography, the image lost its phenomenological value and was elevated to being the guarantor of truth. As evident in the Heidegger quote, presented as the epigraph at the beginning

of this section, from his essay “The Age of the World Picture”, the role of the image is representation rather than mimesis. This is seen as a key characteristic of

Figure 14. The Great Wave, Sete. Albumen silver, wet plate Collodian. Dimensions: 33.7cm x 41.4cm. Gustave Le Gray, 1858. Reproduced from the MOMA collection. (Exception to ©. Section: ss40, 103C. Exception: Research or study).

the modern age, one that confirms Descartes’ view that the representational quality of the image, and consequently the photograph, becomes a scientific method through which observing the image becomes a basis for truth and, therefore, knowledge (Judovitz, 1988). Whilst the digitisation of the photographic process requires a recontextualising of the medium, the acceptance of the photograph as a visual representation of empirical knowledge still largely holds fast, as stated in Bazin and Gray’s “The Ontology of the Photographic Image”:

> The production by automatic means has radically affected our psychology of the image. The objective nature of photography confers on it a quality of credibility absent from all other picture-making. In spite of any objections our critical spirit may offer, we are forced to accept as real the existence of the object reproduced, actually re-presented, set before us, that is to say, in time

> and space. Photography enjoys a certain advantage in virtue of the transference of reality from the thing that it represents. (1996, pp. 13-14)

Conversely, the idea of the photograph, or camera, being an instrument that records reality, whilst widely accepted, can be contested even from the earliest photographs, such as Gustav Le Gray's *The Great Wave* of 1858 (Figure 21). This image was created from two separate negatives – essentially two different moments in time, two separate points of focus, and two different exposures – to recreate that which the eye sees, and compensates for the limitations of the camera's lens. Le Gray's image is a constructed reality, not unlike Andreas Gursky's *The Rhine II* (1999), an image that is widely regarded as marking the watershed between the photographic and the post-photographic era (Figure 22). Gursky's image was one of the first critically acclaimed photographs to be digitised and then have all the buildings digitally removed.

Figure 15. The Rhine II. Photographic print on paper (1564cm x 3083cm). Andreas Gursky, 1999. reproduced from Tate gallery

Digital technologies have fundamentally altered photography's ontological link to representation, memory, and, to some degree, truth (Rubinstein & Sluis, 2013). They have made the photographic image and the whole process more automated and accessible than pre-digital (analogue) photography, which was already regarded as readily available for mass consumption.

3.4 Museums: Digitising the object

Traditionally, museums have been seen as institutions that collected and preserved physical objects to produce knowledge (Bertacchini & Morando, 2011). Broadly speaking, their primary objective was to preserve and catalogue whatever objects that they specialised in. They would then transmit the accrued knowledge to the public and make the objects available for research (Alexander, 1983; Lewis, 2011). Museums in the late 20th century are often criticised for being elitist temples of colonial acquisitions, and even as late as 1996, the historian Gyan Prakash proclaimed that museums themselves had become history (Thomas, 2016). Since then, museums have reinvented themselves and continue to thrive, in part due to technological innovations that have reshaped their role as producers of culturally significant content. The digitisation of museum collections has increased the capacity for storage, and accessibility to the internet has changed the ways in which we manage and access information (Bertacchini & Morando, 2011). Granted that digitisation has introduced new ways to retrieve, experience, and even monetise collections: it is the experiential nature of digital collections that I wish to privilege in order to analyse how we can engage with technology as opposed to the 'real' world.

This leap from the physical object to the digital one represents a paradigm shift in how we represent objects as images, even greater than the inventions of photography, cinema, and television (Jeffrey, 2015). To better understand our relationship with the digital object, it is important to acknowledge both the immateriality and the uncanny nature of digital images. These digital reproductions still invoke issues of authenticity similar to analogue (mechanical) reproductions. Of an effect of mechanical reproductions, Benjamin states: "One might subsume the eliminated element in the term aura and go onto say: that which withers in the age of mechanical reproduction…" (1968, p. 223). The point that Benjamin is making is that reproductive media, such as photography, diminish sense of aura or presence compared to the original object or artwork (Bolter et al., 2006). For the most part, this also stands for digital media, as it is still a reproductive medium. Digital reproductions, due to their ephemeral nature, still lack physical presence, an aura; perhaps the field of haptics may change this, but until then, the digital reproduction will still have a sense of the digital uncanny(Jeffrey,

2015). Whilst digital reproductions create a sense of separation between the subject and object as the technology improves, this separation will change – the immersive nature of the technology is already regarded as more emotive than traditional imagery and even the 'real' object (Geismar, 2015).[3]

Natural history museums are currently in the process of digitising their collections, which can be a vast project in the case of the Natural History Museum, London (NHMUK), involving around 80 million specimens (Paterson et al., 2016). This process started with the lepidopteron (butterfly) collection, comprising 181,545 specimens, and the pilot project was intended to develop an appropriate workflow. The data that is being digitised includes a digital image (2D photograph), species name, geo-referenced location, collector name, and collection date; the main purpose is to release data that had not been readily available previously. The bulk of the digitisation process within museums is currently limited to 2D digital photography, largely due to the cost, time factors, and data storage. However, digital imaging techniques are changing rapidly, as is the capacity for digital storage. The logistical benefits of creating a three-dimensional digital record of collections within museum institutions have been discussed in Chapter Two; however, my practical research explores the creative potential of photogrammetry. The creation of three-dimensional objects from two-dimensional photographs presents many options for using this information in different ways. My creative practice explores these options, ranging from generating physical objects, digital animations, and ultimately, mixed realities (XR).

As discussed previously, the concept of gaining knowledge through empirical observation has dominated institutions such as museums and have defined how we perceive the world in which we live. Whilst contemporary discourse has brought this approach into question, I refer specifically to the phenomenological theories of Merleau-Ponty (1945) and later the post-phenomenological ideas discussed in Chapter Four. Perceiving the world through an anthropocentric lens still dominates our relationship with the natural world as something 'other', separate from us. The purpose

[3] This section incorporates elements from an article by the author, "Photogrammetry: Challenging the Human-nature Divide", published in the proceedings of the Cumulus Conference, 2020.

of the research is to broadly examine the role that digital technologies, and the digitisation of museum collections, can have to potentially alter our perception of a world that is changing.

3.5 Phenomenological perception of photogrammetry

The first installation, *After-Nature: Digital Artefacts for a Post-natural World,* is intended to place the research within the historical context of photography as a medium for empirical observation. Nonetheless, digital technology has fundamentally changed the way in which we use and perceive the image: no longer through printed media but via digital screens and even via mixed reality. In particular, techniques such as photogrammetry have added another dimension to the photographic image, allowing what is essentially photographic data to be experienced in three-dimensional spaces. In the second installation, *Death Mask of a Chimpanzee: Extinction,* the contextual analysis is expanded to include Merleau-Ponty's theories on perception. Whilst the installation still borrows from traditional museum display practice, it is intended to raise questions in the viewer and their perception of the natural world by generating non-empirical perceptual experiences. Merleau-Ponty states:

> … we transport these objects onto consciousness. We commit what psychologists call "the experience terror," that is, we immediately assume that what we know to exist among things is also in our consciousness of them. We build perception out of the perceived. And since the perceived is obviously only accessible through perception, in the end we understand neither. (1945/ 2014, p. 27)

As mentioned above, one of the main components of this contextual research is an examination of the potential links between the phenomenological theories of perception by Merleau-Ponty and possible applications for my creative practice. Phenomenology marks a significant move away from the established philosophies of the early 20th century, whose empirical methods of observation are still embedded in the epistemological approaches of western societies. Merleau-Ponty argued against dualism. He regarded the body as in and of the world around us and not something that was separate, which he felt was inadequate when it came to understanding that

which could not be seen. Our perceptual experience of the world is different to objective thought. We bring all our previous lived experiences into what Merleau-Ponty described as an embodied perception of the world.

Merleau-Ponty's theories were in part influenced by the visual experiments of Gestalt psychology[4], which led to what Gregory has referred to as a top-down theory in perception (Figure 23). The visual experiment that Gregory used to illustrate his hypothesis is known as Chaplin's half mask (Figure 26). As the mask rotates, our perception refuses to invert the mask because, in our lived experience, we are used to seeing faces but not inverted faces. This, therefore, exposes how empirical observation can be inherently flawed. These contextual theories attempt to move the image beyond that of an object, what Bazin would refer to as a transference of reality (1960), into something that represents something 'other', more than the object itself. The second installation, *Death Mask of a Chimpanzee: Extinction*, applies these ideas in a series of visual experiences that provide the viewer/subject with novel ways of experiencing metaphors for mass extinction as well as revealing the fallibility of human perception.

Harmann and the speculative realists reject traditional empirically based philosophies as well as some of the phenomenologist's more anthropocentric theories, such as the embodied experience. They place the same importance on things, matter, and real objects, thus bypassing more traditional viewpoints such as the phenomenal experience (Morelle, et al. 2012). This would fundamentally change the subject-object relationship and the philosophical approach, arguably to start to move away from a strictly anthropocentric view of the world.

[4] Stemming from a German movement in the early 20th century, Gestalt psychologists opposed the structuralist views that informed empiricism. They took a more holistic view on perception, namely, that we perceive objects as part of an intertwined system, rather than their individual components.

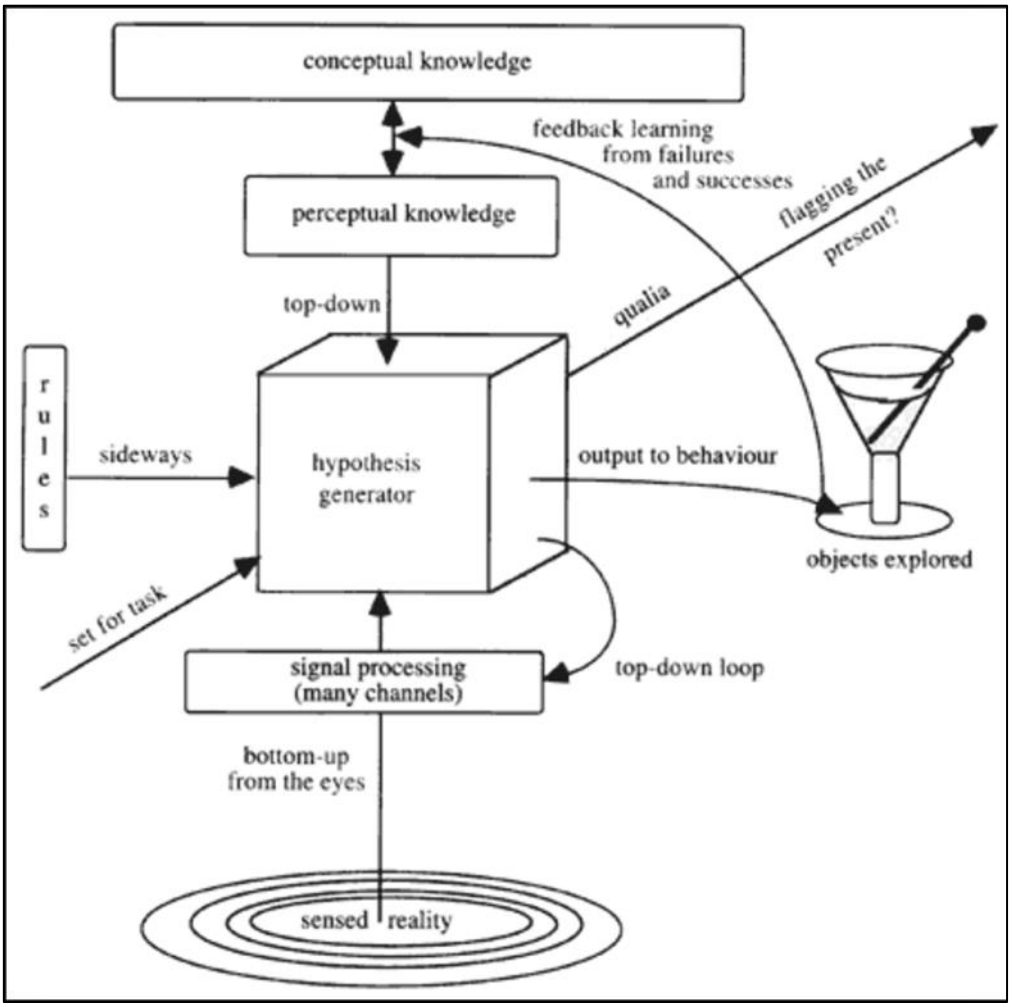


Figure 16. Black Box of vision: a hypothetical design for the visual mind. Reproduced from Mirrors in Mind, Richard Gregory, 1997. (Exception to ©. Section ss40, 103C. Exception: Research or study).

The speculative realists argue that humans need to stop privileging our perception, our agency, over the natural world. This privileged view has led us to a point where our anthropocentric bias has had a more negative than positive impact on our understanding of the objects that make up our environment. This is a point that has been agreed upon by environmental theorists, such as Morton, who has aligned himself with Harman's OOO (Morton, 2011). If we accept, as Merleau-Ponty argued, that empirical observation can only get us part of the way to understanding the thing that we observe and that our observations are intrinsically limited by our anthropocentric prism, then it is possible that our perception of the object is fundamentally flawed, a situation that has created the environmental issues that we are facing. Perhaps one way to overcome the issue is to redress the imbalance that

we as humans have placed upon the subject-object discourse, by shifting the debate from the perception of the subject to one that is more object oriented. I aim to explore, through the practice-based research, our relationship with, and perception of, the object, and the role emerging three-dimensional technologies have in this debate, in particular the changing role of museums, from empirical institutions that categorise nature, to places where we can experience the natural world in ways that elicit curiosity and wonder.

3.5.1 Intertwining the subject-object and culture-nature divide

The subject-object dichotomy has entered current environmental discourse as a way of explaining how anthropocentric bias has exacerbated the culture-nature divide, insofar as the parameters with which humans perceive nature have been defined by humans themselves. The language that we use to attribute a definition of the natural world can never be neutral. It can be argued that the language that western society uses to frame our perception of nature has been framed within the context of imperialism and colonial attitudes (Moore, 2017). This discourse around the culture-nature divide and how this has defined our relationship with the natural world will be outlined in greater detail in chapter four.

For the research, I apply a more contemporary definition of nature to clarify the ambiguous definitions of nature. In *The End of Nature* (1989) McKibben argues that Nature (N) no longer exists; instead, he posits a world where humans have altered every aspect of the natural world. This marks the beginning of the debate as to whether we are still in the Holocene epoch or whether we are in, as Crutzen (2016) suggests, the Anthropocene epoch (the age of humans); the definition of the Anthropocene will be explored in more detail later. Suffice to say, nature (n) refers to a natural world in which humans are intertwined with.

Figure 24. The Hollow face. Reproduced form Mirrors in Mind. Richard Gregory, 1997. (Exception to ©. Section: ss40, 103C. Exception: Research or study.

It is argued that our anthropocentric understanding of the natural world has been framed within our own social (western) construction, that we understand nature through our scientific/empirical study of nature. This Cartesian approach can only reach so far; ontologically, this has a finite point. A more phenomenological approach to our perception of nature is required to bridge the subject-object and culture-nature divides that traditional empirical methodologies have exacerbated. A non-empirical approach to understanding the natural world would be one that is aware of the biological limitations of our human perceptions (Synder, 1998).

Figure 25. Death Mask of a Chimpanzee. Video still, showing front of mask. Image by Gregor MacGregor, 2021.

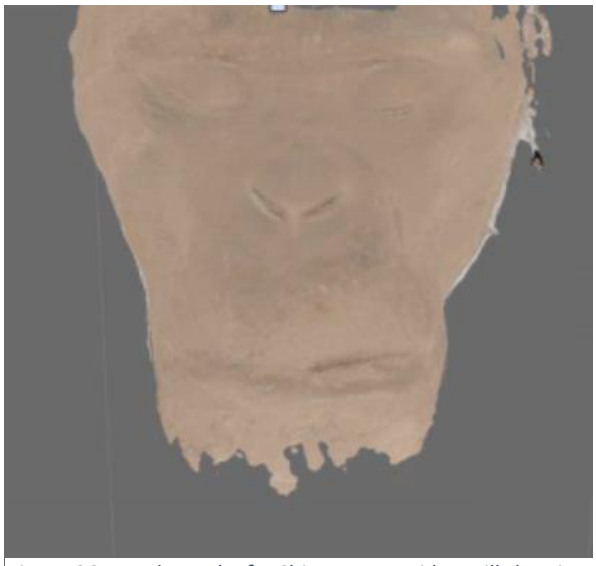


Figure 26. Death Mask of a Chimpanzee. Video still showing inverted mask. Image by Gregor MacGregor, 2021.

As Vogel (2015) suggests, the meaning of the natural world is ambiguous. This ambiguity has, in part, led to a human-nature divide and this divide has created a schism between humans in discussions as to whether humankind lives within the natural world or side by side with it. Current philosophical thought is moving away from traditional western philosophy, which is biased towards prioritising anthropocentric requirements over those of the natural world.

3.6 Merleau-Ponty's *The Visible and the Invisible*

The Cartesian dualistic approach has limitations in that it separates the human from the world around them; it does not consider the fact that humans are a part of the world. One of the first philosophers to address the inadequacy of this Cartesian

dualism was the phenomenologist Heidegger (Cerbone, 2006). It was Heidegger who introduced the term Dasein to explicate our individual human existence, of being in the world, questioning the subject-object relationship.

Other phenomenologists such as Merleau-Ponty argued against Cartesian dualism because he felt it was inadequate to account for understanding that which could not be seen. Phenomenology marks a significant move away from the established philosophies of the time, namely, the theories of Descartes whose empirical methods of observation are still embedded in the epistemological approaches of western societies. Nevertheless, for some, phenomenology does not go far enough, as it does not address the anthropocentric bias inherent in our perception of the world. This is where speculative realism takes up the current debate around OOO (Harmann, 2018). It is a relatively new philosophical movement that aims to end correlationism[5], and anthropocentrism. Whilst it draws comparisons with the environmental discourse of Morton (2016) it is often seen as post-phenomenological. Speculative realists, such as Harman (2018), see phenomenology as having a dualistic relationship between Dasein and Being[6], which therefore still creates an anthropocentric bias. Harman and other speculative realists reject both traditional empirical (Cartesian)[7] philosophies as well as some of the phenomenologists' more anthropocentric ideas. They place the same importance on things, matter, and real objects, bypassing more traditional viewpoints such as phenomenal experience (Morelle, 2012). Object oriented ontology would have a fundamental change in the subject/object relationship and arguably a philosophical approach that starts to move away from a strictly anthropocentric view of the world.

Speculative realists argue that humans need to stop privileging our perception, our agency, over the natural world, as this has led us to a point where our anthropocentric

[5] Correlationism refers to the belief that objects only exist through human minds and language; Morton (2016) refers to this as anthropocentrism in a philosophical form.
[6] The phenomenologist Heidegger uses the term Dasein to describe our individual human existence, excluding traditional assumptions and prejudices of Being, thus recognising the indeterminate nature of the subject and object relationship.
[7] The term Cartesian refers to the traditional western philosophies of, primarily, Rene Descartes (1596–1650) that have dominated the natural sciences. Cartesian thought is regarded as being too empiricist by most modern philosophical movements.

bias has had a more negative than positive impact on our understanding of the objects that make up our environment. This is a point that has been agreed upon by environmental theorists, such as Morton, who has aligned himself with Harman's OOO (Morton, 2011). If we accept that, as Merleau-Ponty argued, empirical observation can only get us part of the way to understanding the thing that we observe and that our observations are intrinsically limited through our anthropocentric prism, then it is possible that our perception of the object is fundamentally flawed, a situation that has created the environmental issues that we are facing. Perhaps one way to overcome the issue is to redress the imbalance that we as humans have placed upon the subject-object discourse, by shifting the debate from the perception of the subject to one that is more object oriented. I aim to explore our relationship with, perception of, the object and the role those emerging three-dimensional technologies will have in this debate. The changing role of museums from empirical intuitions that categories nature to places that we can experience the natural world, in ways that illicit curiosity and wonder.

3.7 Perception of reality in a post-anthropocentric world

Speculative realism is a relatively new philosophical movement that aims to end correlationism and anthropocentrism. Whilst it draws comparisons with the environmental discourse of Morton (2016), it is often seen as anti-phenomenological. Speculative realists such as Harman (2018) see phenomenology as having a dualistic relationship between Dasein and Being, and therefore regard it as anthropocentric. They reject both traditional empirical (Cartesian) philosophies as well as some of the phenomenologists' more anthropocentric ideas. They place the same importance on things, matter, and real objects, bypassing more traditional viewpoints such as phenomenal experience (Morelle et al., 2012). This would have a fundamental change in the subject-object relationship and arguably a philosophical approach that starts to move away from a strictly anthropocentric view of the world.

3.8 Conclusion

The purpose of this chapter has been to establish the contextual framework that relates to the first two installations for the practice-based creative component of the research:

- *After-Nature: Digital Artefacts for a Post-natural World*
- *Death Mask of a Chimpanzee: Extinction*

The research has followed a chronological order, to allow for an historical analysis of the role of the photographic image and how it has informed our perception of the photorealistic imagery that is inherent in photogrammetry, as well as the role that photography has in creating a visual inventory that we use to catalogue the world around us. However, as technology has increasingly digitised the photographic image, it has expanded the ways in which the viewer can experience the image within the digital space and, owing to techniques such as photogrammetry, within three-dimensional physical space too. The next chapter expands on the contextual framework as it relates to the final two creative installations – specifically, the potential to generate experiences that sit outside of the scientific discourse around the natural world, and how/if visual technologies bridge the gap between humans and nature.

Chapter 04 Situating concepts II: The subject-object & human- nature divide…….63

4.1 Introduction

4.2 The Anthropocene: an epoch for the age of humans.

4.2.1 Post nature.

4.2.2 Anthropocene.

4.2.3 Sixth Mass Extinction.

4.3 Hyperobjects.

4.4 Moving beyond the Entropic Vortex of the Anthropocene.

4.4.1 Towards a Digital object-Oriented Ontology.

4.5 Conclusion

4.1 Introduction

This chapter relates to the contextual discourse that has informed two installations:

- *Temporal Undulations: Topography of a Meteorite*
- *Digital Uncanny*

The previous chapter has established the role of the photographic image in informing our perception of the world around us and highlighted the increasing digitisation of that world. Emerging digital visualisation technologies are constantly evolving and changing how we both create and experience the photographic image. As such, this chapter expands the conceptual framework to include the tenuous relationship between the 'real' world and the digital world. As technology becomes more immersive, the relationship between the referent (in this case, the natural world that has been copied) and the object (in this case, the digital representation) becomes increasingly ambiguous. This is particularly so in the age of the Anthropocene[8] where we are developing visual technologies that create experiences that immerse the viewer in 'nature' at a time when nature itself is changing due to human activity. As simulation technologies aim to bridge the subject-object divide, the object, the natural world part of the equation, is in a constant state of flux. In this context, this chapter aims to establish a framework that examines the ways in which we can adapt to this change to better understand humankind's relationship with the natural world.

Therefore, this chapter is designed to interpret existing concepts pertaining to the natural world as well as our increasing reliance on technology to interact with our environment. As with the previous chapter, I have divided these concepts into sections covering the following:

- The Anthropocene – an epoch for the age of humans.
- Object-oriented ontologies – addressing the dualistic bias.

[8] This term refers to the age of humans. Some scientists regard this period as a new epoch where human activity is the primary influence on the Earth's geology and ecology.

- Cosmotechnics – a post phenomenological response to the digital object in the Anthropocene.

The purpose of referencing the contextual discourse is not to propose an academic reinterpretation of these concepts but to define the ideas that have provided an influence upon the practice-based research. This chapter and the previous one aim to establish the theoretical themes connecting the multiple installations that combine to form *No Directions Home: Photogrammetry and the Post-natural World.* From a heuristic perspective, the research aims to address the role that evolving visual technologies have in determining our future relationship with the world by producing a non-empirical visual record, one that elicits visual experiences connecting the viewer with embodied experiences that sit outside of the established scientific debates around climate.

Simulation technologies, such as photogrammetry, are giving the viewer an increasing sense of otherness. The world as we experience it is neither apart from nor a part of us; it is neither completely natural nor completely artificial. As photogrammetry is increasingly being applied to simulation technologies, this generates potential areas for practice-led research that are yet to be explored, such as mixed realities becoming more accessible than the real. To better understand our changing relationship with our perception of images generated by digital technologies, it is important to understand the context of the subject-object divide. This section will include an overview of Descartes' dualistic approach and the philosophers that consequently eroded this method. Western philosophy and the natural sciences have been shaped by the relationship between the subject and the object. This is largely because of Descartes' theories on res cogitas and res extensa, the separation between mind and body (Descartes, 1644/1985). This separation of the subject and object has resulted in a dualistic approach that has acted as a determinant in how we see the world (Haila, 2000).

This dualistic approach has limitations in that it separates the human from the world around them and does not consider the fact that humans are a part of the world. One of the first philosophers to address the inadequacy of this Cartesian dualism was the phenomenologist Heidegger (Cerbone, 2006). It was Heidegger who introduced the

term Dasein to explicate our individual human existence of being in the world, thus exposing the insufficiency of the subject-object relationship.

4.2. The Anthropocene: An epoch for the age of humans

The previous chapter has outlined the role that the image has played in humankind's perception of the natural world, and hinted at the ambiguities around our perceptual capabilities. This section aims to assimilate those concepts with our understanding of what nature represents in contemporary society. It is important to establish the discourse around nature and where it is currently situated and how it can potentially evolve in the near future. Firstly, if we analyse the McKibbins discourse on Nature, we can see that environmentalists such as Vogel (2016) argue that our anthropocentric view of the natural world has created a schism between humans/culture and nature. This anthropocentric view has its base in western empirical methodologies that have underscored the natural sciences from the previous two centuries. Merleau-Ponty (1945) is one of the first continental philosophers to contend that empirical methods are not enough to enable a deeper understanding of the world (Carman, 2008). Whilst his phenomenological theories take us a step away from empirical and Cartesian dualism, his theories around perception and embodied experience can still be perceived as having an anthropocentric bias (Sparrow, 2010).

It is important to understand the historical issues around western cultures' definitions of the natural world and how this has led to an increase in the human-nature divide. In relation to this, I will also incorporate concepts of the Anthropocene (Crutzen, 2002), the age of humans, post-nature (Morton, 2014), the sixth mass extinction (Barnosky et al., 2017), and why this new era requires a different understanding of the relationship between humans and the natural world. My analysis highlights issues around climate change and exposes the limitations of perceiving the natural world through our anthropocentric prism. To further develop the perception of, and relationship with, nature, I incorporate Merleau-Ponty's theories (1994) and Harman's speculative realism (2007). This enquiry seeks to support the notion that emerging three-dimensional technologies can go some way towards understanding the human-nature divide in the context of the Anthropocene and how human perception is inherently biased.

The parameters with which humans perceive nature have been defined by humans themselves and, as such, the language used to define the natural world can never be neutral. It can be asserted that the language western society uses to frame our perception of nature has been constructed within the context of imperialism and colonial attitudes, which can be argued are at the root of the human-nature divide (Haila, 2000). On the one hand, we have early environmentalists, such as Henry David Thoreau (Schama, 1995, p. 7) creating a romanticised vision ("in wildness is the preservation of the world"), implying that an untouched wilderness will provide an answer to the failings of an industrialised world. This romantic view of nature is in opposition to the more imperialistic/colonial approach to nature where nature can be controlled through such means as deforestation to make way for agriculture and industry. This creates a schizophrenic understanding of the meaning of nature and the natural world, leading in part to the current human-nature divide.

As discussed in the previous chapter, our perception of the natural world has been informed and romanticised by our anthropocentric bias, socially constructed. Our historical view of what constitutes Nature no longer exists (McKibben, 1989), and it is becoming increasingly difficult to deny that humans have changed the world (see Section 4.2.2), thereby contextualising, defining, and outlining the discourse around post-nature, the Anthropocene, and the sixth mass extinction, which will be explicated in the following sections.

4.2.1 Post Nature

If we take McKibben's (1989) view that Nature no longer exists due to humans having affected/changed every aspect of the natural world, this means we are in a post-Natural world. He argues that rather than nature being a social construction, human actions have physically de-constructed nature to produce results such as climate change and the depletion of the ozone layer. If we accept that Nature no longer exists, then the 'environment' we inhabit is a post-Natural world. Vogel (2015, p. 43) argues that previous environmental philosophy, through its anthropocentric bias, created a dualism between nature and humans. For us to close/narrow this human-nature divide, we must accept that humans and the environment cannot be separated and that they are 'intertwined'.

4.2.2 Anthropocene

The Anthropocene refers to the epoch that some scientists would argue we are in now, that is, the age of humans, where humanity has become the primary factor in changing the Earth's ecosystem more than any natural events. At this point it is important to note that if the concept of the Anthropocene is accepted, it will ultimately alter the traditional views surrounding the nature-culture divide. The concept was originally introduced by Paul Crutzen (2000) to describe humankind's impact on the biosphere. Whilst still waiting to be ratified by the International Commission on Stratigraphy, the term is gaining in popularity as a reference to our current epoch. However, the Anthropocene Working Group (AWG) are currently collating a proposal that is looking for the Golden Spike[9], or a Global Boundary Stratotype Section and Point (GSSP). This requires a reference point in the Earth's strata that would clearly mark any anthropogenic changes that would signal the end of the Holocene epoch, the previous 12,000 years since the last ice age.

The AWG are currently investigating a wide range of possible physical, chemical, and biological markers (Zalasiewicz et al, 2017); the most promising at the moment is the radionuclide fallout from nuclear tests during the mid-20th century and carbon from fossil fuel burning that dates back to the beginning of the Industrial Revolution. Other factors that are being taken into consideration are techno fossils, plastic pollution, and bones of the domesticated chicken, an animal that is synonymous with post-nature (Carrington, 2016). There are approximately 20 billion domesticated chickens compered to 1.6 billion wild birds in 2009; 90% of large animals (weighing more than 3 kilos) are made up of humans or domesticated animals (Harari, 2016, p.84).

It is the role of the ICS to formally declare the end of the Holocene epoch and the start of the Anthropocene. This has never been done within such a short period of time, geologically speaking. The stratigraphic evidence, whilst compelling, is negligible, given that the Golden Spike is seen to have occurred around the mid 1940s to early 1950s; however, there a growing sense of urgency to officially declare that we are in

[9] The Golden Spike refers to the point at which chronostratigraphy recognizes a new geological epoch.

the Anthropocene epoch. This push for official recognition is seen as being political rather than scientific (Finney & Edwards, 2019). Nevertheless, official recognition of human impact on the Earth's system is important in order to raise the awareness of the public and governmental agencies. Crutzen (2000), who originally coined the term, says it is important to officially recognise the Anthropocene, as it emphasises the enormity of humanity's responsibility in acting in response to change, specifically this great acceleration of human activity impacting upon the planet.

4.2.2 Sixth mass extinction

Human impact on the biodiversity has led some biologists to declare that we are heading towards a sixth mass extinction, an event that could see the extinction of 75% of species. There have been five previous mass extinction events through the last 540 million years (Barnosky et al., 2011), namely the Ordovician, Devonian, Permian, Triassic, and Cretaceous.

The Devonian extinction event is believed to have happened over a twenty-million-year period. To put that into context, if current rates continue, the present-day mass extinction period will reach the same species diversity loss within three hundred years (Barnosky et al., 2011). If species that are currently rated as under threat become extinct within the next century and the rates stay the same, then the threat level for terrestrials, amphibians, birds, and mammals will reach the magnitude of the previous five extinction periods within 240 to 540 years. The current extinction rates are already higher than those that resulted in the previous five extinction events (Barnosky et al., 2011).

The hypotheses that explain the events that led up to a mass extinction event (excluding asteroid impact) all point towards climate dynamics, atmospheric composition, and abnormally high-intensity ecological stressors. However, previous events have all taken place in the absence of humans. Current anthropocentric inputs have resulted in a rate of climate change, rising C02 levels, habitat destruction, pollution, and increasing human biomass that are more extreme than most living species have experienced (Barnosky et al., 2011). These stressors on the environment are currently accelerating and, if this continues, will intensify the potential

extinction faster than the predictions stated above. Whilst the current rate of extinction is dramatic, it does not constitute a sixth mass extinction; however, it is apparent that losing species on the endangered list will cause a sixth mass extinction potentially within three centuries.

These concepts surrounding the natural world are ambiguous. They create a disconnect between humans and nature. Our anthropocentric, humanist perception of the natural world has been skewed by centuries of placing humanity at the apex. Given that humans are the dominant species and that we have, in modern times, perceived nature as separate from humans, this has led to a human-nature divide, which has created environmental issues that our current anthropocentric bias has trouble coming to terms with.

Hayles (2006) argues that an alternative way for humans to potentially integrate into nature may be through simulation technologies. Hayles argues that our perception of the outside world is an interaction between the object and our cognitive-sensory apparatus. Hayles further contends that simulation technologies extend this interaction into the artificial world, reminding us that our interactions with nature are constructed. Simulation technology gives a sense of otherness. The world as we experience it is neither apart from or a part of us; it is neither completely natural nor completely artificial. As photogrammetry is increasingly being applied to simulation technologies, this generates potential areas for practice-led research that are yet to be explored, such as mixed realities becoming more accessible than the real.

4.3 Hyperobjects

As previously discussed, it is acknowledged that human perception is inherently flawed, thus undermining the traditional epistemological foundations upon which human knowledge is built. Current philosophical discourse, such as speculative realism and object-oriented ontology, has gone some way in addressing this issue, specifically in relation to ecological theories, and explained how this has led to an impasse on climate change. This section is intended to explore Morton’s ideas on

Figure 17. Temporal Undulations: Topography of a Meteorite. Installation shot. Image by Gregor MacGregor, 2022.

hyperobjects and the intersection with previously discussed concepts such as Merleau-Ponty's chiasma (1968, p. 130), as well as explicate the influence on the practice-led research. Morton's theories also go some way towards explaining why, despite all the scientific data, humanity still approaches current discourse surrounding nature and climate with a degree of scepticism. The discourse on hyperobjects had a direct influence on the third installation, *Temporal Undulations: Topography of a Meteorite,* (see Figure 27), a visual metaphor that explores Morton's theories from a phenomenological perspective.

Firstly, what are hyperobjects, and why are they relevant? Broadly speaking, Morton (2013) regards a hyperobject as something that is too vast for human interaction, both temporally and spatially; whilst we know it exists, it remains outside our ability to experience the actual thing. As such, it remains unknowable, albeit necessary if we as beings want to move beyond the subject-object binary relationship that dominates our cultural perception of objectified things within the world around us. One example of a hyperobject that has gained much traction is climate change, which Morton refers to

as global warming[10]. Whilst the two terms are interchangeable, for the general population 'global warming' is a term that more closely aligns with the Anthropocene (see Crutzen, 2016) and, as such, this is the term that will be adopted for the purposes of the exegesis.

There are several characteristics that Morton uses to define what a hyperobject is. Viscosity is one such feature. He uses radioactive materials as an example in that they can get everywhere and we, as humans, cannot separate ourselves from them. Morton references Husserl to make the point that we cannot perceive the thing in its entirety (2013, p. 36); there is no correct position from which we can view the object. He goes further by aligning the idea of viscosity to OOO: all non-human objects cannot exhaust each other ontologically; we are intertwined with our phenomenological experience. This concept of viscosity somewhat parallels Merleau-Ponty's interpretation of the phenomenological relationship between subject and object, mostly in his posthumous text *The Visible and the Invisible* (1968). Specifically, with regard to his notes in the chapter "The Intertwining – The Chiasm", he expands on his belief that to perceive the world one must be in it, stating that one must be of the world, intertwined, stuck to it, woven into the fabric of it (Carman, 2008, p. 116).

Another feature of hyperobjects is of nonlocality, whereby a hyperobject must be so widely distributed through time and space as to never be perceived in its totality. Morton uses the following example: when you feel rain you are experiencing the climate but not experiencing the climate as a whole. From an ontological point of view, Morton argues that not only is everything interconnected, but approaching an object from a purely empirical perspective is no longer enough (2013, p. 48). This intertwines with another feature, interobjectivity, which refers to the non-anthropocentric interaction between objects, an interaction between objects as if they are the same thing, such as quantum entanglement, where a quantum can share information with another quantum as if they are one thing (Morton, 2011,). It changes our

[10] NASA states, "Global warming refers to surface temperature increase, while climate change includes global warming and everything else that increasing greenhouse gas amounts will affect" (cited in Morton, 2013, p88).

understanding of causality because the interobjective floats between and through objects; it is space-time (Morton, 2013, p. 83).

Morton also defines hyperobjects through the concept of temporal undulations:

> When you approach an object, more and more objects emerge. It's like being in a dream written by Zeno. Hyperobjects envelop us, yet they are so massively distributed in time that they seem to taper off, like a long street stretched into the distance. Time bends them and flattens them, the same way an electromagnetic wave front shortens at its leading edge. (2013, p. 55)

Some examples that Morton gives as hyperobjects displaying the features of temporal undulations are prehistoric cave art, and meteorites (which have had a direct impact on the direction of the creative practice research; see Chapter 5). These operate as examples of hyperobjects that are so vast that humans cannot truly understand the scale on which they exist in time and space. The Chauvet caves were painted 30,000 years ago but the effects of global warming will still be felt 100,000 years from now (Morton, 2013, p. 59). The more knowledge we gain of the world around us, the more we realise that which we can never know.

4.4 Moving beyond the entropic vortex of the Anthropocene

> The Anthropocene is an "Entropocene": that is, a period in which entropy is produced on a massive scale, thanks precisely to the fact that what has been liquidated and automated is knowledge…(Steigler, 2018, p. 51)

Industrialisation and now, digitisation have resulted in what Steigler argues is an inability for humanity to react accordingly in response to the impending scenarios that the Anthropocene raises. Technology has eroded our need to memorise knowledge. Humanity is losing its conceptual and theoretical capacity. Steigler refers to this as generalised proletarianization. In *The Neganthropocene* (2018), he proposes a philosophical framework in which we can escape this "entropic vortex", one that does not call for a nostalgic return to a pre-industrialised era. Instead, one of the main strategies is to embrace technics; he regards technology as having pharmacological effects in that it can be both a remedy and a poison, and it can both enhance and

inhibit our ability to understand (p. 46). Specifically, he argues that we need to create a cooperative approach towards knowledge, by applying a cyclical process of noetic unfolding towards our use of digital technologies (Steigler, 2018, p. 124). This would entail a decentralisation of digital networks, thus requiring a "thorough reconsideration of the architectonics of digital networks" (Steigler, 2018, p. 132).

As we perceive images increasingly through digital platforms, approaching digital imaging technologies from a pharmacological view appears to make sense. We experience the image via a digital screen, a simulation of the original image (Dewdney, 2021, p. 135). It has become a computational image, no longer a purely optical representation of reality but a hybrid, malleable image formed through algorithmic processing. If, as Steigler suggests, this new technology must form part of the solution, methods such as photogrammetry can release the photographic image from the tyranny of its indexical relation to reality, replacing it with hyper-real representations, for better or worse (Steyerl & Berardi, 2012, p. 26). The image becomes a digital object that viewers can experience through multiple platforms; this plasticity offers a more collaborative, immersive approach towards knowledge (see Figures 29 & 30)

4.4.1 Towards a digital object-oriented ontology

In Chapter Five, I discuss how the final installation, *Digital Uncanny* (see Figures 29 & 30), attempts to converge the multiple theories that have been raised in this chapter, by introducing the image as an augmented reality experience. These augmented digital objects manifest themselves as visual representations of how we, the subject, can interact with the digital object. The digital image is becoming a digital object, one that is more than a representation of the original object. The contextual research has drawn on the theories of Hui, a student of Steigler's, and author of *On the Existence of Digital Objects* (2016), to conflate the theories on the indexicality of the image, the phenomenological experience, and the role of the technical image in a post-natural world.

Hui proposes a philosophical framework where we acknowledge the role of the digital in overcoming the dualistic opposition between nature and technics:

> Both investigations into natural objects and technical objects in the phenomenological tradition show us different directions in which objects could be studied. Digital objects are visible to us in different forms. We can treat them as natural objects. They demand the engagement of our consciousness to furnish concepts for their appearance and our experience with them.
> (Hui, 2016. p. 387)

To overcome the culture-nature divide, Hui argues that technics must be seen as separate from culture, thus allowing nature and technology to intertwine if we are to address the issues surrounding the Anthropocene (2016, p.5). Through a digital-oriented ontology, he aims to move beyond traditional notions of technology and create a philosophy of technology that reflects on future digital developments, overcoming the nature-culture dualism. In the final installation, *Digital Uncanny* (Figure 31), augmented reality has been applied to move the digital image from the screen into a physical space, a space that can be experienced by multiple viewers, representing a communal/cooperative interaction between the viewer(s) and digital object. It is also intended to blur the boundary between the real and the representational, the natural and the digital.

The digital world, or the Metaverse, can also be viewed as a hyperobject and as we become increasingly intertwined with emerging technologies, we need to constantly re-evaluate this relationship. Hui (2016) refers to a digital object as anything that is made from metadata, forms part of a computer program, or exists on a digital screen; it is primarily thought of as being data or information, not as an object or thing. He argues that digital technologies have projected us beyond Heidegger's "temporal ecstasies", and we are now lost in a "technological ecstasy", a way of being that has no direction but is still accelerating (Hui, 2016, p. 47). Digital technologies, in particular mixed realities, have an increasingly symbiotic relationship with humans, generating

Figure 18. Digital Uncanny, third milestone pre-submission. Augmented reality screenshot. Image by Gregor MacGregor, 2022.

Figure 19. Digital Uncanny, third milestone pre-submission. Augmented reality screenshot. Image by Justin Owen©, reproduced with permission.

new temporalities of Dasein; temporal ecstasies are increasingly being determined through algorithms bypassing the traditional subject and intersubject relationship (Lemmens, 2016, p. 314). This gives digital technology an ambiguity that Morton might describe as viscous. Galloway (2012, p. 12) further argues that it is different from photography: we interact with it in ways that we do not with the photograph or film, and does not aim itself at humans as its object. Digital technology has become a hyperobject in and of itself, separate from any referent.

Figure 20. Digital Uncanny. Third milestone pre-submission. Augmented reality screenshot. Image by Gregor MacGregor, 2022.

4.5 Conclusion

The purpose of the two previous chapters has been to establish the contextual framework that has been applied to the practice-based component of my research. The structure of the chapters has been to show the progression of the research in a chronological order; however, due to the cyclical nature of the practice-reflection-practice mode, the research has allowed for the installations to be re-interpreted over the period of research. For example, *After-Nature* was intended to be a more traditional photographic examination of our anthropocentric need to collect and catalogue images in order to examine the natural world. As the contextual discourse introduced aspects of the anthropocentric bias of our perception and the ubiquitous digitisation of the photographic image, the original installation was re-interpreted to include texture maps, invoking Borges' "On Exactitude in Science" (1946/1999).

The first three contextual areas of investigation have laid out the following:

- The historical role of the photographic image in creating a visual inventory of the world around us, and its part in expanding our understanding of the natural world.
- How phenomenological theories on visual perception can expand our understanding of our environment beyond that of empirical observation.
- The potential issues that affect humankind in a post-natural world.

In this section, the research has included the concepts of Steigler and Hui to expand on the previous concepts by incorporating an ontology for digital images, in an increasingly digital world, particularly with reference to Steigler's proposal for escaping the entropic vortex that is the Anthropocene. In the following chapter, as well as situating practices that sit alongside the research, the creative outcomes will be aligned with the conceptual discourse.

Chapter 05 Situating practice: *After-Nature*……...79

5.1 Introduction.

5.2 Photography: A medium for the exactitude of science.

5.3 Sublimating the Museum experience.

5.3.1 Anthropomorphising of Jimmy the chimp.

5.4 Mapping the impossible document.

5.5 The Aura of the digital object.

5.5 Conclusion.

5.1 Introduction

The purpose of this chapter is to outline the evolution of the project's creative output, *No Direction Home,* within the broad field of photographic/art practice, and to outline where my practice sits within current academic and creative discourse. As discussed in Chapter Two, the practice-based research has generated works that incorporate photography, three-dimensional sculpture, digital animation, and augmented reality objects. The creative outcomes are intended to be perceived in order, taking the viewer from a traditional image-based series, emulating the photograph's role as a visual inventory of objects, towards an increasingly digitised artefact (artefactualisation). Each installation creates an experience that questions the relationship between human and non-human, thus challenging our dualistic relationship with the (post) natural world. The installations will be discussed in order as follows:

- *After-Nature: Digital Artefacts for a Post-natural World*
- *Death Mask of a Chimpanzee: Extinction*
- *Temporal Undulations: Topography of a Meteorite*
- *Digital Uncanny*

I will incorporate several case studies that are aligned with my own creative output for the purpose of expressing how the research has evolved, and providing further understanding of the aims that *No Direction Home* achieves. These case studies are drawn from literature, environmental art, photography, and archaeological preservation, and cover discourses around empirical knowledge, phenomenology, technology and the image, and the aura of the digital twin. They are intended to form a creative arc that places the research within the critical discourse outlined in Chapters Three and Four, from the phenomenological experience that digital optical technologies generate, to the mapping of the natural world already in crisis.

The first case study examines William Henry Fox Talbot's *The Pencil of Nature* (1844), the first commercially available photographic book, which, for me, marks the beginning of a photographic medium that could be reproduced in quantities that made it readily available to the mass market. This represents a paradigm shift that changed how we

‘catalogue’ the world around us and defined the world as something ‘other’, deepening the culture-nature divide at a time when the Industrial Revolution was marking the beginning of the Anthropocene.

The other case studies examine the work of Olafur Eliasson, an Icelandic artist who is part of the social practice movement; Dan Holdsworth, a landscape photographer who incorporates new imaging technologies; and the Factum Foundation, a Spanish design studio at the forefront of digitising significant heritage sites.

5.1 Photography: A medium for the exactitude of science

This section relates to the installation *After-Nature: Digital Artefacts for a Post-natural World.* This installation was intended as the first section that introduces *No Direction Home*. The photographic prints represent both the beginning of the era of the technical image (Flusser, 2000) and how digital technologies can potentially alter our perception of the photographic image from a depiction of reality to a projection of a concept. It was important to ground the research within the medium of photography, and photography’s role in collecting and cataloguing the world around us. As such, the first body of work draws inspiration from William Henry Fox Talbot’s *The Pencil of Nature* (1844). As discussed in Chapter Three, *The Pencil of Nature* (PoN) was the first photographic book that was published and sold commercially in six volumes, at twelve shillings per volume. It was published with a total of 24 printed photographic images and included Talbot’s thoughts on the potential applications for this new medium. In his introductory letter, Talbot describes the photographs as follows:

> The plates of the present work will be executed with the greatest care, entirely by optical and chemical processes. It is not intended to have altered in any way, and the scenes represented will contain nothing but the genuine touches of Nature’s pencil. (1844, n.p.)

The first part of the installation is a series of photographs of the Western Australian Museum’s collection from the Welshpool storage facility (see Figure 32). This photographic series was inspired by Talbot’s use of photography as a visual

inventory of objects (see Figure 33); it is intended to place the research within photographic discourse. This series is intended to broadly imitate Talbot's use of photography to copy nature by generating a visual inventory (Roberts, 2004), transferring a sense of "legalistic truth" onto the image (Sekula, 1986, p. 345).

Figure 22. Articles of Bones. photographic print (100cm x 150cm). image by Gregor MacGregor, 2020.

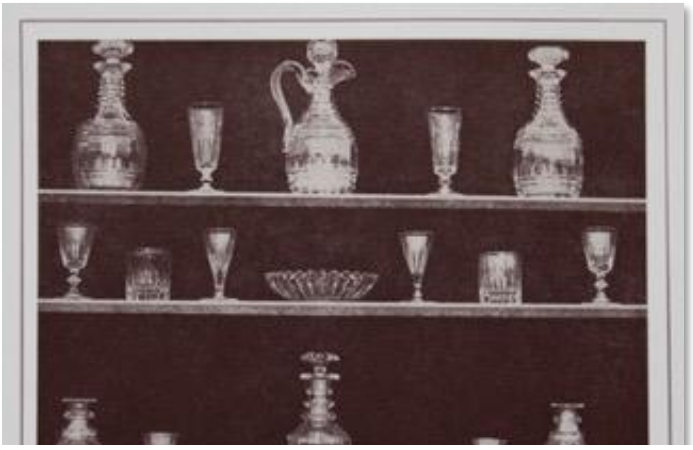
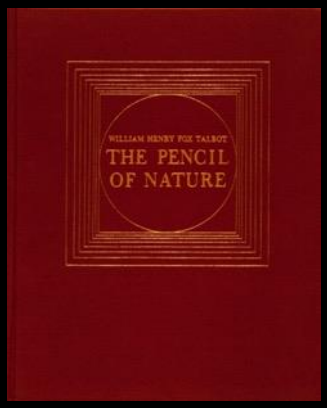
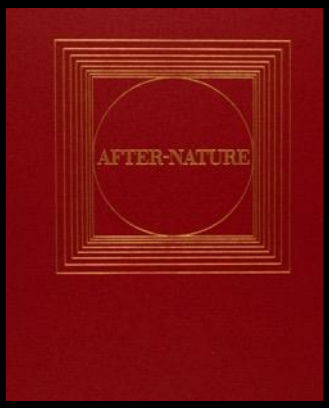
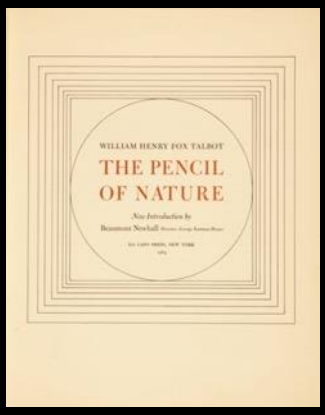


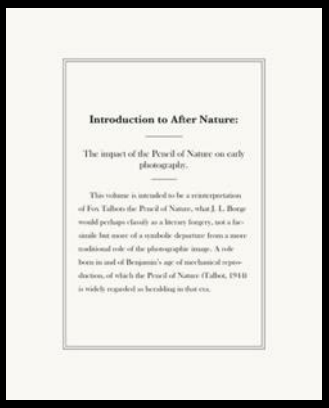
Figure 21. William Fox Talbot, 1844. Plate IV, Articles of Glass. Collodion print, dimensions unknown from The Pencil of Nature. De Capo press, New York. (Exception to ©. Section: ss40, 103C. Exception: Research or study).

As discussed in Chapter Three, *After-Nature* was originally intended to illustrate a 'copy' of Talbot's PoN (see Figure 32). However, the process of photogrammetry kept coming back to the creation of maps and the idea of using images to navigate through a world in constant flux. The final draft of *After-Nature* replaced the original photographic series with a series of twenty-four texture maps, which are computer-generated maps that Metashape uses to wrap around the mesh model of the object. It is this map that gives the scanned object its photorealism and, as such, blurs the distinction between the map and the territory. This idea of what it means to map the world through technologies such as photogrammetry









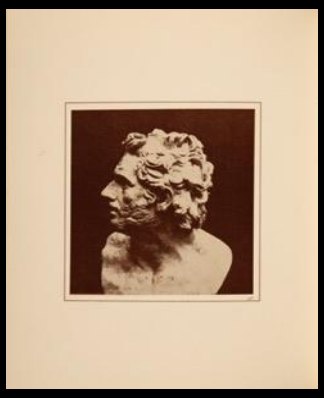


Figure 23. Left hand side: Fox Talbot, 1844. Reproduced from the Pencil of Nature. Right hand side, Gregor MacGregor. 2022. reproduced from After-Nature. (Exception to©. Section: ss40, 103C. Exception: Research or study.

became a recurring motif throughout the research, a link connecting all the installations.

Borges' "On Exactitude in Science" replaces Talbot's letter that opens the original *PoN* and is presented using the same layout as Talbot's letter (see Figure 35). It is intended to act as a metaphor for our relationship between the subject (index) and the object (referent). *After-Nature* takes on the form of a forgery, in the same way that Borges presents his parable, invoking what Baudrillard refers to in the following terms:

> Today abstraction is no longer that of the map, the double, the mirror, or the concept. Simulation is no longer that of a territory, a referential being, or a substance. It is the generation by models of a real without origin or reality: a hyperreal. (1983, n.p.)

The points that Borges raises in his parable align with my research in that no matter how complex the digital reproduction becomes, the representation is always an abstraction of the original, a simplification (Mehaffy & Salingaros, 2017). As digital technologies create increasingly complex systems of representations, to what end do we apply these new systems? Does the digital twin, the map, supersede the original, as Borges suggests? Is this ever possible? As the Dao (*Tao Te Ching*) suggests, "Nature can never be completely described, for such a description of Nature would have to duplicate Nature" (Lao Tse, as cited in Robinson, 4th C).

As optical technologies become more immersive, the boundaries between the natural and digital worlds blur, challenging our perception of the image as object. The boundaries between the referent (the object pictured) and the representation (the digital image of the object) come closer together. This subsequently challenges the relationship between subject and object. In this research, the referent is the natural world to which a process called photogrammetry is then applied to produce a more immersive representational experience ofthan the original photograph. The digitisation of objects from the natural world reflects humankind's need to collect

Suàrez Miranda,
Viajes de varones prudentes, Libro IV,
Cap. XLV, Lerida, 1658.

A literary forgery

from

Historia universal de la infamia:

On Exactidude in Science

By

Jorge Luis Borges

... In that Empire, the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province. In time, those Unconscionable Maps no longer satisfied, and the Cartoghraphers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it. The following Generations, who were not so fond of the Study of Cartography as their Forebears had been, saw that the vast map was Useless, and not without some Pitilessness was it, that they delivered it up to the Inclemencies of the Sun and Winters. In the Deserts of the West, still today, there are Tattered Ruins of that Map, inhabited by Animals and Beggars; in all the Land there is no other Relic of the Discipline of Geography.

Figure 24. On Exactitude in Science. A Universal History of Infamy. Borges, J, L. 1946. Reproduced as a facsimile of Fox Talbots letter to the readers in Pencil of Nature. (Exception to ©. Section ss40, 103C. Exception: Research or study.)

and catalogue such objects to preserve and retain memories, the same need that gave us museums. Through the deconstruction of digital photogrammetry, this research aims to examine the creative potential that emerging optical technologies offer beyond that of empirical observation.

During my residency at the Perth Centre for Photography (PCP) in 2021, it was the computer-generated texture maps (Figure 36) that began to represent both a new form of technical image and a metaphor for how we are relying on technologies to interpret information for the future. The three-dimensionality of these images changes our perception of the image as object; they are more immersive and elicit a different emotional response from the viewer/subject (Hayles, 1996). I have chosen to use this response towards immersive

Figure 25. Proof pages from After-Nature. Reset Residency, installation at Perth Centre for Photography. Image by Gregor MacGregor, 2021.

technology to challenge our relationship with the natural world. The digitization of museum collections as well as an increased capacity for digital storage and accessibility to the internet have changed the ways in which we manage and access information (Bertacchini & Morando, 2011). This, in turn, introduces new ways to retrieve, experience, and even monetize collections. It is the experience of digital collections that I wish to privilege in my analysis of how we can engage with technology, as opposed to the 'real' world.

This leap from the physical object to the digital one represents a paradigm shift in the way we represent objects as images, even greater than the inventions of photography, cinema, and television (Jeffrey, 2015). To better understand our relationship with the digital object, it is important to acknowledge both the immateriality and the uncanny nature of digital images.

After-Nature, as mentioned earlier, is intended to be the first of the installations that the viewer experiences. It allows the viewer to know that the research is grounded within the photographic medium. All the following images, three-dimensional prints, maps, animations, and augmented images have been made using only photographic images, albeit by means of photogrammetry. However, it is the inclusion of Borges' "On Exactitude on Science" that offers the viewer a clue to the overall arc of the research, which is about questioning the wisdom of collecting increasingly detailed images/maps. The physical volume of *After-Nature*, when it is placed alongside the Newhall edition of *PoN,* appears as a forgery filled with texture maps. Only when the viewer reads the introductory letter in the opening leaf of the facsimile/forgery, *After-Nature,* will they get the clue that informs the rest of the exhibition.

In the next section I examine the work of Olafur Eliasson, an Icelandic artist who is part of the social practice movement, and how this has informed my own practice, specifically *Death Mask of a Chimpanzee: Extinction.*

5.2 Sublimating the museum experience

This section introduces the work of Olafur Eliasson, specifically his installation *The Weather Project* (2003) at the Tate Modern (see Figure 37). Through this case study analysis, I will discuss the role of the social practice movement, and the importance of immersive installations within a gallery/ museum environment. This installation was my first introduction to the work of Eliasson, taking up the whole of the Turbine Hall at the Tate Modern gallery. *The Weather Project* was on a scale that was so vast the viewer became a participant within the installation. It was also the first time that I had engaged with an artwork that directly responded to the emerging discourse on global warming, one that was a constructed reality based within a gallery/museum. Eliasson

is an artist who is actively researching current natural sciences and creating phenomenological experiences for the viewer, leaving it to the viewer's embodied experience to determine how they interpret the work. The scale of this piece allows the viewer to freely walk around the artwork. This mode of engagement turns the gallery/museum into an active experience, one that sits outside the traditional didactic space that they have become.

Eliasson's practice of incorporating phenomenological embodied experiences to allow the viewer to interpret their own perception of the natural world is an approach that I have incorporated into my own research albeit on a smaller scale. Nevertheless, the sublime nature that is inherent in the large-scale artistic works is something that I have adopted whenever possible, specifically with *Death Mask of a Chimpanzee: Extinction*. Originally intended for inclusion in the previous installation, this work evolved into its own series because of the three-dimensional print shown at the *Light and*

Figure 26. Olafur Eliasson, The Weather Project, 2003. Monofrequency lights, projection foil, haze machines, mirror foil, aluminium, and scaffolding. 26.7m x 22.3m x 155.4m. Installation in Turbine Hall, Tate Modern, London. Photo: Studio Olafur Eliasson,© Olafur

and Shadow exhibition at FutureLab, Curtin and Shanghai (2022).

This installation is experienced as a photographic print, a three-dimensional print, and a digital animation. The intention is to offer the viewer the opportunity to experience the same image using three different visual experiences.

The large format photographic print (see Figure 38) has been printed so that the viewer experiences an image that is difficult to perceive, disappearing into a void and invoking a sense of loss. The chimpanzee is, at current rates, expected to be extinct by 2050, a portent of what some scientists regard as the sixth mass extinction.

The original three-dimensional print/image (see Figure 39) has been coated in a material that absorbs 99% of visible light, rendering the artefact almost invisible. Its visual appearance, like a shadow, is intended to act as a metaphor for the loss of the natural world, further eliciting a foreboding sense of the sixth mass extinction. When viewed from behind an acrylic box, the mask is virtually invisible, prompting the viewer to move in closer to inspect the object only to see their own reflection, a visual metaphor for the Anthropocene.

The digital animation (see Figure 67)) is based on Richard Gregory's visual experiments on human perception (*Chaplin's half mask*). As the mask rotates, the image inverts, revealing the fallibility of human perception. In this way, the installation engages the viewer to experience the same image through three different materials, namely, the photographic print, the three-dimensional object, and the digital screen.

The viewer wanders around the installation freely. The images are aligned in such a way that more than one is always visible. In the *No Direction Home* (2022) exhibition at the Perth Centre for Photography, when the viewer looked into the perspex box at the mask, they would see not only themselves but all three parts of the installation (see Figure 39). As with Eliasson's practice, this was intentional – placing the viewer within the installation creates an embodied experience that appropriates Gestalt psychology's experiments on visual perception and their influences on Merleau-Ponty's *Phenomenology of Perception* (1945). When an artwork is presented within

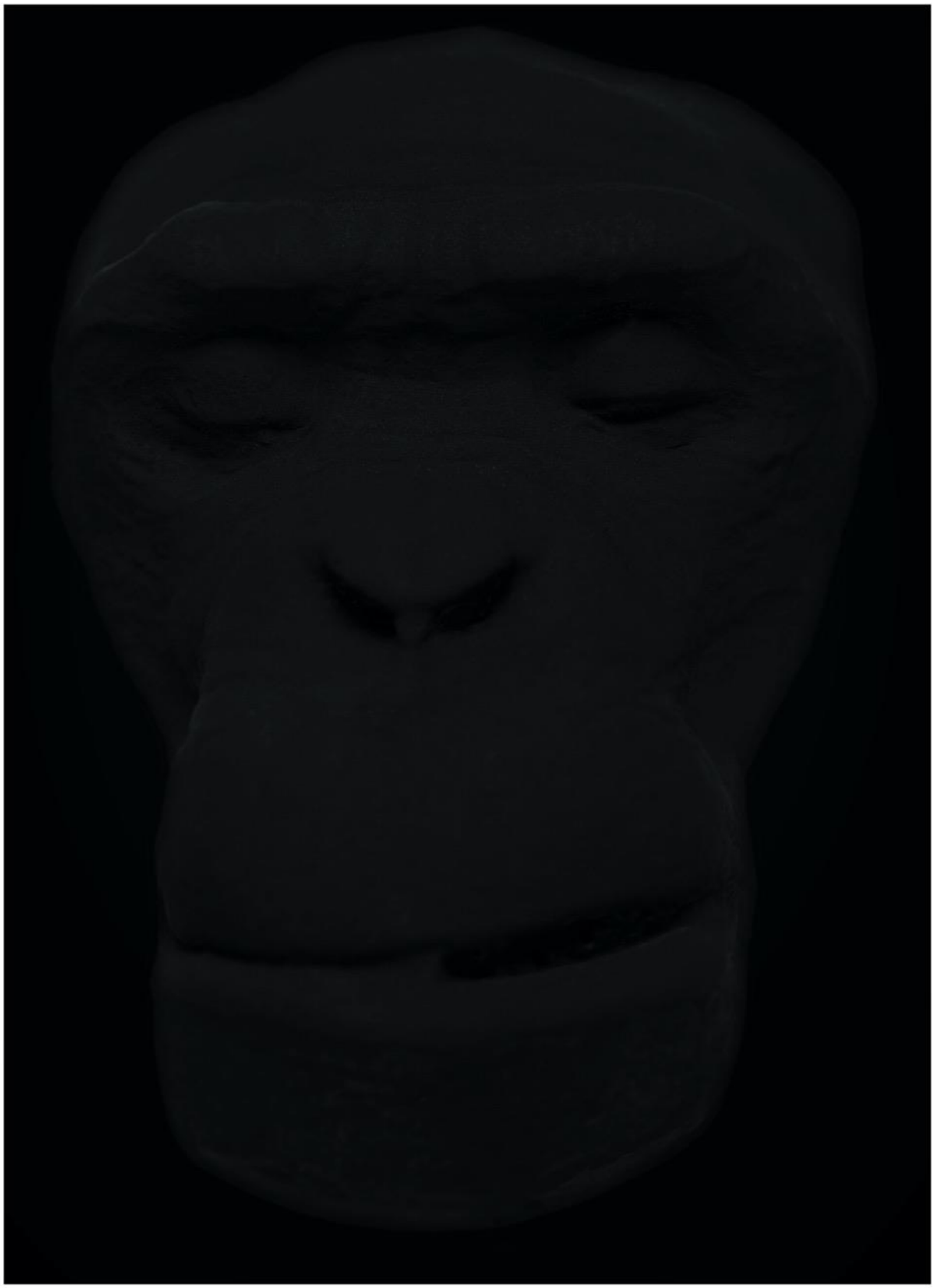


Figure 27. Death Mask of a Chimpanzee: Extinction. Photographic print 100cm x 150cm. Image by Gregor MacGregor, 2022

a gallery space[11], the intention is to generate an interaction with the viewer and diminish the impact of what Merleau-Ponty regards as the “historicity” of the artwork (Johnson & Smith, 1993, p. 101). These are all concepts that Eliasson has applied to his own practice. From early on, he has utilised phenomenological theories on perception, specifically how they allow us to understand the individual experience of reality even when that reality is a constructed artwork representing the natural world.

Figure 28. Death Mask of a Chimpanzee: Extinction. 3d Print (SLA), 25cm x 15cm. Acrylic box and plinth 30cm x 30 cm x 120cm. Light and Shadow exhibition. Image by Gregor MacGregor, 2020.

[11] Broadly speaking, the terms ‘gallery’, ‘museum’, and ‘art museum’ (as in the Tate Modern) are interchangeable, in that they all function as a space to present objects within a context of reference, learning, and something other that is separate from its original purpose.

Eliasson was the first artist to engage me, via a purely phenomenological perspective, regarding the climate change discourse. It is this intertwining of these two seemingly disparate ideas that underpins the whole body of research. The concept of approaching the climate change debate from a non-scientific outlook is something that stems from climate change scientists who are involved in the Intergovernmental Panel on Climate Change (IPCC). The IPCC was created in 1988 by the United Nations. It aims to provide a scientific report for governments around the world to develop policies around climate change. The IPCC assesses thousands of published scientific papers to ensure an objective report on the impacts and future risks surrounding the climate. It has published six Assessment Reports since 1990. The most recent report (AR6) was published in 2022. Despite these reports, the urgency for change is not being picked up on by the general population. Communicating the scientific facts does not appear to be enough to engage the public and broadly influence governmental policies; therefore, artists like Eliasson have intentionally created art experiences to engage viewers on an emotional level. This alignment of incorporating the science of climate change and situating the phenomenological subject within the embodied sensory experience establishes Eliasson's practice within the social practice movement (SPM). SPM is an art movement that covers a broad group of artists who incorporate whatever method required to engage the viewer in participating with an artwork that is aimed at raising awareness of social or environmental issues. My own research has been situated within this mode of practice for almost 20 years now, since that initial interaction with *The Weather Project* (2003).

5.2.1 The anthropomorphising of Jimmy the Chimp

The Weather Project (2003) has informed my practice. I have aligned it with *Death Mask of a Chimpanzee: Extinction*, which specifically engages the viewer with the discourse surrounding the sixth mass extinction event. However, I would like to incorporate some historical context to this death mask, which is of the chimpanzee known as Jimmy and was somewhat of a celebrity at Perth Zoo from 1963 to 1968. Jimmy's celebrity was a result of the widely believed, but untrue, rumour that he was the original Cheetah from the Hollywood Tarzan movies, although he had featured in some Hollywood movies like *Dark Venture* (1953).

His ‘owner’, the magician John Calvert, took Jimmy on a tour to Australia; however, after a series of misadventures and due to Australia’s strict quarantine laws, Jimmy was eventually repatriated to Perth Zoo. Jimmy had been trained to participate in films and Calvert’s magic act, where he had been trained to smoke cigarettes. During his time at Perth Zoo, local crowds flocked to see Jimmy and offer him cigarettes to smoke, Jimmy died at the age of sixteen. The average life of a chimpanzee is 40-50 years in the wild; a post-mortem revealed smoking to be the cause of death. His remains were offered to the Western Australian Museum, where a death mask was made; his death mask and remains are still in the collection.

For the *Death Mask of a Chimpanzee,* I have aligned my research with Olafur Eliasson’s environmental art practice. In the next section, I will return to my previous background as a studio-based photographer. The purpose of this is to reinforce the photographic aspect to my research and further situate my own practice with the work of the landscape photography of Dan Holdsworth.

5.3 Mapping the impossible document

> We first arrive at science as research when and only when truth has been transformed into the certainty of representation. What it is to be is for the first time defined as the objectiveness of representing, and the truth is first defined as the certainty of representing…. (Heidegger, 1977, p. 127)

Twenty years ago, as a studio-based photographer whose practice included technical still-life photography for various commercial clients, my practice involved large format technical cameras. These modular cameras, specifically the Sinar P2, had a resolution unlike anything I had experienced before, or since; however, it required a methodical, technical approach, very different to the process of small format digital photography. In retrospect, the technical aspects of large format photography conflicted with the more streamlined workflow of the small format digital cameras that have come to dominate the photographic medium. As such, this drew me towards photogrammetry. Whilst working as a studio-based photographer in London, I was aware of the work of the London-based landscape photographer, Dan Holdsworth. His work with large

format cameras and his aesthetics had a modern and technical component that was compelling.

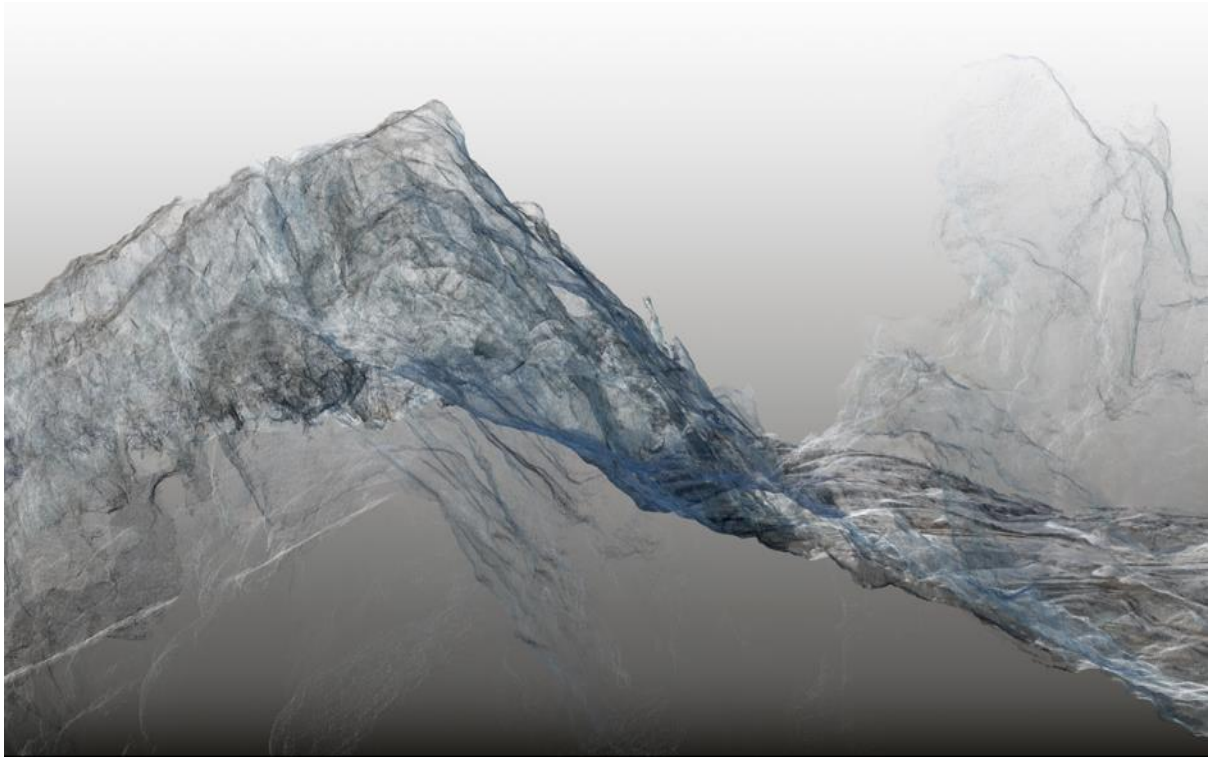


Figure 29. Argentiere Glacier No.1. C-type photographic print, 44.2cm x 80cm. Reproduced from holdsworth.works.archive.image © Dan Holdsworth, 2016. (Exception to ©. Section:ss40. 103C. Exception: Research or Study).

However, I did not return to his work until doing research for the installation *Temporal Undulations: Topography of a Meteorite.* His philosophy on the medium of photography and experimental application of optical digital technologies, primarily LIDAR (see Figure 40), caused me to reassess what photography can mean in the digital era. Holdsworth is a photographer who spans both the analogue and digital eras of photography, which represent the largest paradigm shift within the medium, encompassing both a proliferation and a dematerialisation of the photographic image. His approach to the technological developments has similarities with my own practice, specifically the image as digital data, which I have endeavoured to incorporate into the research and reassess what photography becomes in the near future.

Firstly, Holdsworth acknowledges that photography has never been a static medium. It has constantly incorporated evolving technologies. The photograph has always existed as an indexical archive in books, frames, etc. Whilst the digital nature of the

image effectively dematerialises the photograph as object, it still exists within a virtual/digital archive (Holdsworth, 2018, p. 219). The technical image that Holdsworth investigates generates an archive of the near future. It is catalogue of visual imagery that fundamentally alters photography's ontological link between representation, memory, and, to some degree, truth (Rubinstein & Sluis, 2013), thereby making the photographic image and the whole process more automated and accessible than pre-digital (analogue) photography, which was already regarded as readily available for mass consumption.

Traditionally, the photographic image is associated as being a flattened moment in time, representing a frozen memory, adding to an ever-expanding archive that acts as a visual marker of linear time. Prior to the photographic image, the idea of image as representation was seen as more mimetic. With the invention of photography, the role the image loses its phenomenological value and is elevated to that of guarantor of truth. Heidegger's quote in the epigraph for this section, taken from the essay "The Age of the World Picture", refers to the role of the image as being that of representation rather than mimesis. This is seen as a key characteristic of the modern age, one that confirms Descartes' view that the representational quality of the image, and consequently, the photograph, becomes a scientific method through which observing the image becomes a basis for truth and, therefore, knowledge (Juduvitz, 1988).

Emerging digital technologies have created a paradigm shift, one that Holdsworth has embraced with both a creative and critical eye. He is a landscape photographer who sees the landscape as something that extends infinitely in front of the viewer. He sees the digital image as mirroring our internal space, allowing other lines of thought to be explored (Holdsworth, 2018, p. 225), to achieve what Harman (cited in Cole, 2015) would describe as follows: "We can only think the unthinkable if we adopt… oblique approaches to the object world [which] we cannot directly experience" (p. 345).

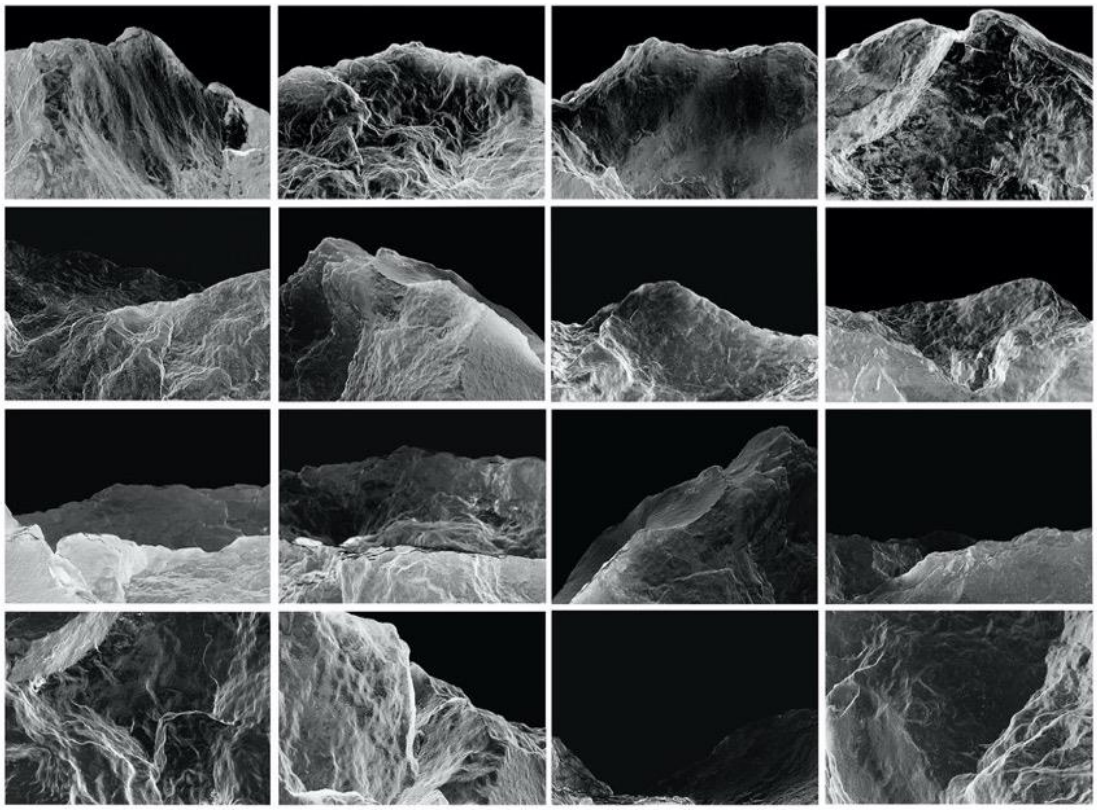


Figure 30. Temporal Undulations: Topography of a Meteorite. Photographic print, 100cm x 120cm. Contemporary landscape in Photography, award winning entry, Perth Centre for Photography. Image by Gregor MacGregor, 2022.

This overall approach aligns with *Temporal Undulations: Topography of a Meteorite*, the third installation of the series. This series starts with a three-dimensional print (which was generated by using 350 photographs, as outlined in chapter four), a digital animation, and a series of photographic prints taken of the three-dimensional print, creating a triptych of images all using the same meteorite as a reference point. Like Holdsworth's work, *Temporal Undulations* explores the creative potential of what is regarded as technical/scientific process and presents the viewer with a series of phenomenological experiences. The series is intended to explore the idea that as humans we cannot comprehend concepts that sit outside of humanity's collective experience; and if we cannot observe it, then it sits outside of our reality. Originally, the concept behind *Temporal Undulations* was inspired by the term 'hyperobjects': "Hyperobjects are time-stretched to such a vast extent that they become impossible to hold in mind" (Morton, 2013, p. 58).

Temporal Undulations is a reference to Morton's description of objects as they appear in time and space. He uses meteorites as a metaphor for the temporal nature of objects that make them physically unknowable. In his texts *Dark Ecology* (2016) and *Hyperobjects* (2013), Morton argues that our traditional (empirical) approach to understanding our place in the world is inadequate, thus exacerbating the human-nature divide, and leading to humans failing to fully understand concepts such as time, space, and climate. As such, *Temporal Undulations* is intended to work as a metaphor, exploring our relationship with a nature that no longer exists and is outside of our perception of it.

This installation also invokes Benjamin's optical unconscious. Benjamin states, "The camera introduces us to unconscious optics as does psychoanalysis unconscious impulses" (1968, p. 61). As he explains: "With the close-up, space expands; with slow motion, movement is extended. The enlargement of a snapshot does not simply render more precise what in any case was visible, though unclear: it reveals entirely new structural formations of the subject" (Benjamin, 1968, p. 60).

The original concept for *Temporal Undulations* was to produce a typological grid of an image of the surface of a three-dimensional print from a meteorite, mapping the latter's surface as if it were a series of landscapes (Figure 41), initially familiar through the trope of known landscapes but ultimately a study of something that is known yet unknowable. Using the typological method to explore the physiognomy of the landscape, the images trigger the viewer's expectations that the photographs reveal

Figure 41. Temporal Undulations. Photographic print, 100cm x 150cm. Image by Gregor MacGregor, 2022.

Figure 42. Monolith, The Face of Half Dome Rock. Photographic Print. ©Adams estate. Image by Ansell Adams, 1927. (Exception to ©. Section: ss40, 103C. Exception: Research or study).

the essence of the object (Incirlioglu, 1994, p. 17), especially when combined with Borges' "On Exactitude in Science", and a three-dimensional print of the meteorite questioning the viewer's initial perception of the images.

During the residency at PCP, the installation expanded to include an animation of the meteorite taking the viewer around and through the object, an experience that cannot be done through traditional photography. For the final installation the typology was reduced, so as not to dominate the triptych, and the images were inverted to create the sense of an object floating in space (Figure 41). This technique also enhanced the sense of the familiar by recreating the trope of sublime black and white landscape photography, such as that of Ansell Adams' (Figure 42), whilst revealing Merleau-Ponty's discourse on the intertwining between the known and the unknown, the visible and the invisible (Merleau-Ponty, 1968, p. 130). Combined with the three-dimensional print and the animation, the installation is intended to allow the viewer to experience the image of the meteorite as photographic object, physical object, and digital object (Figure 43).

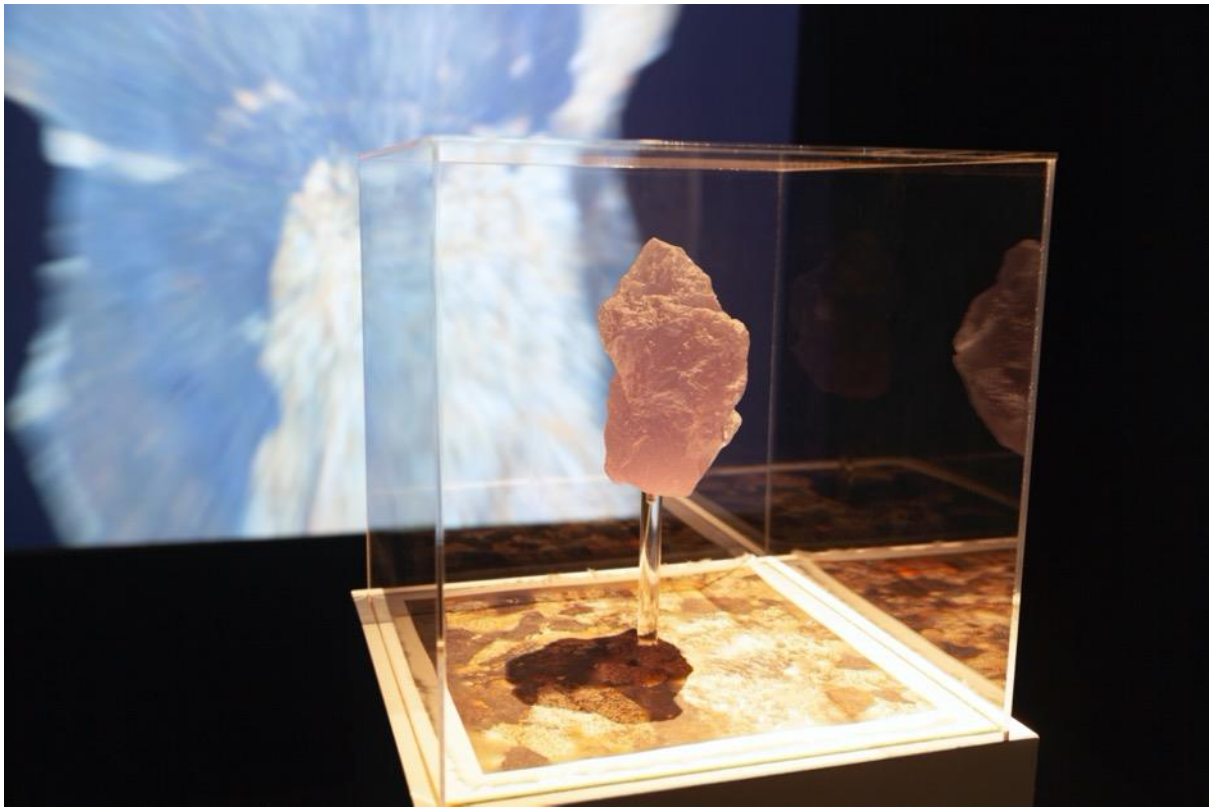


Figure 31. Temporal Undulations: Topography of a Meteorite. 3D Print (SLA), and digital animation, Reset residency. Image by Gregor MacGregor, 2021.

The purpose of the installation is to explore the immersive and physical nature of the technical image and how they affect our experience of the world around us, thus questioning our anthropocentrically biased perception of the environment as something separate from us. *Temporal Undulations* is inspired by Morton's theories on hyperobjects, that is, objects so vast that they are beyond our understanding, thereby exacerbating the human-nature divide and resulting in a failure to fully understand concepts such as time, space, and climate. As such, this installation is intended to explore our relationship with and our perception of a nature that no longer exists .

In the final section, I outline the last installation, *Digital Uncanny*, which explores the image as a digital object and the use of an immersive digital experience to transform our perception of the photographic image beyond its role of documenting the other. The section also integrates a case study of the design studio Factum Foundation, which utilises similar technologies to create digital twins of at-risk cultural heritage sites

and offers an analysis of its founder Adam Lowe and his discussion with the philosopher Bruno Latour (2013).

5.4 The aura of the digital object

This section explicates the final installation, *Digital Uncanny*, and considers how it aligns with the creative practice and critical discourse of the design studio Factum Foundation to show how digital visualisation technologies are continually evolving and are able to fundamentally alter the way in which we create, view, and experience photographic images. As these images are increasingly immersive and interactive, our experience of the image changes dramatically beyond that offered by a traditional photograph.

The Factum Foundation is a not-for-profit organisation founded in 2009 by Adam

Figure 32. Factum Foundation, 2019. Digital reconstruction of the sacred cave of Kumukuwaka. https://www.factumfoundation.org/pag/1289/the-sacred-cave-of-kamukuwaku (accessed: 31/05/21). ©Factum Foundation. (Exceptionto ©. Section ss40, 103C. Exception: Research

Lowe. It is a multi-disciplinary workshop that is dedicated to the digital production of 'facsimiles' of culturally significant artefacts. The Foundation is at the forefront of developing techniques for high resolution recording and advancing re-materialisation techniques for the digital preservation of cultural heritage artefacts. Based in Madrid, Factum Arte/Foundation promotes the use of high-resolution recording, digital restoration, and creative re-materialisation while bringing into focus the changing attitudes towards owning, sharing, preserving, and displaying cultural artefacts. The

example I have included is a still from the short documentary about their work digitally reconstructing the sacred cave of Kamukuwaká (see Figure 44).. I have included them for two reasons: firstly, they develop workflows that cross over into the photographic, the physical object, and the digital space; and secondly, they aim to shift the viewer's perception on the role of the facsimile with regards to the original.

One of these cultural sites that Factum Foundation has digitally preserved is the above-mentioned sacred cave of Kumukuwaká in Xingu, Brazil. It is an important site for the indigenous Wauja peoples. The cave itself contains petroglyphs relating to the creation myths of the Wauju people, from the time beyond Time, the Kamo; the fact that this intersects with Morton's ideas on hyperobjects, specifically temporal undulations, is not discounted. In 2018 it was discovered that the cave was being intentionally vandalised. It is on contested land. In collaboration with the Wauju people, Factum Foundation undertook a digital restoration and, through photogrammetry, Lidar, and CNC milling, created an exact facsimile of the original cave (Smith, 2020, p. 52). The cave acts as a tool with which the Wauju can engage with the narrative of their creation. The myth relies heavily upon the location to bring the narrative to life. Therefor the digital simulacra of the cave will have a somewhat different aura, This difference in the aura of the digital reproduction is addressed in a conversation which the founder, Adam Lowe, had with the philosopher Bruno Latour (1947–2022).

In the text *The Aura in the Age of Digital Materiality* (2019), Lowe and Latour go some way in addressing the critical aspects of generating a digital facsimile when we can no longer rely on the original to engage the viewer. They argue that we are conditioned to believe that only the original possesses an aura, as well as location and materiality, and that it cannot be replaced by a copy – and in the age of mechanical reproduction and analogue photography, the point has some merit. Digital facsimiles are grouped together with the idea of a photographic rendering of the original, combined with the digital screen as the visual outcome, giving rise to the association of a digital copy being a poor representation of the original. However, the digitisation of the original is only one stage of the process; increasingly complex digital techniques offer a new way to explore/experience the original and re-define what originality means (Lowe & Latour, 2020, p. 36). Digital techniques such as photogrammetry not only generate a digital copy, but also offer other options, such as three-dimensional printing and virtual

or augmented experiences which, whilst not intended to replace the original, can offer new ways to relate to the original. This exploring of the virtuality of the digital reproduction is something that has been incorporated into my own research, as can be seen in the use of three-dimensional printing and augmented reality.

The final phase of my practice-based research, *Digital Uncanny* is aimed at questioning the empirical role of collecting objects from the natural world and the impact that this has had on the human-nature divide, and our relationship with a nature that no longer exists. This series emerged because of my paper and presentation at the Cumulus Roma Conference, 2020/1, where I discussed the idea of creating non-empirical experiences that explore new ways for understanding our relationship with the natural world around us.

Digital Uncanny is inspired by the illustrated plates of Albertus Seba's collection of natural curiosities from around the world. This collection was originally reproduced and widely viewed throughout European society in the 17th century. Enabling sections of society access to such images for the first time was a way of democratising knowledge by spreading previously unattainable information. The collection itself was eventually sold off and became the basis for most natural history museums in Europe.

The triptychs in *Digital Uncanny* are part of a series that explores how expanded photographic techniques can generate an altered experience, compared to the traditional photographic image, using photogrammetry to generate 3D facsimiles of the original object (see Figures 46 & 47). On the right is an image of a three-dimensional print, stripped of any pretense at reality. On the left is a computer-generated map of the photographs that the software requires to allow the viewer a realistic perception of the object. In the middle is a QR code, which a viewer using a smartphone can use to experience a three-dimensional, augmented reality version of the image, which represents the final stage of the digitization of the object.

This final installation is intended to raise questions around the empirical role of collecting objects from the natural world and the impact that this has had on the human-nature divide, and our relationship with a nature that no longer exists. At the Cumulus Roma Conference, I also discussed this installation as a case study into how

digital technology and the photographic image can immerse us, the subjects, in a world that has up until now been largely viewed or experienced as something separate or other from humankind.

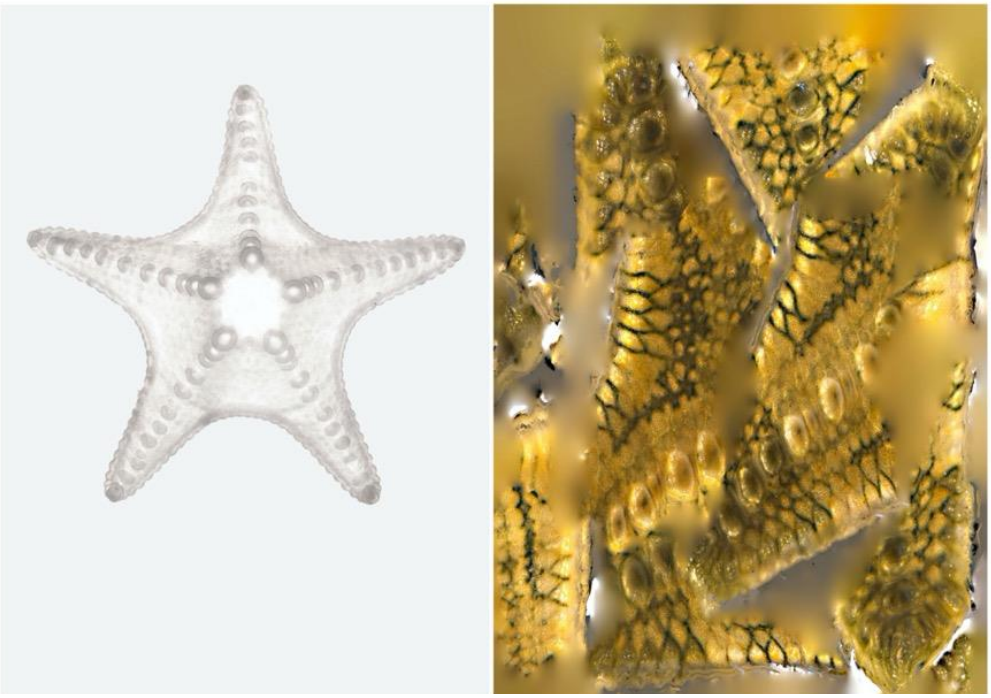


Figure 34. Digital Uncanny, Starfish Diptych. Photographic Print, 100cm x 100cm. Image by Gregor MacGregor, 2022.

Figure 33. Digital Uncanny, Augmented reality Starfish. Image by Gregor McGregor, 2022.

5.5 Conclusion

This chapter has aimed to illustrate the practice-based research and situate it alongside the work of various practitioners who share the creative impulse to examine the role of the photograph in the near future, and to explore the idea that the image is more than a mere copy but a digital twin.

Technology has changed the ways in which human subjects can create, view, and ultimately experience images. As these images become increasingly realistic, they must ultimately change our perception of the image as object. As technology becomes more immersive, the boundaries between the natural and digital worlds will blur, challenging the relationship between subject and object. Through practice-led research, I have tried to explore how we can adapt this change to our advantage. As we go from one climate crisis to another, it is becoming increasingly clear that our relationship with the natural world is fundamentally flawed. Humans are having a detrimental effect on the environment that they require to survive. My research has looked at possible ways in which we can potentially alter our perception of the natural world through visual applications of digital technologies as it becomes increasingly problematic to experience the natural world because our very presence causes more problems than solutions.

Through the application of phenomenology, object oriented ontology into my practice-led research, my aim is to create post-empirical experiences, that place the viewer within, that explore new ways to understand our relationship with the natural world around us. Another purpose of these installations is to question the impact that our anthropocentric bias has had on the natural world, the environment, and to explore the possibilities that technology, through creative practice, can raise awareness of the biases in our perception of the objects within our environment.

The next chapter will lay out the completed artworks as they have been discussed in this chapter to showcase the artworks as they would be viewed in an exhibition: they are laid out in order from the photographic image as an inventorial document through to an increasingly digitised image and finally, the digital object: an augmented reality version of the object as it has been scanned using photogrammetry.

Chapter 06: Creative outcomes: *No Direction Home,* final portfolio..106

6.1 Introduction

6.2 After-Nature: Digital artefacts for a post natural world

6.3 Death Mask of a Chimpanzee: Extinction

6.4 Temporal Undulations: Topography of a meteorite

6.5 Digital Uncanny

6.6 Conclusion

6.1 Introduction

The previous chapter has situated the creative outcomes within various contemporary art practices. This chapter acts as a stand-alone portfolio of the creative output of the research. As outlined in previous chapters, the practical component of the research is presented in four stages, each intended to engage the viewer in various issues that affect the Anthropocene, and to question the role of the photographic image in an increasingly digital environment. The chapter will be laid out into four sections aligning with the order in which the installations are intended to be viewed, with each section becoming increasingly digitised, moving further away from the indexical nature of the photograph as a visual document. The layout of this chapter broadly mirrors the third milestone, pre-submission installation and the exhibition, *No Direction Home,* at the Perth Centre for Photography. For a video of the walkthrough of the third milestone, see Appendix for a video link. The final portfolio of works is presented in the following order:

- *After-Nature: Digital Artefacts for a Post-natural World*
- *Death Mask of a Chimpanzee: Extinction*
- *Temporal Undulations: Topography of a Meteorite*
- *Digital Uncanny*

Each installation creates an embodied experience that questions the relationship between human and non-human, thus challenging our dualistic relationship with the (post) natural world.

6.2 *After-Nature: Digital Artefacts for a Post-natural World*

The first section of this series is inspired by Talbot's use of photography as a visual inventory of objects. It is a photographic series of collected objects from the WA Museum's storage facility. Talbot's *The Pencil of Nature* (1844) is widely regarded as the first commercially sold photographic book, which created a paradigm shift in the democratisation of visual information on its publication.

The second part, *After-Nature*, is a forgery/facsimile/copy of *The Pencil of Nature,*

representing a departure from traditional photography by replacing the photographic series with maps (photographic texture of the original object). Inspiration was also drawn from Borges' "On Exactitude in Science" (1946/1999), a parable on humanity's need to collate observed knowledge and how this can overshadow reality.

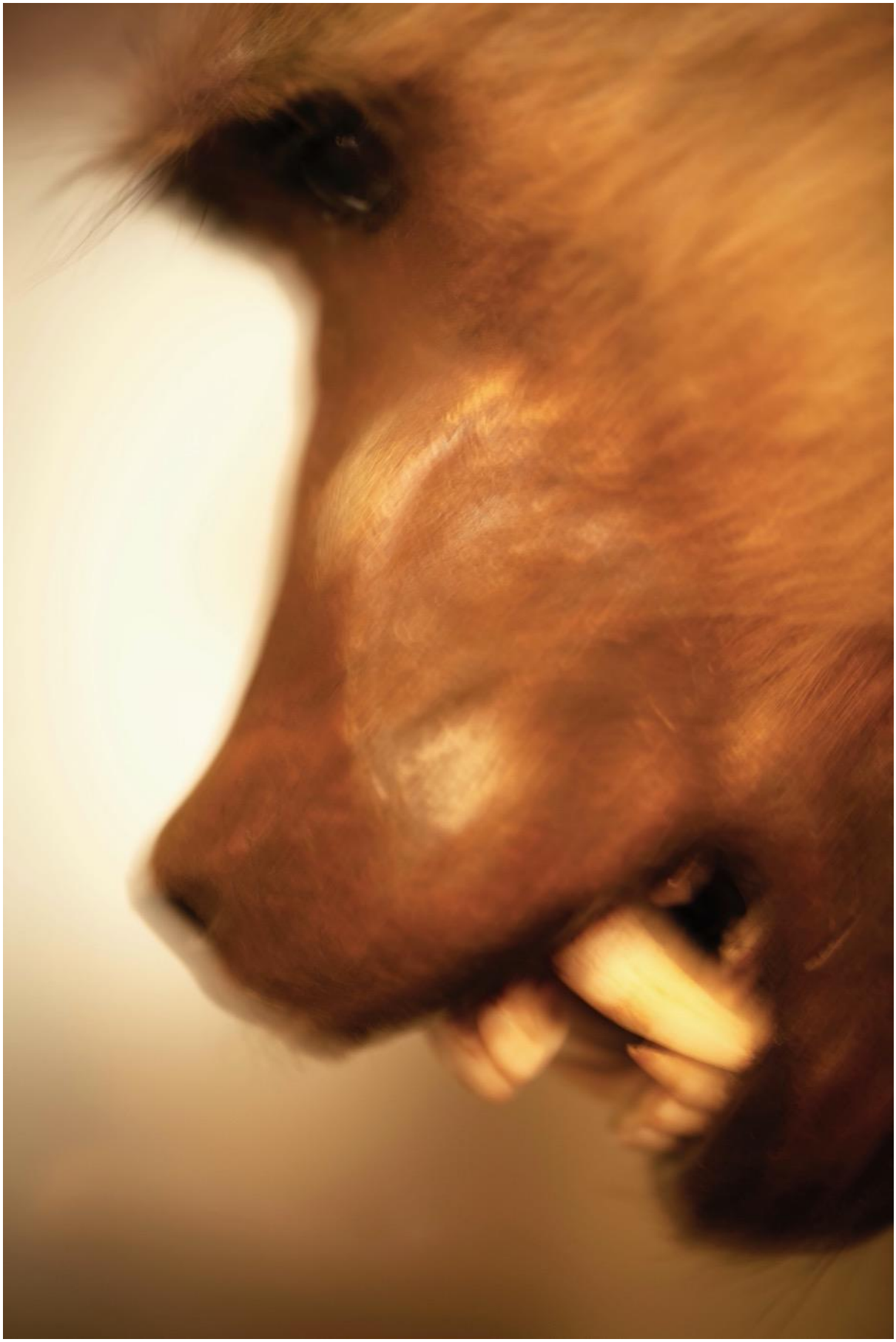


Figure 35. After-Nature. Baboon. Photographic print, 100cm x 150cm. Image by Gregor MacGregor, 2021.

Figure 48. After-Nature: Chimpanzee wrapped in plastic. Photographic print. Image by Gregor Macgregor, 2020.

Figure 49. After-Nature: Blue whale on pallet. Photographic print. Image by Gregor MacGregor, 2020.

Figure 50. After-Nature: Primate feet and silver tape. Photographic print. Image by Gregor MacGregor, 2020.

Figure 51. After-Nature: Table of birds. Photographic print. Image by Gregor MacGregor, 2020.

Figure 52. After-Nature: Dolphin in plastic wrap. Photographic print. Image by Gregor MacGregor, 2020.

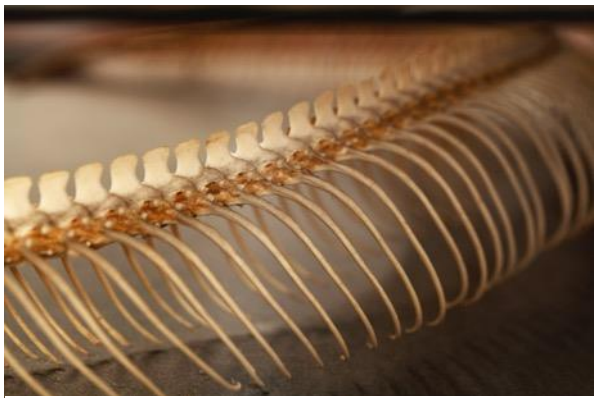


Figure 53. After-Nature: Python in glass box. Photographic print. Image by Gregor MacGregor, 2020

Figure 36. After-Nature: Articles of bones. Photographic print, 100cm x 150cm. Image by Gregor MacGregor, 2020.

Figure 55. After-Nature: Bird in box. Photographic print. Image by Gregor MacGregor.

Figure 56. After-Nature: Albino Raven. Photographic print. Image by Gregor MacGregor.

Figure 38. After-Nature: Shells in a cigarette packet. Photographic print. Image by Gregor MacGregor.

Figure 37. After-Nature: Shells in boxes. photographic print. Image by Gregor MacGregor, 2020.

Figure 59. After-Nature: Seagulls eggs in tray. Photographic print. Image by Gregor MacGregor, 2020.

Figure 60. After-Nature: Shells in matchboxes. Photographic print. Image by Gregor MacGregor, 2020.

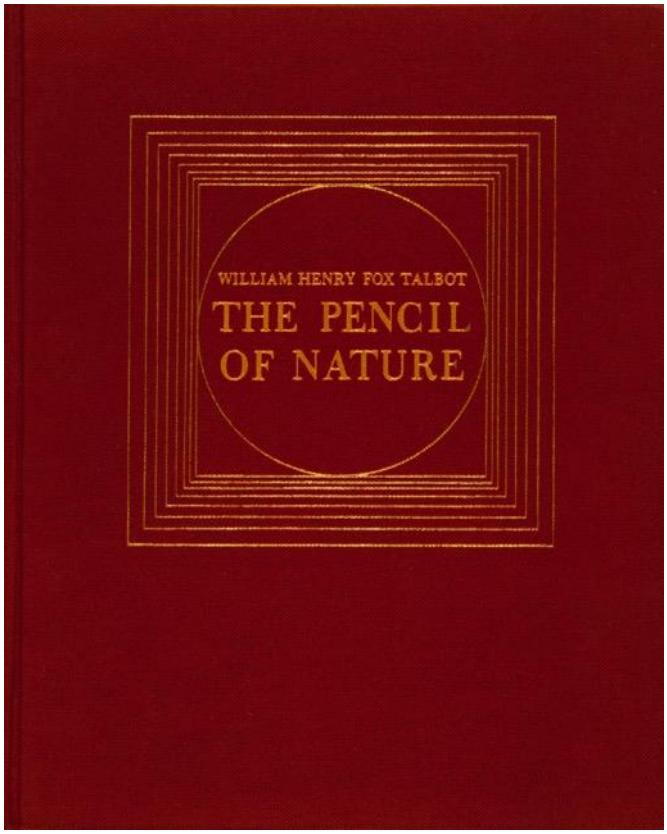


Figure 39. Pencil of Nature. William Fox Talbot. 1844.

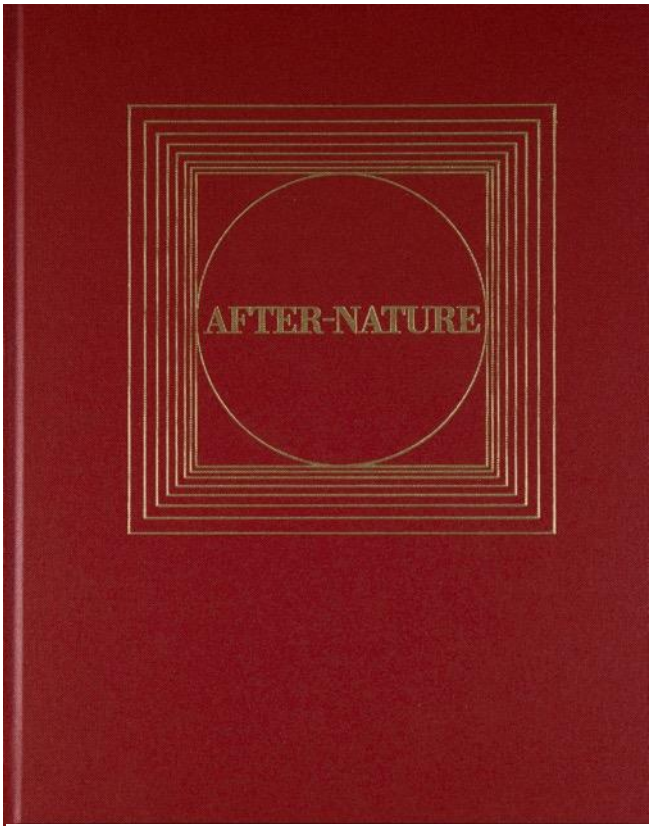


Figure 40. After-Nature (A forgery of sorts). Image by Gregor MacGregor.

6.3 Death *Mask of a Chimpanzee: Extinction*

Death Mask of a Chimpanzee: Extinction is a triptych presented as a photographic print, a three-dimensional print, and a digital animation. The photographic print was printed dark on matt paper to intentionally make it difficult to perceive. The image itself is printed at seventy-five percent opacity, invoking a sense of loss. The chimpanzee is expected to become extinct by 2050; at current rates, scientists believe that this will signify the beginning of the sixth mass extinction.

The three-dimensional print has been coated in a material that absorbs 99% of light, rendering the artefact almost invisible, implying a sense of loss and acting as a metonym for the extinction of the chimpanzee. The viewer needs to move towards the object to inspect it inside its acrylic box, only to see their own reflection, a visual metaphor for the Anthropocene.

The third component is a digital animation, based on Richard Gregory's visual experiments on human perception, specifically *Chaplin's half mask*. As the mask rotates, the image inverts, revealing how easily our observed perception of reality can be distorted.

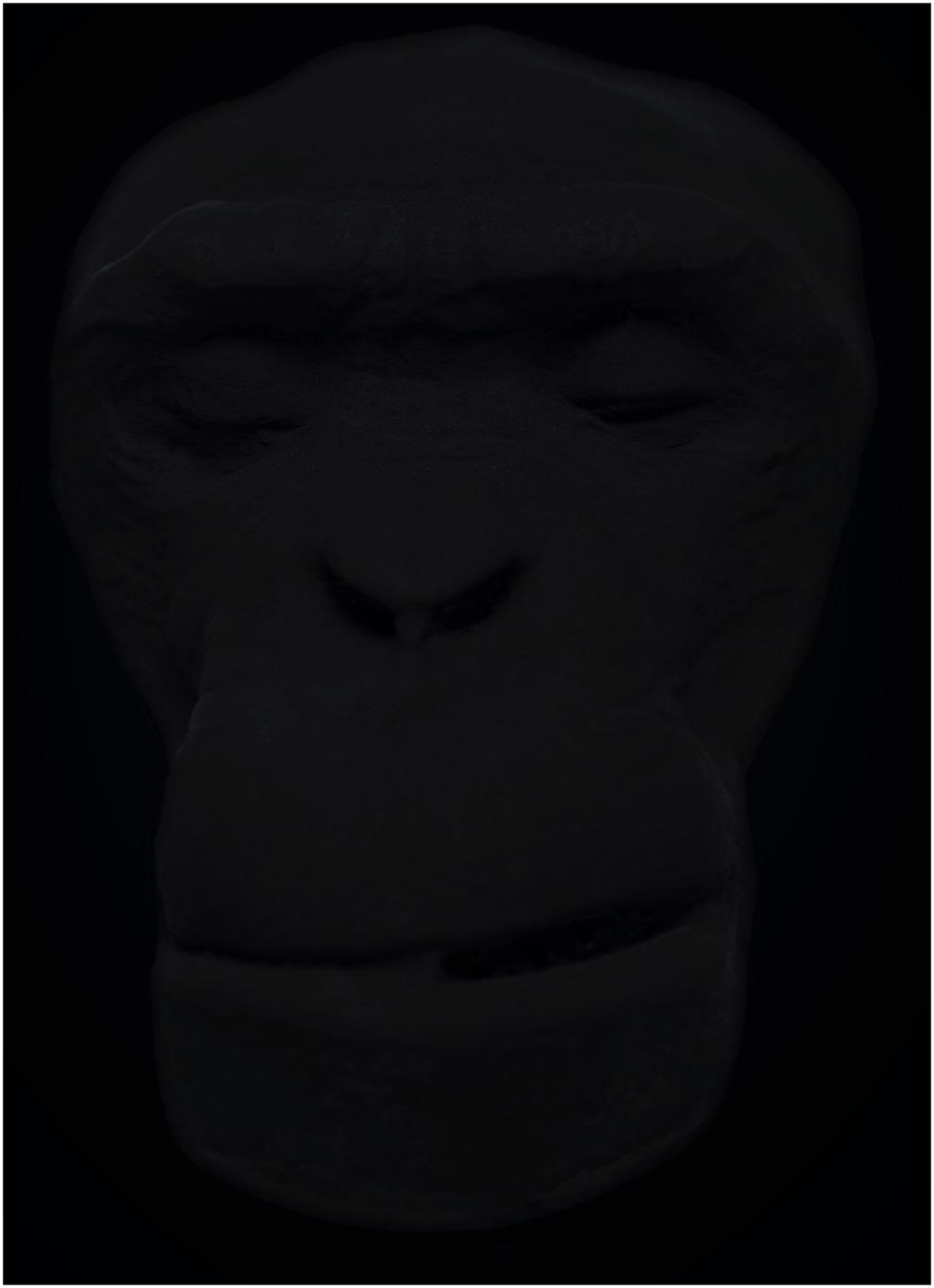


Figure 41. Death Mask of a Chimpanzee: Extinction. Photographic print, 100cm x 150cm. Image by Gregor MacGregor.

Figure 42. Death Mask of a Chimpanzee: Extinction. 3D print, 25cm x 15cm. Image by Gregor MacGregor.

Figure 43. Death Mask of a Chimpanzee. 3D print with reflection. Image by Gregor MacGregor.

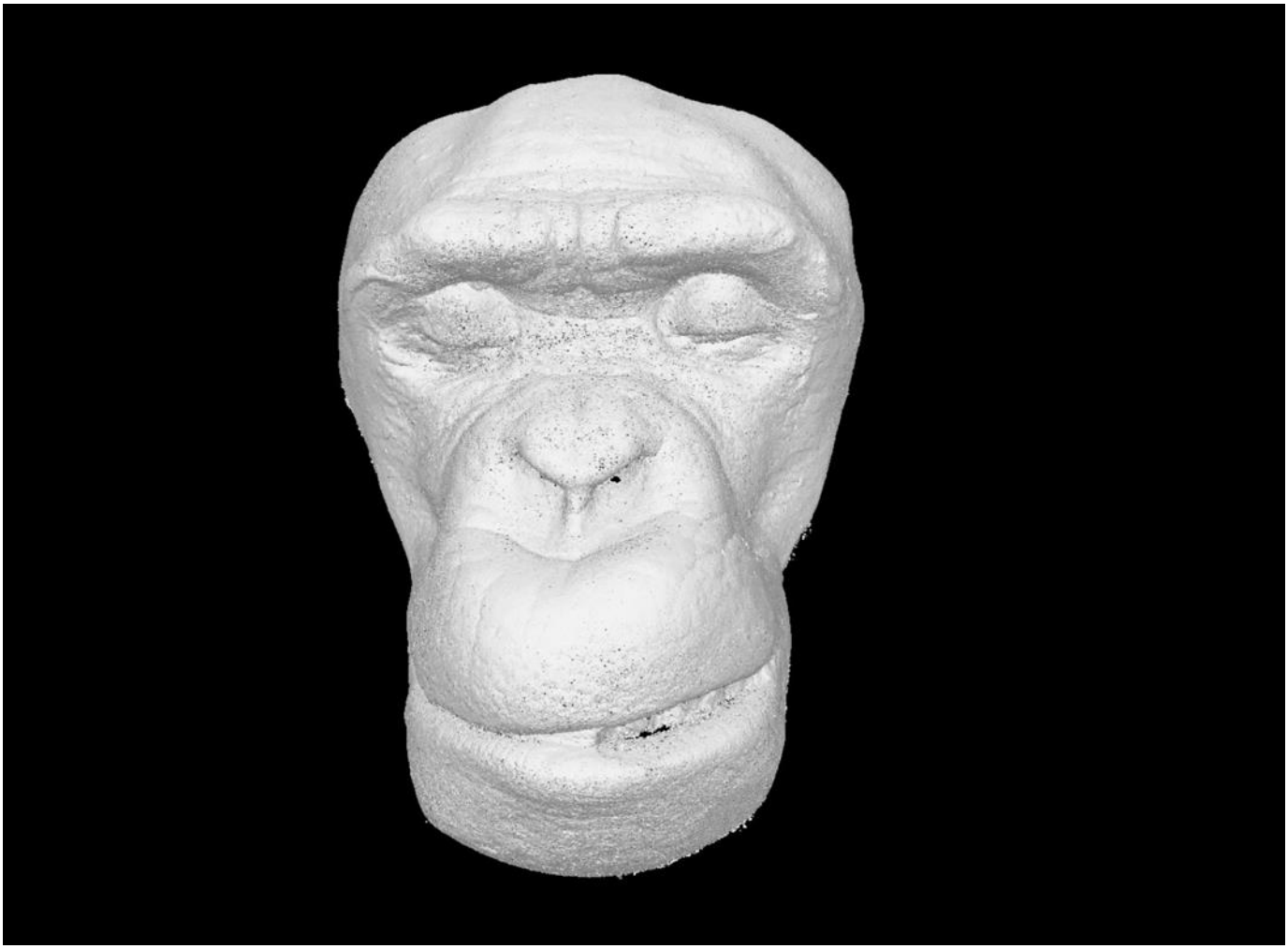


Figure 44. Death Mask of a Chimpanzee: Extinction. Still from digital animation. Image by Gregor MacGregor.

Vimeo Link: https://vimeo.com/779507046

6.4 *Temporal Undulations: Topography of a Meteorite*

Hyperobjects are time-stretched to such a vast extent that they become impossible to hold in mind (Morton, 2013, p. 58). *Temporal Undulations* references Morton's description of objects as they appear in time and space; he uses the meteorite as a metaphor for the temporal nature of objects that make them physically unknowable.

In this series, the typological grid is a series of images of the surface of a three-dimensional print of a meteorite, mapping the surface as if it were a series of landscapes. The typological grid is used to explore the physiognomy of the landscape and exploit the viewer's expectations that photographs reveal the essence of the object. The physical three-dimensional print is intended to cause the viewer to question their initial perception of the grid. The final piece is the digital animation that tracks both around and through the meteorite, revealing the digital nature of the image.

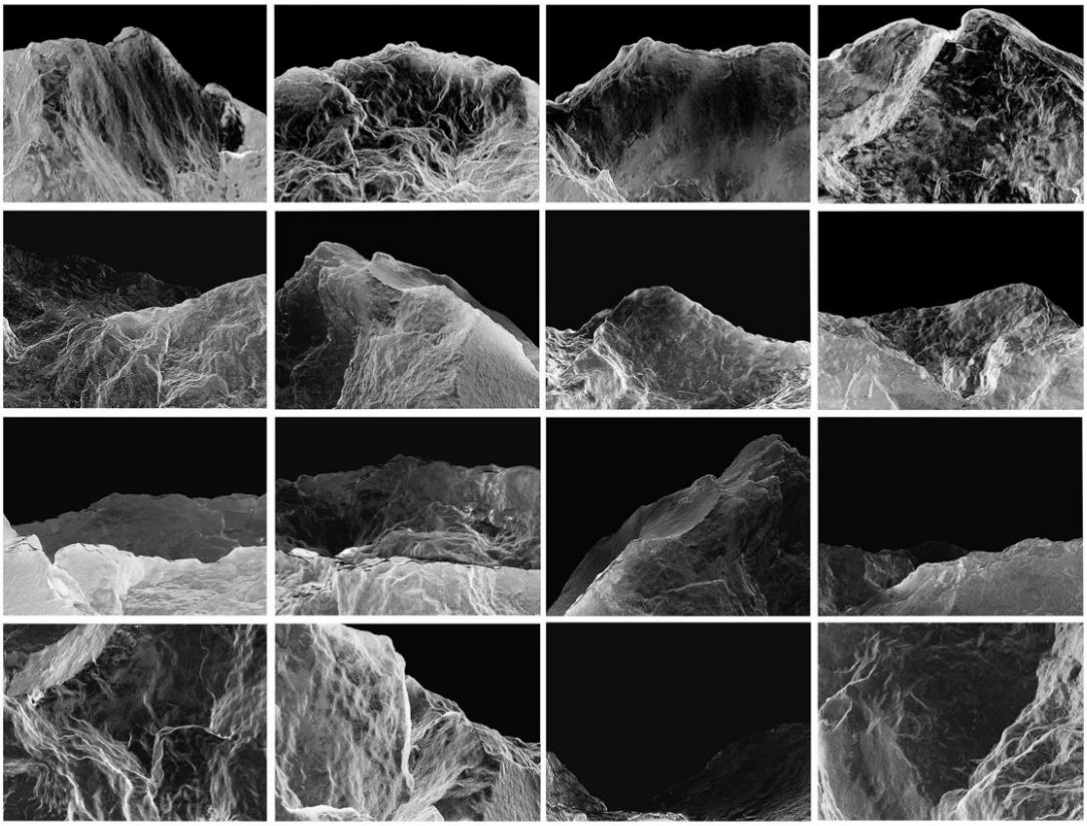


Figure 45. Temporal Undulations: Topography of a Meteorite. Typological grid. Photographic print, 120cm x 100cm. Image by Gregor MacGregor.

Figure 47. Temporal Undulations: Topography of a Meteorite. 3D print, 20cm x 15cm. Image by Gregor MacGregor, 2022.

Figure 48. Temporal Undulations: Topography of a Meteorite. Still from digital Animation, full render. Image by Gregor MacGregor.

Vimeo Link: https://vimeo.com/787442714

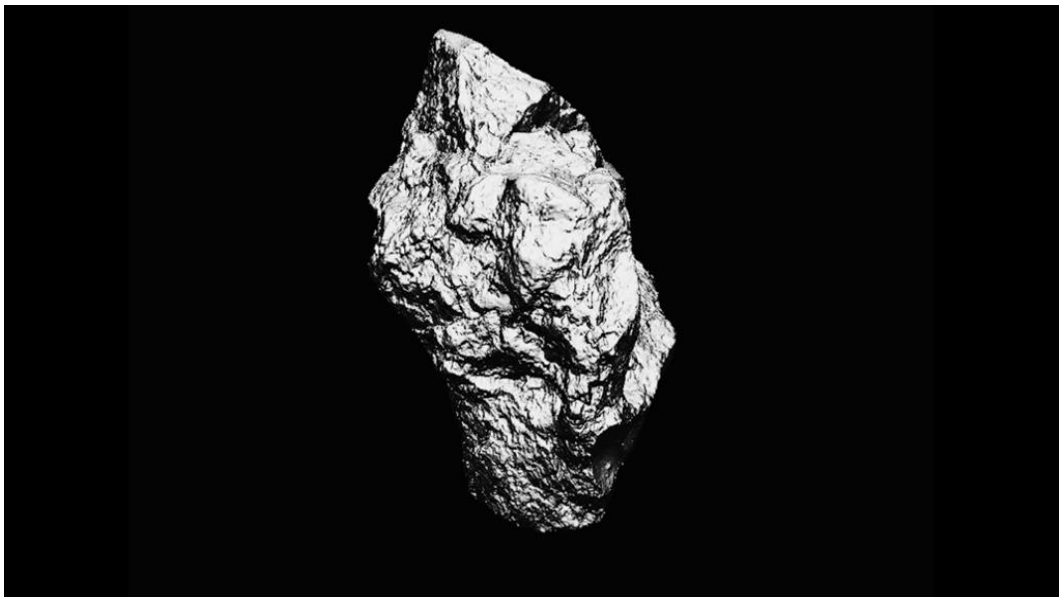


Figure 49. Temporal Undulations: Topography of a Meteorite. Still from digital animation, digital mesh. Image by Gregor MacGregor.

Vimeo Link: https://vimeo.com/787457407

6.5 *Digital Uncanny*

> … still today. There are tattered ruins of that map. (Borges, 1944/1999, n.p.)

Digital Uncanny is a triptych that extends the role of the photographic image through augmented reality. The first image is a photographic image of the clear three-dimensional print stripped of any photographic reality. The second image is a computer-generated texture map representing the information that is required to generate a realistic perception of the original object. *Digital Uncanny* also takes the viewer back to the forgery that is *After-Nature*. The third image is a QR code; a viewer with a smartphone can scan the code to see a three-dimensional representation of the original artefact, a digital object that only exists within a digital space.

The term uncanny it is intended to include both the original Freudian definition, *unheimlich*, and a broader definition of the uncanny with regard to the creative output of this research, specifically *Digital Uncanny*. The title for the creative research *No Direction Home*, does borrow from the original Freudian definition of *unheimlich,* which translates as unhomely or unfamiliar. If one accepts the earlier hypothesis that we are in the age of the Anthropocene, then that which is intrinsically familiar, the natural world, is becoming increasingly unfamiliar. Humanity has changed the post-natural world that past a point to which we can return, creating an uneasiness that is simultaneously familiar and unfamiliar.

As the creative work progresses, the imagery becomes increasingly digitised, acting as a metaphor for the natural world disappearing and all that we have left being a digital copy. In the final installation *Digital Uncanny,* the augmented reality imagery invokes Freud's definition of the uncanny, from his essay The *Uncanny* (1919). This was achieved by generating a digital reproduction of the original which is intended to generate a sense of unease between the digital copy and the collective memory of the familiar original.

The process of photogrammetry can itself produce a digital image that is recognised as evoking a sense of unease, a digital uncanny, sometimes referred to as the

uncanny valley as it produces a sense of detachment from an image that initially appears very similar to the referent (Nancarrow, 2019). The technique has been utilised throughout the creative research to explore the cognitive disconnect experienced when viewing a digital copy through augmented reality. This is intended to produce an emotional response that explores the sense of the uncanny and loss.

Figure 50. Digital Uncanny: Sea Urchin. Photographic print, 100cm x 100cm. Image by Gregor MacGregor, 2022.

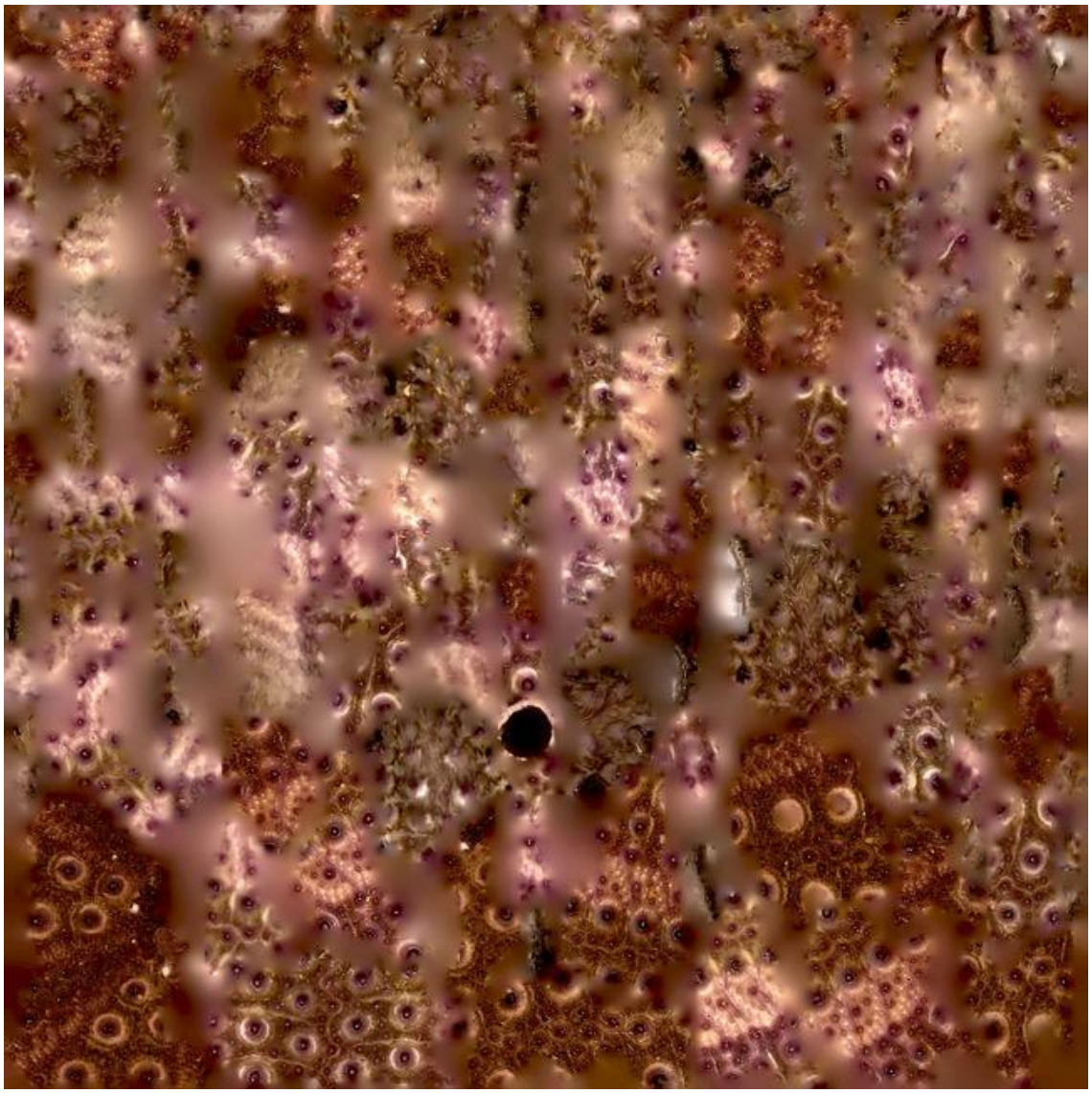


Figure. 72. Digital Uncanny: Sea Urchin, Texture map. Photographic Print, 100cm x 100cm. Image by Gregor MacGregor. 2022.

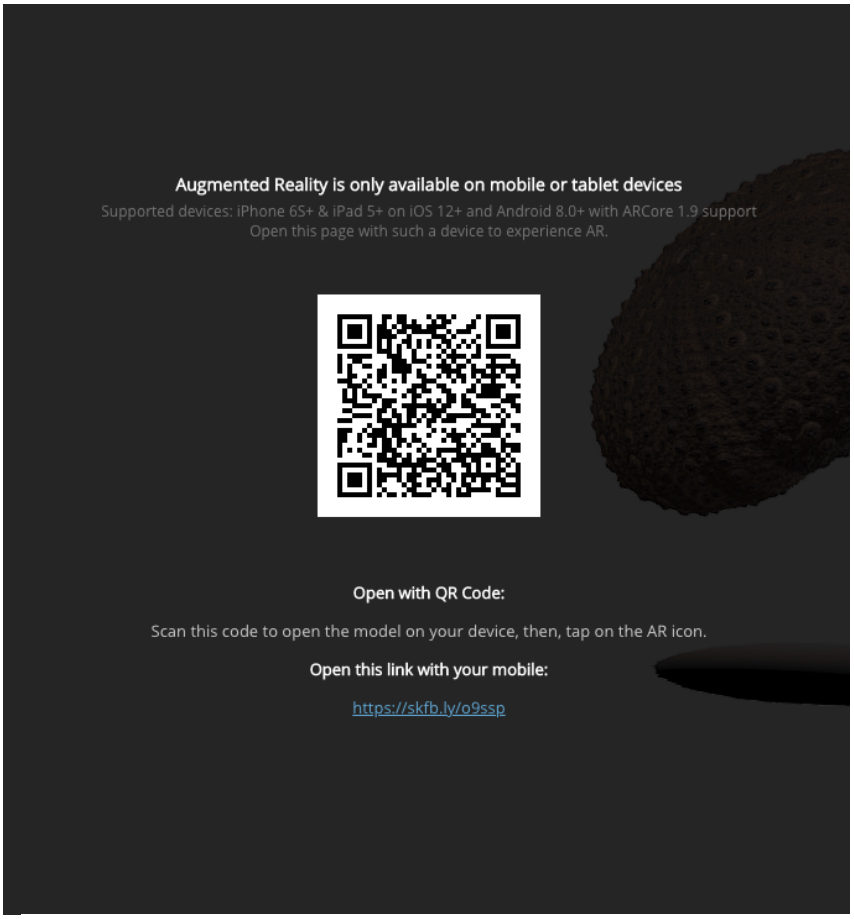


Figure 53. Digital Uncanny: Sea Urchin. QR code. Image by Gregor MacGregor.

Figure 54. Digital Uncanny: Sea Urchin. Augmented reality. Image by Gregor MacGregor, 2022.

Figure 55. Digital Uncanny: Hawk. Photographic print, 100cm x 100cm. Image by Gregor MacGregor.

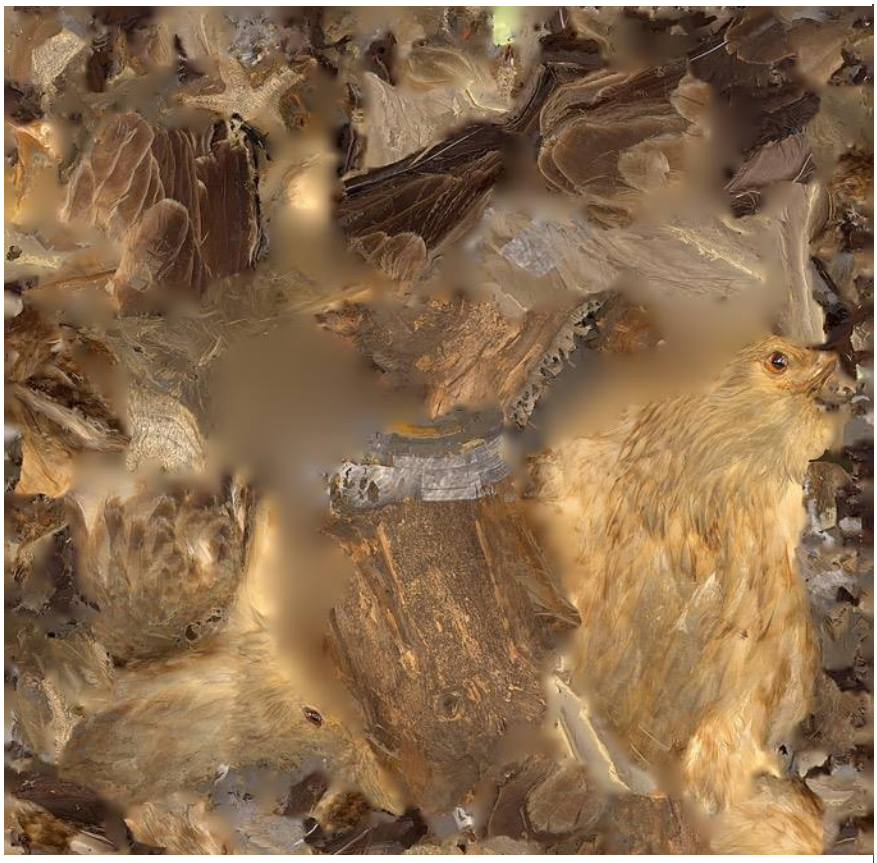


Figure 76. Digital Uncanny: Hawk, Texture Map. Photographic print, 100 x 100cm. Image by Gregor MacGregor.

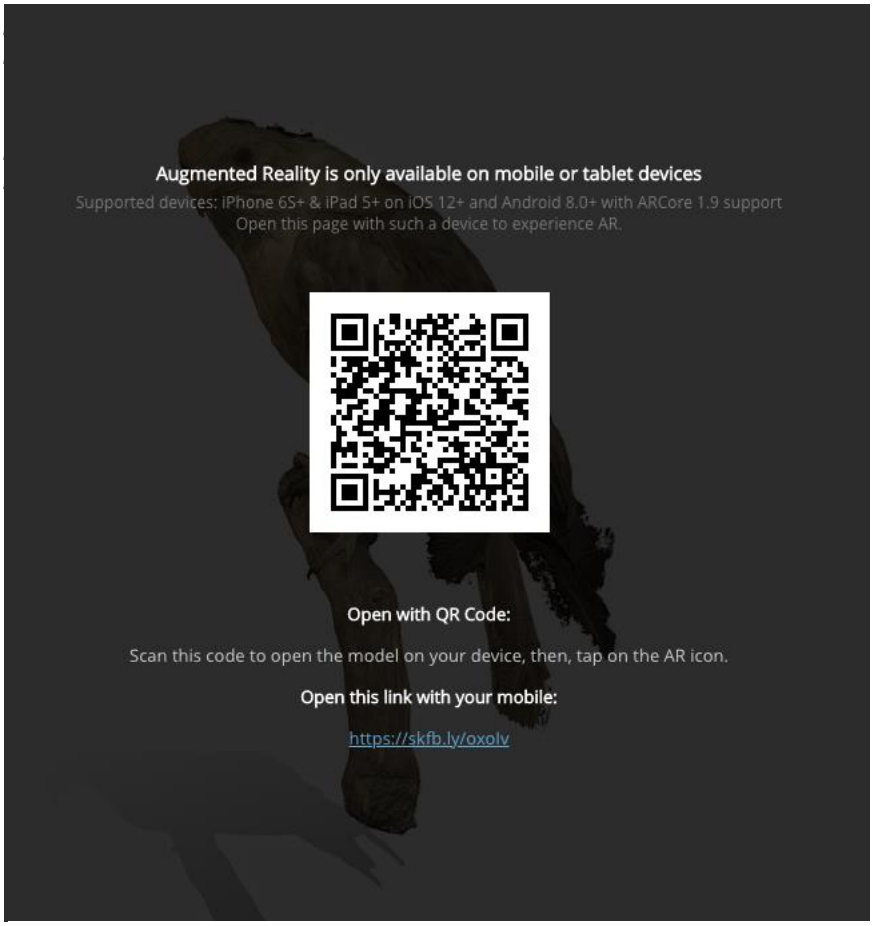


Figure 77. Digital Uncanny: Hawk. QR code. Image by Gregor MacGregor.

Figure 78. Digital Uncanny: Hawk. Augmented reality. Image by Gregor MacGregor.

Figure 58. Digital Uncanny: Coral. Photographic print, 100cm x 100cm. Image by Gregor MacGregor.

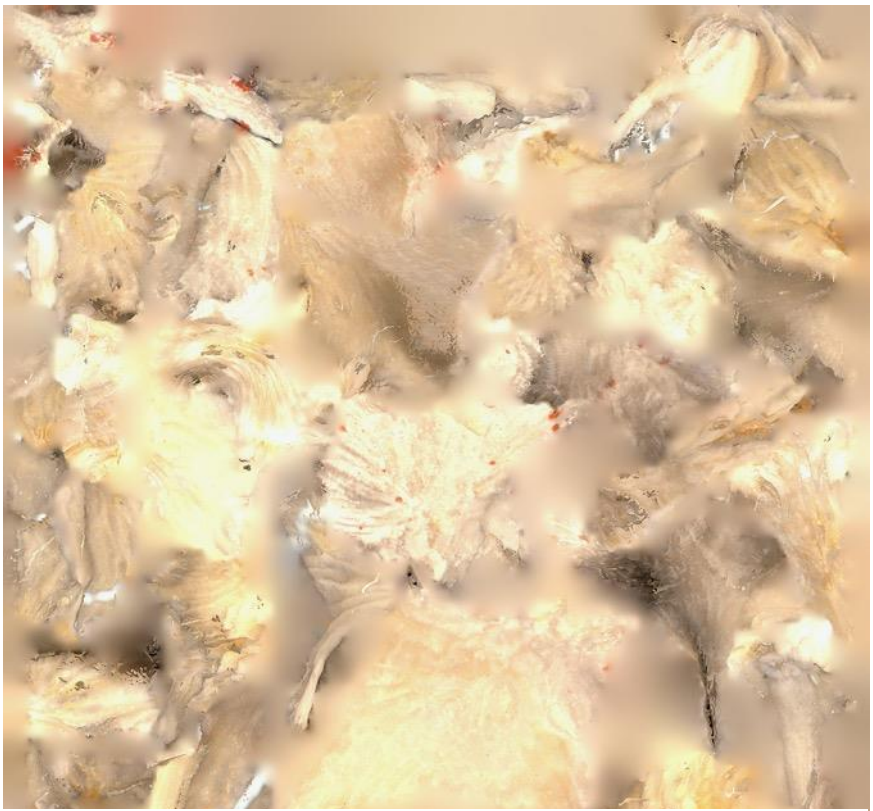


Figure 59. Digital Uncanny: Coral. Texture map. Photographic print, 100cm x 100cm. Image by Gregor MacGregor.

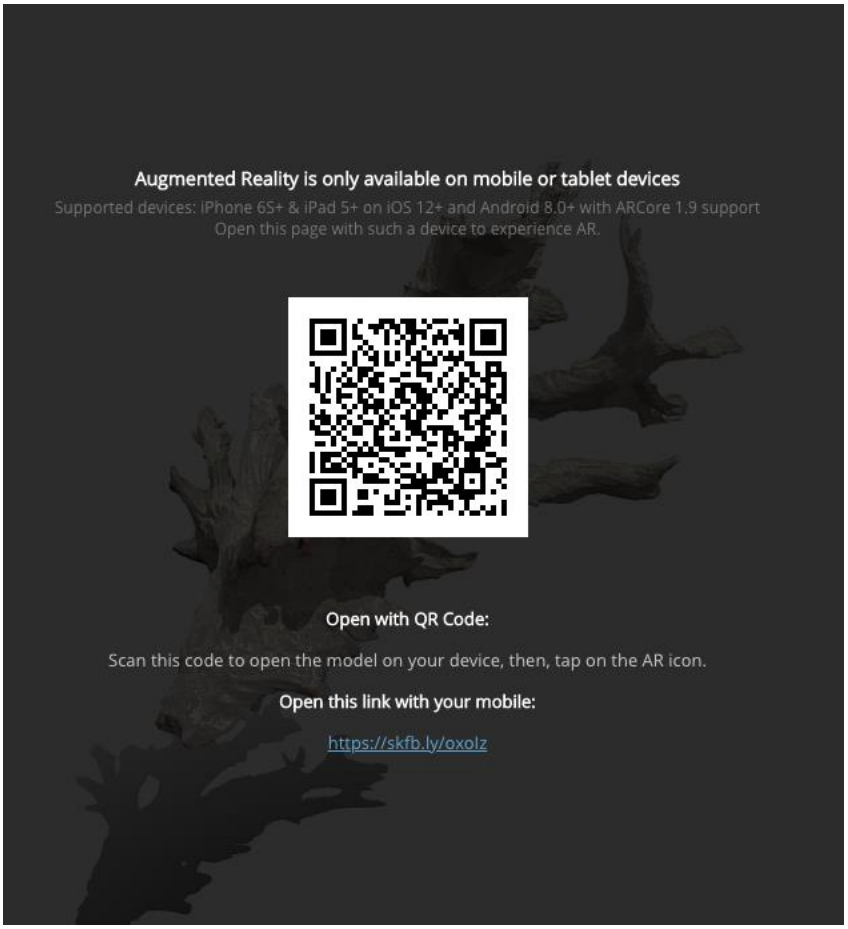


Figure 60. Digital Uncanny: Coral. QR code. Image by Gregor MacGregor.

Figure 61. Digital Uncanny: Coral. Augmented reality. Image by Gregor MacGregor, 2022.

6.6 Conclusion

The creative component of the research has examined the role of the photograph in an increasingly digitised world, which is progressively broken down in stages from the photograph itself to the virtual digital object. In the next chapter, I will draw on both the creative research and the critical discourse that the research has applied to conclude the research and resolve the initial questions outlined in the introductory chapter. This will be achieved through further developing the relationship between the diverse components of the research and considering how they sit within the overall inquiry.

Chapter 07 Conclusion……..…132

7.1 Introduction

7.2 The Chiasm: Intertwining

7.3 The Anthropocene

7.4 A new narrative

7.5 Optical technologies

7.6 Navigating a digital world

7.7 Re-constructing the image

7.1 Introduction

This exegesis is intended to support the creative outcomes that have emerged through *No Direction Home: Photogrammetry and the Post-natural World* and to discuss these outcomes with reference to the theoretical framework that has emerged from the research. In this regard, the aim is to examine the role of the photographic image as a visual inventory, cataloguing the world around us at a time when that world is in a period of constant change. The purpose of this research is to create a series of embodied experiences that sit alongside the scientific discourse on climate change, not to dialectically oppose phenomenological experience and scientific realism but to intertwine them.

In 1990, the Intergovernmental Panel on Climate Change (IPCC) met and issued a report that stated:

> Emissions of greenhouse gases… will result in a likely increase in global mean temperature of about one degree Celsius above the present value by 2025, and three degrees Celsius before the end of the century. The rise will not be steady. (p. 52)

The one-degree Celsius increase (compared to preindustrial levels) was reached in 2017, in what is now being called the Great Acceleration. The IPCC has convened six times since this initial report, with little action being taken to halt or reverse the causes, leading some scientists to call for another pathway to communicate the impact of our actions. It is this need to look at the issues surrounding our climate change that has acted as the initial spur for my research, combined with my awareness of the increasing digitisation of visual information and its conflicted relationship in creating a digital twin of the world as the original (as we know it) rapidly disappears.

In this regard, the research can be separated into two distinct areas around current environmental issues and discourse on the digitisation of the world around us, and this has been reflected in the structure of the exegesis; however, ultimately, I argue that the two cannot be separated. Technology has changed the ways in which we, the

subject can create, view, and ultimately experience images. As these images become increasingly realistic, this must ultimately change our perception of the image as object. As technology becomes more immersive, the boundaries between the natural and digital worlds blur, thus challenging the relationship between subject and object. Through my research, I have tried to explore how we can adapt this change to our advantage. As we go from one climate crisis to another, it is becoming increasingly clear that our relationship with the natural world is fundamentally flawed. Humans are having a detrimental effect on the environment that they require to survive. My research has looked at possible ways in which we can potentially alter our perception of the natural world through visual applications of digital technologies because it is becoming increasingly problematic to experience the natural world, as our very presence is causing more problems than solutions.

The introductory chapter outlined the initial research questions as well as several key aims that align with the previously mentioned issues. In this chapter, I address the issues in response to the initial research question, namely: In what ways will emerging three-dimensional technologies challenge our perception of the subject/object divide and our relationship with the natural world?

I will address the following topics later in the chapter to explicate the initial research questions:

- Can an enhanced appreciation of the Anthropocene be arrived at through creative outcomes that conflate the human-nature divide with phenomenological inquiries into the subject-object divide?
- Can museums apply imaging technology to move beyond their epistemological role of re-presenting historic realities of the natural world?
- How will digital technology change our perception of the photographic image?
- Will generating digital simulations of the natural world affect the ways in which we experience the ‘real’ natural world?

7.2 The Chiasma: Intertwining

The primary question is intended to intertwine two seemingly separate themes: our relationship with an ever-changing post-natural world; and a visual reality that is informed by technology, specifically optical technologies based on the photographic image. The research is driven by current discourses around climate change and my personal experience as a professional photographer of the changing nature of the photographic medium.

Throughout the research process I have used the deconstruction of the photogrammetric process to create visual experiences that engage the viewer and me with ideas of a post-natural world, a world where humanity does not see itself as something separate but as part of a larger system, where emerging optical technologies can help replace the previous ways of looking at nature through an empirical lens. This represents a step towards a new visual language that generates a new way of seeing nature, one that is not grounded in historical theories informed by the previous three centuries of knowledge that has dominated the philosophical ideas of the industrial age.

7.3 The Anthropocene

If we take the position of the IPCC previously outlined, one accepts that the world is undergoing a period of rapid ecological change, exacerbated by human/industrial activity; this is the position taken by my research. The question remains, what we can do about it? The empirical data outlined by the IPCC is largely uncontested; however, governments and societies generally remain slow to react, given that we are already in a period where climate change is accelerating. Owing to the position that I have taken in this research, I accept the science behind the data but realise this is not enough. Therefore, I have produced a series of creative outcomes aimed at engaging the viewer.

The purpose of these installations is to elicit a response from the viewer, specifically a phenomenological response, an embodied experience that places the viewer outside of the discourse on empirical observation. As outlined in Chapter Three, the embodied

experience plays into Merleau-Ponty's theories on perception (1945) and breaks down the dualistic relationship between the viewer and the object being perceived. By questioning the dualism of the subject and object this provides a point at which to start the research and apply the theoretical structure to an understanding of the natural world that is moving towards a state that humanity does not understand or, indeed, recognise. It is important to acknowledge that whilst phenomenology contributes to deconstructing the dualistic nature of the subject-object relationship, they still place the individual, or the human, at the centre of the relationship, thus maintaining an inherent anthropocentric bias in our perception of the natural world.

I surmise, not without some irony, that optical technologies can play a part in bridging the relationship between human perception and the 'other' by means of the chiasma. The creative outcomes are not intended to generate an understanding of exactly how and why the natural world is changing, but to engage the viewer in a more phenomenological sense that nature is changing and our existence is potentially at stake. The digital image has been applied, through multiple applications such as three-dimensional printing and augmented experiences, to engage the viewer/subject with technology to engage them in embodied experiences that sit outside those available to a passive observer. To break down the anthropocentric bias inherent within such a perceptual experience, I have situated the object-oriented ontologies first outlined by the speculative realist Harman (2018) within the context of my discussion, and also elevated the digital image as an object in alignment with Hui's (2016) digital ontology. As we move forward, what we recognise historically as the world/nature will evolve into something that is yet unrecognised. As such, the status of the photograph as a document of reality has been applied in ways that should help direct a new narrative, one that deepens our appreciation of the challenges that lie ahead.

7.4 A new narrative

The link between the photographic image and its museological applications was recognised by the very earliest photographers, as outlined in Chapter Three, and examined in the first installation, *After-Nature: Digital Artefacts for a Post-natural World.* The indexicality of the photograph and its role in representing truth and reality has long been ingrained within the photographic era; digital technologies have

undermined the veracity of the photographic image, but the indexical link remains unbroken. The status of the photographic image as an authentic copy of the original has supported a narrative that has been created in the modern era, one that has also seen its simultaneous institutionalisation via the museum. Thus, photography has created a narrative dominated by the institutions of the industrial era, informed by a colonial/industrial/capitalist system, creating a sense of the otherness of nature.

Traditionally, the role of the institutions such as museums has been to collect, preserve, and catalogue objects to enable an understanding of them (Bertacchini & Morando, 2011), a system built around the historical method of empirical observation. This places the viewer at the centre of the perceptual experience without any consideration for anthropocentric biases projected onto the object, thus reinforcing the dominant theories of the era. Historians have begun to recognise that these institutions are themselves becoming historically obsolete (Thomas, 2016). The current digitisation of museum collections plays an important role in changing the colonial narrative by creating new and novel experiences to engage the viewer. Exactly what the narrative is remains to be written; however, it is important that it places the subject in a position that immerses them within the story.

Museums such as the Smithsonian and British Natural History Museum are currently in the process of digitising their collections, primarily as an act of digital preservation; however, these digital assets have the potential for multiple applications. In Chapter Five (Section Four), I presented case studies on the sacred cave of Kumukuwaká and the digital re-materialisation process of the Factum Foundation. Allowing for the fact that a digital facsimile cannot replace the aura of the original, digital reproduction creates new ways to explore and experience the original even when the original has been destroyed. Whilst digital reproduction is still largely at the uncanny phase, the technology is evolving, already offering submillimetre-accurate models that can exist in the physical and digital space. Another example of digital simulacra being applied within the museum setting is at Lascaux IV Caves Museum in France, which recreates the temperature and humidity levels, as well as the flickering light, of the original cave. The museum has intentionally designed the exhibits to immerse the viewer, enabling them to become more than a passive observer and to participate in an experience closer to that of the original cave occupants.

7.5 Optical technologies

That the photographic image is seen as a document of reality, a reproduction of a moment that has objectively occurred, is regarded as a given. With the advent of digital technologies that are replacing the traditional photographic methods, it would be logical to surmise that this no longer holds true. The digital image and associated software provide endless options for manipulation that should break the link of the image with an indexical reality; however, the photo-realistic digital image still retains its link to photography's truth effects. Photography is a link that techniques such as photogrammetry borrow heavily from, even though these digital facsimiles largely exist within a digital space. It is this space, along with the digital screen and mixed realities (XR), which are increasingly dominating the visual experience. The representational quality of the photographic image and the scientific basis behind the technology are essential to regarding the image as truthful and, therefore, key to observational knowledge (Juduvitz, 1988). This, I would argue, holds true for digital optical technologies that are grounded in the photographic image, even though the photogrammetric image could be seen as a mimetic reproduction of the original. Emerging optical technologies can expand on the role of the photographic document as a guarantor of truth. Since the invention of photography, the image has moved further away from its phenomenological significance; however, as I have stated throughout the exegesis, the digital image offers opportunities to not only experience the image from an objective position but also returns it to a more phenomenological role. This is a point that has been explored in my own creative outcomes by examining the potential for using a primarily scientific method to generate phenomenological experiences, thereby engaging the viewer in the discourse of climate change in ways that sit outside of scientific debate by exploring the immersive nature of the image, with the intention of placing the viewer/subject away from objective observation and closer to an experience that places them within the narrative.

7.6 Navigating a digital world

The digitisation of real-world objects is generating an inventory of digital artefacts during a period of rapid change, one that arguably poses an existential risk to the natural world as we know it. As outlined in the discourse around *Death Mask of a Chimpanzee*, there is a strong likelihood that we are rapidly approaching a sixth mass extinction event, something that sits outside of human experience. As the real world disappears, the digital world will dominate our understanding/knowledge of the real world. How will these new technologies affect our ability to navigate reality? At the current moment in time, I would follow Hui's position in that we are currently in a state of "technological ecstasy" (2016, p. 47): we are currently embracing digital technologies without understanding their full implications.

Hui follows Stiegler's position on technology in that it is not the technology but the method of distribution of the data that is the problem. Steigler argues (as outlined in Chapter Four) that technology is a "pharmacologie" in that it is both a poison but also the medicine that we need to use to take us out of our technological ecstasy. The existence of the digital image/object is undeniable; the question is what to do with this data. The centralised nature of data distribution/algorithms is, as Steigler explains, no different to previous institutions in that they ultimately control the narrative. In *The Neganthropocene* (2018, p. 131) Steigler argues for a decentralisation of the digital infrastructures that distribute information; this process of decentralising digital information would be the next step in escaping the entropic vortex of the Anthropocene. We cannot go back to a pre-digital era; therefore, we have to engage with the technology if we are to redefine our understanding of nature.

The photographic image has become the single most popular method of transferring visual information; if anything, digital technology has expanded this function of the photograph. However, the digital image has a viscosity different from analogue photography (Galloway, 2012, p. 12), which is no longer linked to a representation of the original referent. The digital image, as explored through the method of photogrammetry, allows the viewer to interact with the image on a more phenomenological level, one where the viewer can have multiple embodied experiences. This allows the viewer to engage with the narrative on their own terms,

generating a dialogue that no longer places the viewer as a separate being from the object; this approach is more immersive and places the viewer within the narrative.

7.7 Re-constructing the image

Broadly speaking, the research has sought to explore how technology has changed the role of the photograph through the application of photogrammetry. The photographic image has long been considered a true document; the digitisation of the photographic process has initiated the possibility to construct new images from photographic information. Whilst the photograph as a document that records a moment in time still largely holds true, photogrammetry, which uses multiple photographic images triangulated to generate photographic objects with depth, offers opportunities to construct new narratives. The narrative that the research has engaged is not new; however, empirical data has failed to activate the necessary actions as the climate crisis approaches at an ever-increasing speed. The amount of empirical data that the IPCC has presented to the public and governments has proven to be outside of humankind's experience: what Morton refers to as a hyperobject (2013). Taking Steigler's position, then, digital technology, whilst a "pharmocologie", must at the least play a part in constructing a new narrative, one that places the subject within, the hyperobject, our perception of the natural world. Or perhaps; because the world is changing, we need to relate to it in a way that no longer separates humanity from nature or views the latter as something that we can exploit endlessly. Instead of the photographic image being a purely objective document of an observed reality, the role of the image needs to expand into a more phenomenologically immersive experience. Emerging optical technologies can play a part in constructing a new narrative by creating a new inventory of the world, a digital simulacrum that engages the viewer, using an increasingly ubiquitous medium, in ways that present that empirical information cannot.

References

Adams, L. (2008). *The indeterminate precision of narrative* [Doctoral exegesis, Southern Cross University]. http://epubs.scu.edu.au/theses/329/

Alexander, E. P. (1983). *Museum masters: Their museums and their influence*. American Association for the State and Local History.

Baker, G.P. (2005). Photography's Expanded Field. *October,* 114. (120-140). https://doi.org/10.1162/016228705774889574.

Bang, A. L., Krogh, P., Ludvigsen, M., & Markussen, T. (2012). The role of hypothesis in constructive design research. In *Proceedings of The Art of Research IV.* (1-11) Aalto University School of Arts, Design and Architecture,Helsinki, Finland

Barnosky, A., Matzke, N., Tomiya, S., Wogan, G., Swartz, B., Quetal, T., Marshall, J., McGuire, E., Lindsey, L., Maguire, K., Mrsey, B., & Ferrer, E. (2011). Has the earth's sixth mass extinction already arrived? *Nature*, *471*, 51-57. https://doi.org/10.1038/nature09678

Baudrillard, J. (1983). *Simulations.* Semiotext[e].

Bazin, A. (1960). The ontology of the photographic image (H. Gray, Trans.). *Film Quarterly*,*13*(4), 4-9. https://doi.org/10.2307/1210183.

Ben-Zeev, A. (1989). Explaining the subject-object relation in perception. *Social Research*, *56*, 511-542. https://www.jstor.org/stable/40970553

Benjamin, W. (1968). The work of art in the age of mechanical reproduction. In *Illuminations* (H. Zohn, Trans., & H. Arendt, Ed.) (pp. 217-252). Schocken.

Bertacchini, E., & Morando, F. (2011). The future of museums in the digital age: New models of access and use of digital collections. *International Journal of Arts Management*, *15*(2), 60-72. https://hdl.handle.net/2318/105581

Bishop, C. H. (2005). *Installation Art: A critical history.* (57). Routledge. Taylor & Francis Group.

Bolter, J., MacIntyre, B., Gandy, M., & Schweitzer, P. (2006). New media and the permanent crisis of aura. *The International Journal of Research into New Media Technologies*, *12*(1), 21-39. https://doi.org/10.1177/1354856506061550

Borges, J. L. (1999). On exactitude in science. In *Collected fictions* (A. Hurley, Trans.) (pp. 325). Penguin Books.

Brandt, E., Binder, T., & Sanders, E. B-N. (2012). Tools and techniques: Ways to engage telling, making, and enacting. In J. Simonsen, & T. Robertson (Eds.), *Routledge international handbook of participatory design* (pp. 145-181). Routledge.

Carman, T. (2008). *Merleau-Ponty.* Routledge. Taylor & Francis Group.

Carrington, D. (2016, August 29). The Anthropocene epoch: Scientists declare dawn of human-influenced age. *The Guardian.* https://www.theguardian.com/

Cerbone, D. (2006). *Understanding phenomenology*. Routledge. Taylor and Francis Group,

Cole, A. (2015). Those obscure Objects of Desire: On the Uses and Abuses of Object-oriented ontology and Speculative Realism. *Artforum.* 318-23.

Collier, P. (2002). The impact on topographic mapping development in land and air survey: 1900–1939. *Cartography and Geographic Information Science. 29*(3):155-174. https://doi.org/10.1559/152304002782008440.

Crouch, C., & Pearce, J. (2012). *Doing research in design* (68). Bloomsbury.

Crutzen, P. (2016). Geology of mankind. In P. Crutzen., & H. Brauch, (Eds.), *A pioneer on atmospheric chemistry and climate change in the Anthropocene*. Springer Briefs on Pioneers in Science and Practice *50* (211-215). https://doi.org/10.1007/978-3-319-27460-7_10

Dewdney, A. (2021). *Forget photography.* Goldsmiths Press.

Descartes, R. (1985). *Principles of philosophy: The philosophical writings of Descartes 1*. Cambridge University Press.

Finney, S, C. & L. Edwards. (2019). *The "Anthropocene" epoch: Scientific decision or political statement?* GSA Today, 26(3-4). doi 10.1130/GSATG270A.1.

Flusser, V. (1983/2000). *Towards a philosophy of photography.* Reaktion Books.

Freud, S. (1919). Das Unheimliche [The Uncanny]. (1-21). Trans. Strachey, A. *Sigmund Freud, Collected Papers, IV.* Basic Books..

Freeman, V,J. (2013). *The theory of the copy: Henry Fox Talbot and "The Pencil of Nature".* Concordia University.

Galloway, A. R. (2012). *The interface effect.* Polity.

Gaver, W., & Hook, K. (2017). What makes a good CHI design paper? *Interactions*, *24*(3), 20-27.

Geismar, H. (2015). Post-photographic presences, or how to wear a digital cloak. *Photographies*, *8*(3), 305-321. https://doi.10.1080/17540763.2015.1102760

Gray, C., & Pirie, I. (1995). 'Artistic' research procedure: Research at the edge of chaos. https://design.osu.edu/carlson/id785/drpp.pdf

Grayling, A. (2019). *The History of Philosophy*. Penguin & Random House..

Gregory, R. L. (1998). *Mirrors in mind.* Penguin.

Gruin, A., Remondino, F., & Zhang, L. (2004). Photogrammetric reconstruction of the Great Buddha of Bamiyan, Afghanistan. *The Photogrammetric Record*,*19*(107),177-199. https://doi.org/10.1111/j.0031-868X.2004.00278.x

Haila, Y. (2000). Beyond the nature-culture dualism. *Biology and Philosophy*, *15*, 155-175.

Hansen, F. T. (2010). *Integration of the 3D Graphic Digital Media in the shaping process of ceramic craft.* [Doctoral thesis, Danish School of Design]. The Danish School Press.

Harari, N, J. (2016). *Homo Deus. A Brief History of Tomorrow.* Vintage

Harman, G. (2017). *Object-oriented ontology: A new theory of everything.* Penguin & Random House.

Harman, G. (2018). *Speculative realism: An introduction*. Polity Press.

Hayles, K. (1996). Simulated nature and natural simulations: Rethinking the relation between the beholder and the world. In W. Cronon (Ed.), *Uncommon ground: Rethinking the human place in nature* (pp. 409-425). W.W. Norton & Company..

Heidegger, M. (1977). *Basic writings: From Being and Time (1927) to the Task of Thinking (1964)*. Harper Perennial Modern Thought..

Holdsworth, D. (2018). *Mapping the limits of space.* Hatje Cantz.

Hui, Y. (2016). *On the existence of digital objects.* (165). University of Minnesota Press.

Incirlioglu, C.G. Typologies in photography. *ODYU Mimarlik Fakultesi Dergisi, 14(1-2), 11-22.*

Intergovernmental Panel on Climate Change. (1990-92). Climate Change: The 1990 and 1992 IPPC Assessments. *IPCC First Assessment Report Overview and Policymaker Summaries and IPPC Supplement.* https://www.ipcc.ch/report/climate-change-the-ipcc-1990-and-1992-assessments/

Jeffrey, S. (2015). Challenging heritage visualisation: Beauty, aura, and democratisation. *Open Archaeology*, *1*, 144-152. https://doi.org/10.1515/opar-2015-0008

Jewitt, C. (2012). Digital technologies in museums: New routes to engagement and participation. *Designs for Learning*, 5 (1-2), 74-93. https://doi.org/10.2478/dfl-2014-0005.

Johnson, A. Galen. & Smith, M. (1993). *The Merleau-Ponty aesthetics reader.* (Ch.9, Ed , Smith B. M. Ch.12, Ed, Mongin,O). Northwestern University Press.

Judovitz, D. (1988). Subjectivity and Representation in Descartes. Cambridge.

Koskinen, I., Zimmerman, J., Binder, T., Redström, J., & Wensveen, S. (2011). *Design research through practice: From lab, field, and showroom*. (169-170). Morgan Kaufmann.

Koskinen, I., & Krogh, P. (2015) Design accountability: When design research entangles theory and practice. *International Journal of Design*, *9*(1), 121-127. https://www.researchgate.net/publication/276264839

Langdon, M. (2014). *The work of Art in a Digital Age: Art, Technology and Globalisation*. (28,30-33). Springer. University of Notre Dame. doi: 10.1007/978-1-4939-1270-4.

Latour, B. (2004). Why has critique run out of steam? From matters of fact to matters of concern. *Critical Inquiry*, *30*(2), 225-248.

Lemmens, P. (2016). Review of Yuk Hui: On the existence of digital objects. *Jarbuch Technikphilosophie.* (p. 314).

Levi Strauss, D. (2020). *Photography and belief*. (57). David Zwirmer Books.

Lewis, G. (2011). History of museums. In *Encyclopedia Britannica*. http://www.britannica.com/EBchecked/topic/398827/history

Lister, M. (2013). *The Photographic Image in Digital Culture.* (88-89). Routledge, Taylor & Francis Group.

Lowe, A., & Latour, B. (2020). *The aura in the age of digital materiality: Rethinking preservation in the shadow of uncertainty.* Silvana Editoriale. Factum Foundation.

Malraux, A. (1947). *Psychologie de l'Art: Das imaginaire museum.* Woldemar Klein.

Markowitz, D., Laha, R., Perorie, B., Pea, R., & Bailenson, J. (2018). Immersive virtual reality field trips facilitate learning about climate change. *Frontiers in Psychology*, *9* https://doi.org/10.3389/pstch.2018.02364

Mehaffy, M., & Salingaros, N. A. (2017). *Design for a living planet: Settlement, science, and the human future.* Sustasis Press.

Merleau-Ponty, M. (1945). *Phenomenology of perception* ((D. Landes, Trans.). Routledge, UK.

Merleau-Ponty, M. (1968). *The visible and the invisible* (A. Lingis, Trans.). Northwestern University Press.

McCarthy, J. (2014). Multi-image photogrammetry as a practical tool for cultural heritage survey and community engagement. *Journal of Archaeological Science*,*43*(1) https://www.researchgate.net/publication/259759667

McKibben, B. (1989). *End of nature*. Random House Trade Paperbacks.

Metashape, (2020). *Agisoft Metashape User Manual.* *https://www.agisoft.com/pdf/metashape-pro_1_6_en.pdf*

Miller, S. (2020). *Contemporary Photography and Theory: Concepts and Debates.* (67-68, 72-74). Routledge, Taylor and Francis Group.

Moore, J. (2017). The Capitalocene, Part 1: On the nature and origins of our ecological crisis. *The Journal of Peasant Studies*, *44*(3), 593-630. doi: 10.1080/03066150.2016.1235036

Morelle, L., Cogburn, J., & Cogburn, E. B. (2012). Speculative realism. *Speculations III*, 241-72. https://philpapers.org/browse/speculative-realism

Morton, T. (2011). Here comes everything: The promise of object-oriented ontology. *Qui Parle: Critical Humanities and Social Sciences*, *19*(2), 163-190. https://muse.jhu.edu/article/431001

Morton, T. (2013). *Hyperobjects: Philosophy and ecology after the end of the world.* University of Minnsota Press, Minneapolis, London.

Morton, T. (2016). *Dark ecology: For a logic of future coexistence.* Columbia University Press.

Musch, I. (2001). *Albertus Seba's collection of natural specimens and its pictorial inventory.* (10-14). Taschen.

Nancarrow, J (2019). 'Countering the "Digital Uncanny:" Post-Processing for 3-D Digital Heritage' In Studies in Digital Heritage.doi:10.14434/sdh.v3i2.27748

Newhall. B. (2006). *The history of photography.* (43-45). The Museum of Modern Art.

Paterson, G., Alburquerque, S., Blagoderov, V., Brooks, S., Cafferty, S., Cane, E., Carter, V., Chainey, J., Crowther, R., Douglas, L., Durant, J., Duffell, L., Hine, A., Honey, M., Huertas, B., Howard, T., Huxley, R., Kitching, I., Ledger, S., McLaughlin, C., Martin, G., Mazzetta, G., Penn, M., Peresa, J., Sadka, M., Scialabba, E., Self, A., Seibert, D., Sleep, C., Toloni, F., & Wing, P. (2016). Digitising the British and Irish Butterflies in the Natural History Museum. *Biodiversity Data Journal*, (*4)* . https://doi.org/10.3897/BDJ.4.e9559

Roberts, R. (2004). Images and artefacts: William Henry Fox Talbot and "The Museum". In B. Finn (Ed.) *Presenting Pictures (Artefacts)*. (pp. 4-20). National Museum of Science and Industry.

Ritchen, F. (2009). *After photography.* (140-160). W.W. Norton & Company..

Rubenstein, D., & Sluis, K. (2013). The digital image in photographic culture: Algorithmic photography and the crises of representation. In M. Lister (Ed.), *The photographic image in digital culture* (pp. 22-40). Routledge.

Schama, S. (1995). *Landscape and memory.* Random House..

Schweibemz, W. (2016). The development of virtual museums. (1). *ICOM News*, 3. https://www.researchgate.net/publication/240296250

Sekula, A. (1981). The traffic in photographs. *Art Journal*, *41*(1), 15-25.

Setiyadi, S., Cahyadi, W., & Mukhtar, H. (2021). A comparative study of affordable photogrammetry software for reconstructing 3D model of a human foot. *IEEE 7th International Conference on Smart Instrumentation, Measurement and Applications (ICSIMA2021).* https://doi.org/10.1109/ICSIMA50015.2021.9526314

Smith. F. S. (2019). The Sacred Cave of Kamukuwaka. The Preservation of indigenous culture in Brazil. (ed Lowe. A) Factum foundation for digital technology in conservation. https://www.factumfoundation.org/pag/1289/the-sacred-cave-of-kamukuwak%C3%83

Smithsonian,(2018).*DigitizationofSmithsonianCollections. https://www.si.edu/newsdesk/factsheets/digitization-smithsonian-collections*

Sparrow, T. (2010). Plasticity and aesthetic identity; or, why we need a Spinozist aesthetics. *The Nordic Journal of Aesthetics*, *40-41*, 53-74.

Steigler, B. (2018). *The Neganthropocene*. (31). Open Humanities Press.

Steyerl, H., & Berardi, F. (2012). *The wretched of the screen.* Sternberg Press.

Synder, G. (1998). Is nature real? *Resurgence*, *190*, 32.

Talbot, W. H. F. (1844). *The pencil of nature* (2nd edition). De Capo Press.

Tao te Ching (2015). *The Dao* (R. Robinson, Trans.). Routledge. https://doi.org/10.4324/9781315727400 (Original work published 4th C).

Thomas, N. (2016). *The return of curiosity*. Reaktion.

Vaughan, L. (2017). *Practice-based design research.* Bloomsbury.

Vogel, S. (2016). *Thinking like a mall: Environmental philosophy after the end of nature*. The MIT Press, USA.

Wensveen, S. (2018). *Constructive design research* [Inaugural lecture]. Department of Industrial Design, Eindhoven University of Technology. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://research.tue.nl/files/109322452/Rede_Wensveen_LR_19_10_2018.pdf

Younan, S., & Gill, S. (2013). *Digital three-dimensional copies of museum artifacts: Dynamics of Access, Ownership, and Meaning* [Paper presentation]. The International Research Conference in the Series Consciousness Reframed: Art and Consciousnesses the Post-Biological Age. https://www.semanticscholar.org/paper/Digital-Three-Dimensional-Copies-of-Museum-Dynamics-Younan-Gill/4a2e362e2628607d44b000a9f501f4a922502527

Zalasiewicz, J. Waters, C. Summerhayes, C. et al. (2017). The working group on the Anthropocene: Summery of evidence and interim recommendations. *Anthropocene.* (19). 55-60. Doi: 10.1016/j.ancene.2017.09.001

APPENDIX: Exhibition documentation

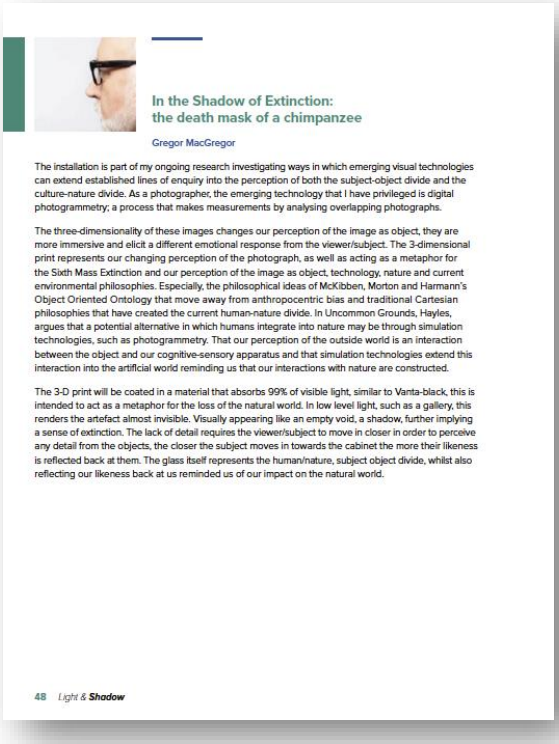
Light and Shadow exhibition

EAaD School, Xi'an Eurasia University and School of Design and the Built Environment, Curtin University. 2022.

ISBN: 978-0-6453653-0-6

EAaD School, Xi'an Eurasia University and School of Design and the Built Environment, Curtin University. 2022.

MacGregor, G. 2022. Light and Shadow Catalogue



In the Shadow of Extinction:
the death mask of a chimpanzee

Gregor MacGregor

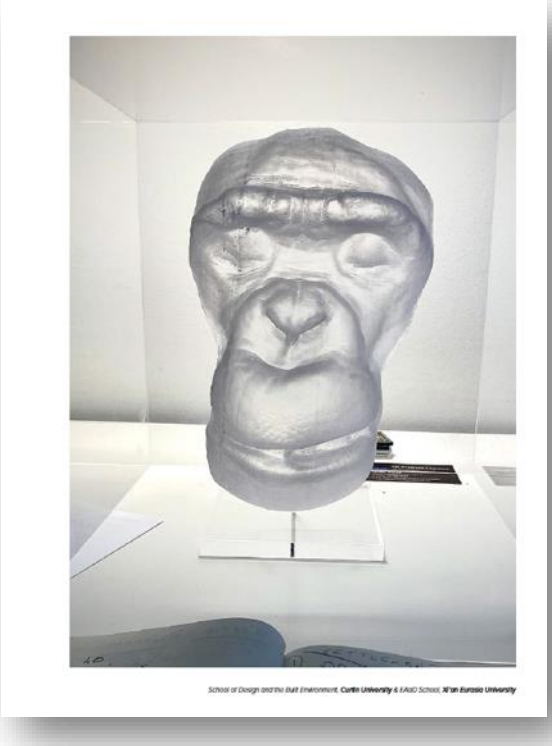
The installation is part of my ongoing research investigating ways in which emerging visual technologies can extend established lines of enquiry into the perception of both the subject-object divide and the culture-nature divide. As a photographer, the emerging technology that I have privileged is digital photogrammetry; a process that makes measurements by analysing overlapping photographs.

The three-dimensionality of these images changes our perception of the image as object, they are more immersive and elicit a different emotional response from the viewer/subject. The 3-dimensional print represents our changing perception of the photograph, as well as acting as a metaphor for the Sixth Mass Extinction and our perception of the image as object, technology, nature and current environmental philosophies. Especially, the philosophical ideas of McKibben, Morton and Harmann's Object Oriented Ontology that move away from anthropocentric bias and traditional Cartesian philosophies that have created the current human-nature divide. In Uncommon Grounds, Hayles, argues that a potential alternative in which humans integrate into nature may be through simulation technologies, such as photogrammetry. That our perception of the outside world is an interaction between the object and our cognitive-sensory apparatus and that simulation technologies extend this interaction into the artificial world reminding us that our interactions with nature are constructed.

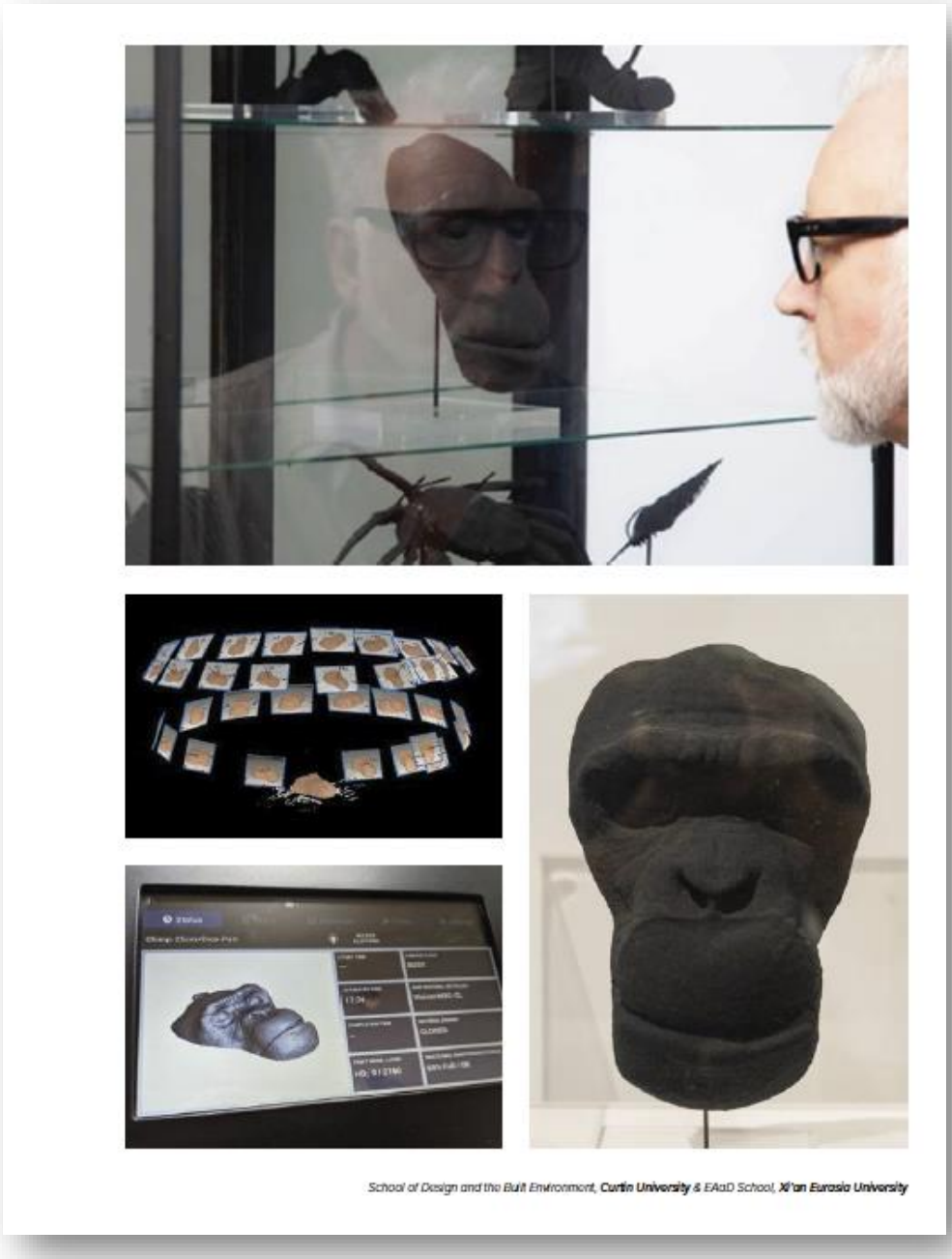
The 3-D print will be coated in a material that absorbs 99% of visible light, similar to Vanta-black, this is intended to act as a metaphor for the loss of the natural world. In low level light, such as a gallery, this renders the artefact almost invisible. Visually appearing like an empty void, a shadow, further implying a sense of extinction. The lack of detail requires the viewer/subject to move in closer in order to perceive any detail from the objects, the closer the subject moves in towards the cabinet the more their likeness is reflected back at them. The glass itself represents the human/nature, subject object divide, whilst also reflecting our likeness back at us reminded us of our impact on the natural world.

48 *Light & Shadow*

MacGregor, G. 2022. Light and Shadow process notes.



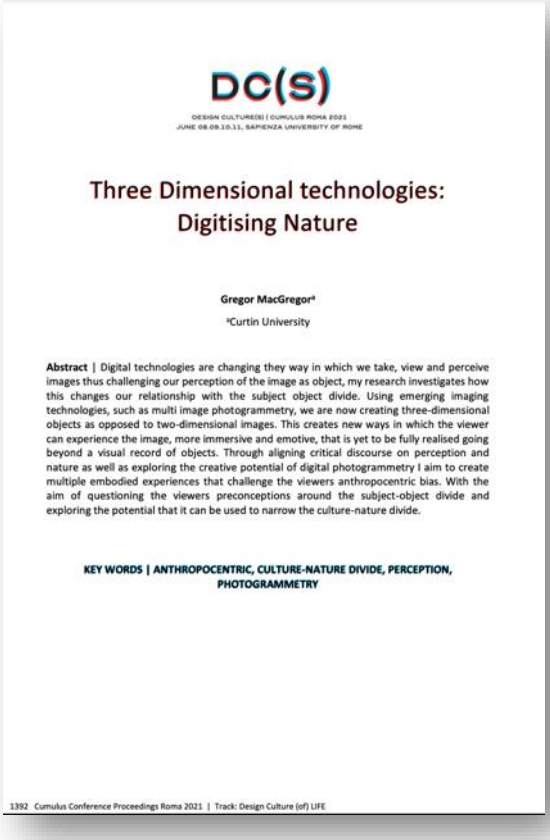
MacGregor, G. 2022. Light and Shadow. SLA 3D Print



MacGregor, G. 2022. Light and Shadow. Process workflow.

MacGregor, G. 2021, Cummulus conference presentation.

ISBN 978-952-64-9004-5, ISSN 2490-046X.


DC(S)

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Three Dimensional technologies: Digitising Nature

Gregor MacGregor[a]

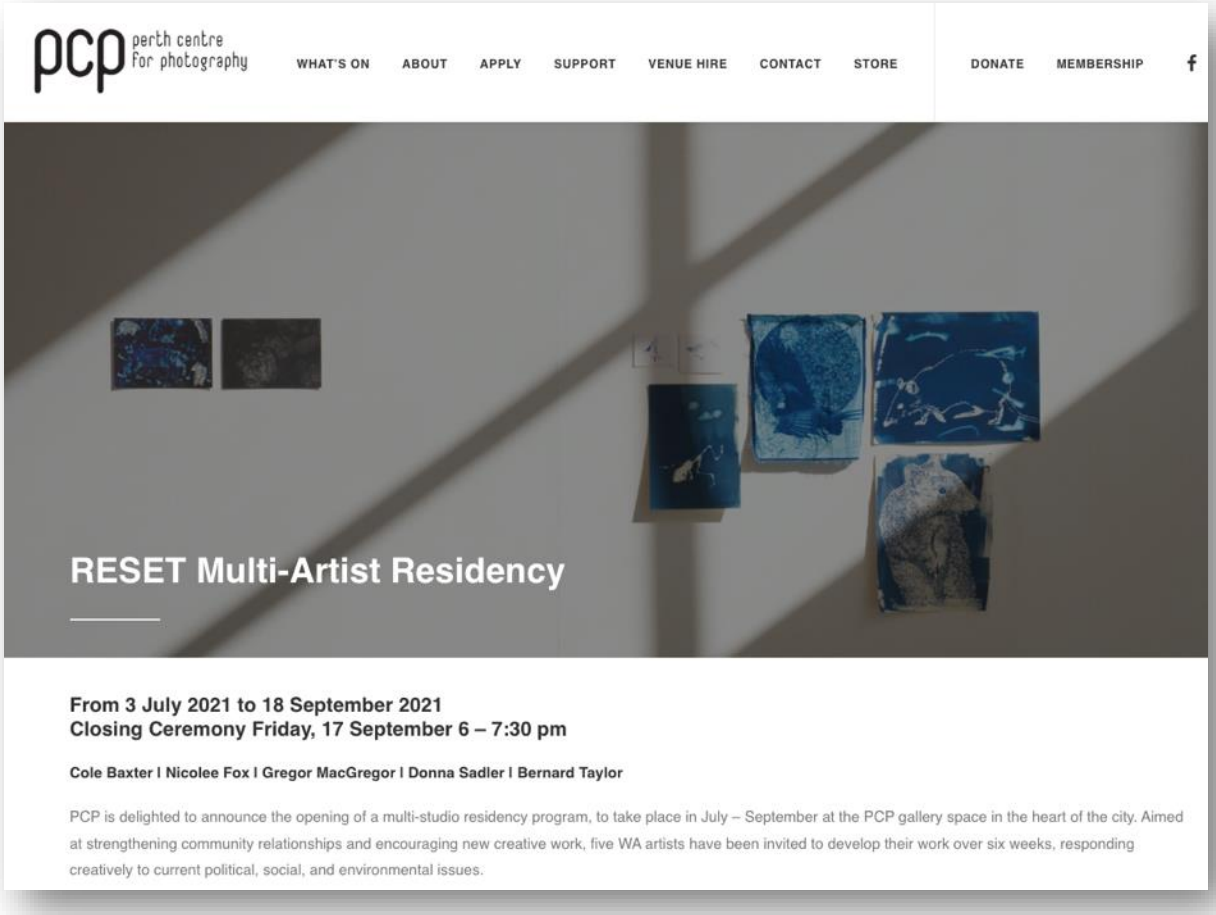
[a]Curtin University

Abstract | Digital technologies are changing they way in which we take, view and perceive images thus challenging our perception of the image as object, my research investigates how this changes our relationship with the subject object divide. Using emerging imaging technologies, such as multi image photogrammetry, we are now creating three-dimensional objects as opposed to two-dimensional images. This creates new ways in which the viewer can experience the image, more immersive and emotive, that is yet to be fully realised going beyond a visual record of objects. Through aligning critical discourse on perception and nature as well as exploring the creative potential of digital photogrammetry I aim to create multiple embodied experiences that challenge the viewers anthropocentric bias. With the aim of questioning the viewers preconceptions around the subject-object divide and exploring the potential that it can be used to narrow the culture-nature divide.

KEY WORDS | ANTHROPOCENTRIC, CULTURE-NATURE DIVIDE, PERCEPTION, PHOTOGRAMMETRY

MacGregor, G. 2022. Conference catalogue

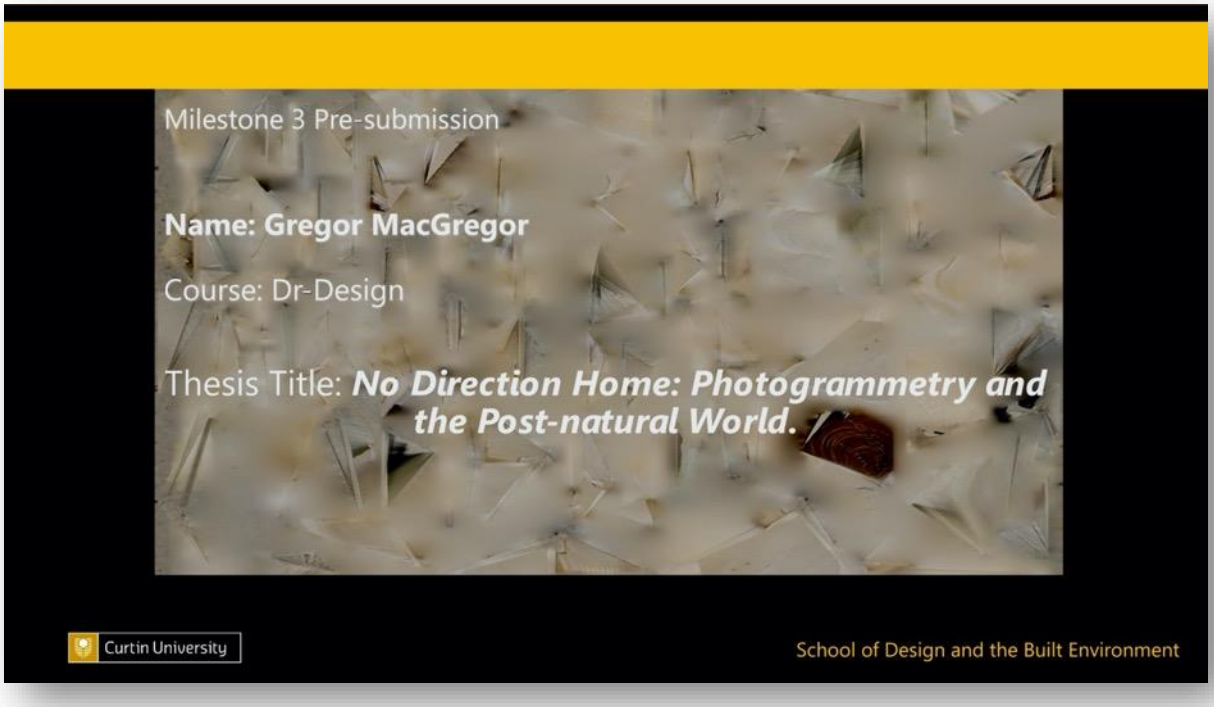
Perth Centre for Photography residency



Reset Residency, 2021, *No Direction Home* Installation.

Reset Residency, 2021. *Temporal Undulations* Installation.

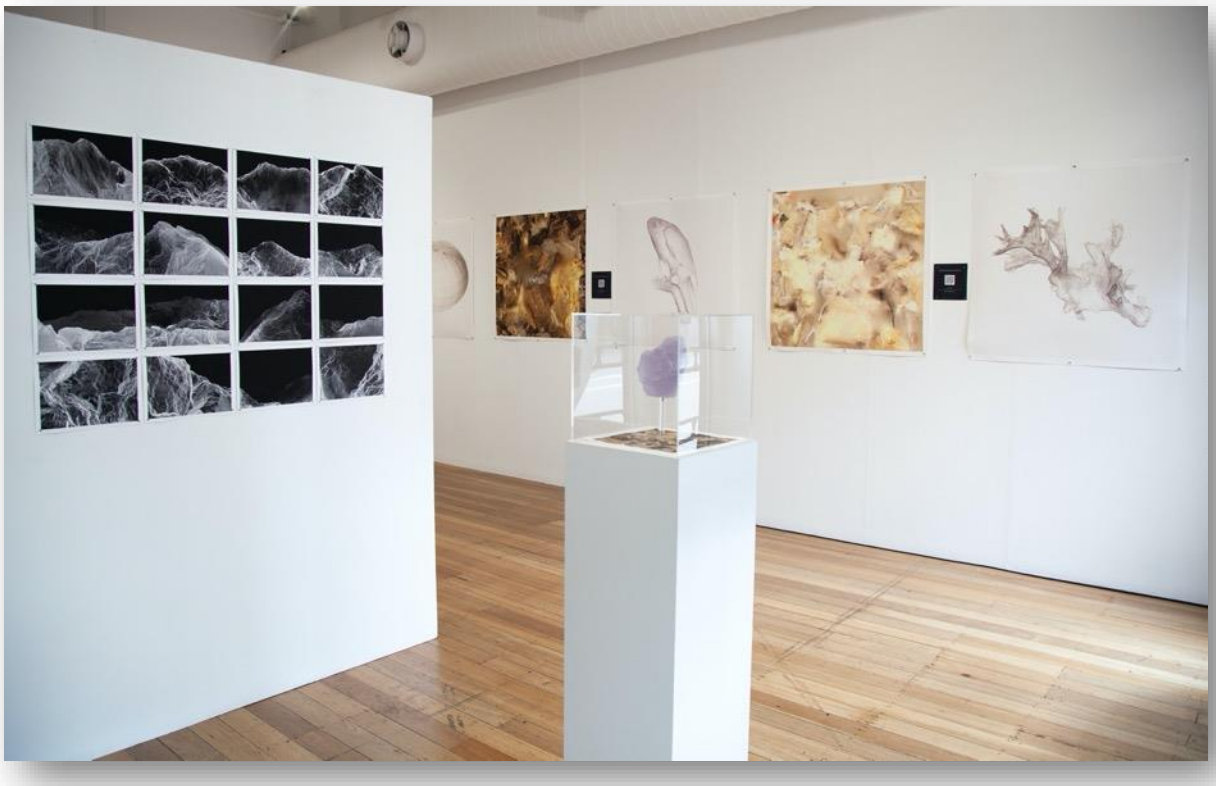
Third Milestone presentation



Vimeo Link: https://vimeo.com/770560993

Perth Centre for Photography exhibition, *No Direction Home*, 2022

MacGregor, G. 2022. Installation at PCP



MacGregor, G. 2022. Installation shots of *No Direction Home* exhibition, PCP.

Contemporary Landscapes in Photography, Overall winner, 2022

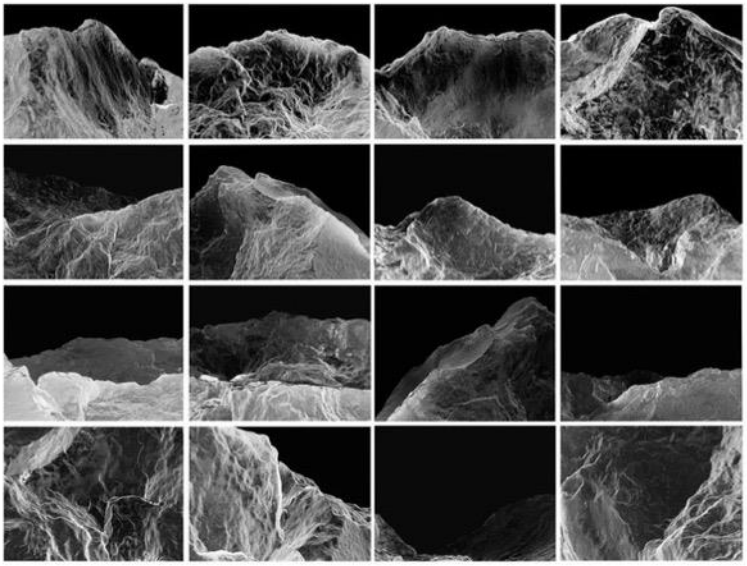
perth centre for photography

WINNERS ANNOUNCED

CLIP AWARD '22 OVERALL WINNER

Gregor MacGregor

Temporal Undulations - Topography of a meteorite



Perth Centre for Photography, Award announcement, 2022.