

2023

Reframing museum epistemology for the information age: a discursive design approach to revealing complexity

Manton, Coral

<http://hdl.handle.net/10026.1/20411>

<http://dx.doi.org/10.24382/1164>

University of Plymouth

All content in PEARL is protected by copyright law. Author manuscripts are made available in accordance with publisher policies. Please cite only the published version using the details provided on the item record or document. In the absence of an open licence (e.g. Creative Commons), permissions for further reuse of content should be sought from the publisher or author.



UNIVERSITY OF PLYMOUTH

Reframing museum epistemology for the information age: a discursive design approach to revealing complexity

By

Coral Manton

A thesis submitted to the University of Plymouth in partial fulfilment for
the degree of DOCTOR OF PHILOSOPHY

School of Art, Design and Architecture

April 2022

COPYRIGHT STATEMENT This copy of the thesis has been supplied on condition that anyone who consults it is understood to recognise that its copyright rests with its author and that no quotation from the thesis and no information derived from it may be published without the author's prior consent.

ACKNOWLEDGEMENTS:

I am fortunate to have so many wonderful collaborators and a network of curious and talented creative people who supported my endeavours and kept me going when times were tough.

I thank the network of museums and libraries that have supported and inspired my research.

I am hugely thankful for the loving support of my family, partner and friends. Without them, none of this would be possible.


I am grateful for the guidance and patience of my supervisory team, who have supported me throughout this research.

I thank the University of Plymouth and my funders, the 3D3 Centre for Doctoral Training, for this opportunity to expand my knowledge, develop my craft and access new opportunities.

AUTHOR'S DECLARATION

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Doctoral College Quality Sub-Committee. Work submitted for this research degree at the University of Plymouth has not formed part of any other degree either at the University of Plymouth or at another establishment.

Word count of main body of thesis: 54,231

Signed 

Date 29th April 2022

Abstract:

Coral Manton

Reframing museum epistemology for the information age: a discursive design approach to revealing complexity

This practice-based research inquiry examines the impact of an epistemic shift, brought about by the dawning of the information age and advances in networked communication technologies, on physical knowledge institutions - focusing on museums. The research charts adapting knowledge schemas used in museum knowledge organisation and discusses the potential for a new knowledge schema, the network, to establish a new epistemology for museums that reflects contemporary hyperlinked and networked knowledge. The research investigates the potential for networked and shared virtual reality spaces to reveal new 'knowledge monuments' reflecting the epistemic values of the network society and the *space of flows*.

The central practice for this thesis focuses on two main elements. The first is applying networks and visual complexity to reveal multi-linearity and adapting perspectives in relational knowledge networks. This concept was explored through two discursive design projects, the *Museum Collection Engine*, which uses data visualisation, cloud data, and image recognition within an immersive projection dome to create a dynamic and searchable museum collection that returns new and interlinking constellations of museum objects and knowledge. The second discursive design project was *Shared Pasts: Decoding Complexity*, an AR app with a unique 'anti-personalisation' recommendation system designed to reveal complex narratives around historic objects and places. The second element is folksonomy and co-design in developing new community-focused archives using the community's language to build

the dataset and socially tagged metadata. This was tested by developing two discursive prototypes, *Women Reclaiming AI* and *Sanctuary Stories*.

CONTENTS:

Abstract:	5
LIST OF ILLUSTRATIONS:	11
1. Introduction & Overview	19
1.1. Introduction.....	20
1.2. Key Terms	27
1.3. Museums and Me.....	30
1.4. Methodology	32
1.4.1 Contextual Framework	32
1.4.2. Discursive Design Practice	34
1.4.3. Evaluation of Discursive Design Practice	36
1.5. Research questions, aims and objectives.....	37
1.6. Chapter Outline	40
1.7. Limitations of Research	41
1.8. Framing Museums.....	41
1.8.1. Shifting the role of the museum	42
1.8.2. The unseen machinery/knowledge infrastructure of the museum	52
1.8.3. Colonialist Knowledge Infrastructure	60
1.8.4. Museum Knowledge	63
1.8.5. Museum space.....	69
1.9. Opening the Black-Box:	71

2. Museum historiography through the concept of the episteme:	73
2.1. Circles, Trees, Networks	75
2.2. Circles	77
2.2.1. Circles of Knowledge:	78
2.2.2. The origin of museums:	81
2.2.3. The Renaissance Episteme:	82
2.2.4. The Wunderkammer:	86
2.2.5. Theatres of Knowledge:	89
2.2.6. Ideal Architecture for Museums:	92
2.2.7. Immersive Knowledge Architectures, Libraries:	100
2.3. Key points, Circles:	108
2.4. Knowledge Monuments:	110
2.4.1. The British Library – Inside a knowledge monument:	115
2.5. Trees	129
2.5.1. The Tree of Knowledge:	129
2.5.2. The Classical or Enlightenment Episteme:	134
2.5.3. Discriminating Hierarchies	138
2.5.4. First Public Museums:	140
2.5.5. Grand Narratives:	143
2.5.6. Criticism of Trees:	146
2.6. Key points, Trees:	147
2.7. Networks	149
2.7.1. Postnormal times, Visual Complexity and Networks	149
2.7.2. The Modern episteme	161
2.7.3. Folksonomies	164
2.7.4. Online Museums	168

2.7.5. The Museum without Walls	174
2.7.6. Knowledge Visualisation and Immersive Technologies	201
2.7.7. Museum without Objects – immersive and persuasive.....	209
2.5.8. Towards a new museum epistemology	215
2.5.9. Frameworks for Museum Knowledge Visualisation	216
3. Prototypes	219
3.1. The Museum Collection Engine (MCE)	221
3.1.1. Introduction	221
3.1.2. Intention	222
3.1.3. Design and Implementation.....	225
3.1.4. Observations and Evaluation of Practice	237
3.1.5. Next Steps	239
3.1.6. Key Insights and New Knowledge	240
3.2. Shared Pasts: Decoding Complexity.....	243
3.2.1. Introduction.....	243
3.2.2. Intention	244
3.2.3. Design and Implementation	247
3.2.4. Observations and Evaluation of Practice.....	258
3.2.5. Next Steps.....	264
3.2.6. Key Insights and New Knowledge.....	265
3.3. Women Reclaiming AI	267
3.3.1. Introduction.....	267
3.3.2. Intention	269
3.3.3. Design and Implementation	270
3.3.4. Observations and Evaluation of Practice.....	276
3.3.5. Next Steps.....	277

3.3.6. Key Insights and New Knowledge	277
3.4. Sanctuary Stories.....	278
3.4.1. Introduction and Intension.....	278
3.4.2. Design and Implementation	280
3.4.3. Observations and Evaluation of Practice	285
3.4.4. Key Insights and New Knowledge	285
3.5. British Library Algorave	286
3.5.1. Introduction and Intension.....	286
3.5.2. Observations and Evaluation of Practice	289
3.5.3. Key Insights and New Knowledge	289
3.6. Visual Complexity for Museum Knowledge	290
3.7. Community Building	295
3.8. Knowledge Monument for Information Age.....	297
3.9. New Epistemology.....	298
4. Conclusion	300
4.1. Contribution of new knowledge: Visual Complexity and Networks in representing and organising museum knowledge	301
4.2. Contribution of new knowledge: Discursive design for museum practice	301
4.3. Contribution to new knowledge: Knowledge Monuments for the Information Age.....	302
4.4. Contribution to new knowledge: Folksonomy in archive creation	302
4.5. Contribution to new knowledge towards a new epistemology for museums...	303
4.6. Concluding Remarks	303
BIBLIOGRAPHY	305
PUBLICATIONS:.....	331
CONFERENCE PRESENTATIONS & TALKS:	332

WORKSHOPS:..... 332

EXHIBITIONS: 333

LIST OF ILLUSTRATIONS:

Figure 1 Museum Collection Engine (MCE) network visualisation installation (Manton, 2018)	25
Figure 2 Shared Pasts: Decoding Complexity app logo, designed by Intercity. (Manton, 2019).....	26
Figure 3 Women Reclaiming AI logo, designed by Intercity. (Aga & Manton, 2018)	26
Figure 4: The 'Genus' and 'Species' of discursive design (Tharp & Tharp, 2018, p.84)	35
Figure 5 Word Cloud from analysis of mission statements of 40 leading UK museums and galleries by Nick Poole CEO of UK Collections Trust (UK Collections Trust , 2013)	44
Figure 6 Collections storage at the Museum Collection Centre (Birmingham Museums, 2017)	53
Figure 7 Birmingham Museums Trust Collection Centre Warehouse (Birmingham Museums, 2017)	54
Figure 8 Robert Fludd, Intergræ Speculum Artisquæ Imago 'Mirror of the whole of nature and the image of art'(1617) (Wellcome Collection, n.d.)	80
Figure 9 Part of a compilation of alchemical texts and images entitled Musaeum Hermeticum Reformatum et Amplificatum, this engraving depicts the cosmology conveyed by The Emerald Tablet – a highly esteemed Hermetic text, once translated by Isaac Newton, which was the main source of alchemical thought and practice (Lima, 2017, p. 33).....	80
Figure 10 Curiosity cabinets and universal knowledge as depicted by the Danish Collector Olaus Wormius in Museum Wormianum (1655)	87
Figure 11 Fold-out engraving from Ferrante Imperato's Dell'Historia Naturale (Naples 1599).....	88
Figure 12 Lorenzo Legati, Museo Cospiano, (1677).....	88
Figure 13 Memory Theatre in 'L'idea del theatro', 1550, by Giulio Camillo illustrated by Frances Yates in their book the Art of Memory (Yates, 1999)	90
Figure 14 Memory System or 'Memory Wheel' from Giordano Bruno 'De Umbris Idearum', Paris 1582.....	91
Figure 15 Bartolomeo Del Bene (1585) Civitas veri si morum 'City of Truth': City Plan (Stimac, 2020).....	93
Figure 16 Bartolomeo Del Bene (1585) Civitas veri si morum 'City of Truth': Portal of Touch identified on city plan (Stimac, 2020)	93
Figure 17 Bartolomeo Del Bene (1585) Civitas veri si morum 'City of Truth': Portal of Touch (Stimac, 2020)	94
Figure 18 Bartolomeo Del Bene (1585) Civitas veri si morum 'City of Truth': mound at the centre of city (Stimac, 2020).....	94
Figure 19 Bartolomeo Del Bene (1585) Civitas veri si morum 'City of Truth': Temple of Intelligence (Stimac, 2020) ..	95
Figure 20 The Great Court of The British Museum. Photo: Nigel Young Foster + Partner (The British Museum , 2020)	96

.....	96
Figure 21 Altes Museum, Karl Friedrich Schinkel (1830). The Altes Museums is situation on ‘Museum Island’ in Berlin. Google Culture has a web exhibition dedicated to the domed halls on Museum Island (Google Arts & Culture, 2020)	96
Figure 22 Altes Museum, Karl Friedrich Schinkel (1830), transverse section	97
Figure 23 Guggenheim Museum rotunda and “oculus” (Guggenheim, 2014).....	97
Figure 24 Birmingham Museum and Art Gallery ‘Round Room’ (Birmingham Museums, 2017)	98
Figure 25 Rotunda Museum, Richard Hey Sharp, Scarborough, 1829. (Scarborough Museums Trust, n.d.)	98
Figure 26 Rotunda Museum, Richard Hey Sharp, Scarborough, 1829. Refurbished in and reopened in 2008 (Scarborough Museums Trust, n.d.)	99
Figure 27 Rotunda Museum, Richard Hey Sharp, Scarborough, 1829. Refurbished in and reopened in 2008 (Scarborough Museums Trust, n.d.)	99
Figure 28 Rotunda Museum, Richard Hey Sharp, Scarborough, 1829. Collection of William Smith (Scarborough Museums Trust, n.d.).....	100
Figure 29 Panoramic photograph of the Reading Room at The British Museum, 2006. (The British Museum, 2018)	101
Figure 30 Abbey Library, Göttweig, Austria. Johann Lucas von Hildebrandt (1718). Photo credit: (Royan, 2009).....	101
Figure 31 Library of Strahov Monastery, Prague, Jeroným Hirnheim (1679). Photo credit: (Royan, 2009)	102
Figure 32 Bibliothèque Nationale Richelieu, Reading Room (Wikimedia Commons, 2012)	104
Figure 33 Bibliothèque Nationale Richelieu, Reading Room (Wikimedia Commons, 2017)	105
Figure 34 Book Mountain, Netherlands (MVRDV, 2012)	105
Figure 35 Tianjin Binhai Library, China, (MVRDV, 2017). Image: (Wikimedia Commons, 2017).....	106
Figure 36 Tianjin Binhai Library, China (MVRDV, 2017).....	106
Figure 37 Tianjin Binhai Library, China (MVRDV, 2017).....	106
Figure 38 Stockholm Public Library, Eric Gunnar Asplund, Stockholm, 1924-1928 (Wikiarguitectura, n.d.).....	109
Figure 39 Stockholm Public Library, Eric Gunnar Asplund, 1924-1928. Building Plan. (Wikiarguitectura, n.d.)	109
Figure 40 Stockholm Public Library, Eric Gunnar Asplund, 1924-1928. Exterior. (Wikiarguitectura, n.d.)	110
Figure 41 Library of Birmingham Rotunda, Francine Houben, 2013 (Birmingham City Council, 2014)	110
Figure 42 What's In Store Gallery, The Herbert Art Gallery and Museum, Coventry (2018)	112
Figure 43 Visual storage in the porcelain galleries, Victoria & Albert Museum, Wikimedia Commons (2013)	113
Figure 44 Visual storage in the porcelain galleries, Victoria & Albert Museum, photo credit: Sarah Stierch (2013) ..	114

Figure 45 Pinterest search for museum storage returns impressive images of collections of similar items. Pinterest (2021)	114
Figure 46 Buckingham House: the Octagon Library of George III, watercolour and body colour over pencil, (1818) (Royal Collection Trust, n.d.).....	117
Figure 47 The King’s Library Gallery in the British Museum, now the restored Enlightenment Gallery, engraving (1834) (British Library, n.d.)	118
Figure 48 The King's Library Tower at the British Library's St Pancras site. Photo credit Clive Sherlock. (British Library, 2014).....	119
Figure 49 Automated store, The British Library, Boston Spa.	123
Figure 50 Automated store, The British Library, Boston Spa.	123
Figure 51 Engineer inspects the storage void of the National Newspaper Building. Photo credit: Kippa Matthews .	124
Figure 52 The storage void of the new British Library National Newspaper Building at Boston Spa in West Yorkshire. Photo credit: Kippa Matthews	125
Figure 53 The storage void of the new British Library National Newspaper Building at Boston Spa in West Yorkshire. Photo credit: Kippa Matthews	125
Figure 54 Plans for viewing platform for new storage vault at British Library Boston Spa, Carmody Groake, 2021 (Architects Journal, 2021) (British Library, 2021)	126
Figure 55 Drawing of the Great Chain of Being from Didacuc Valades, Rhetorica Christiana (1579)	132
Figure 56 ‘Genealogical distribution of the arts and sciences’ by Chrétien Frederic Guillaume Roth from Encyclopédie by Jean le Ron d’Alembert and Denis Diderot (1780)	133
Figure 57 Encyclopædia Metropolitana, Methodology of Classification of Sciences, Samuel Coleridge (1818)	134
Figure 58 The Imperial Gallery in Prague, by Johann Bretschneider (1715)	137
Figure 59 Page from Crew's Musaeum Regalis Societatis (1681)	137
Figure 60 Ernst Haeckel, Pedigree of Man, (1879)	140
Figure 61 The catalogue for Cubism and Abstract Art, an exhibition at The Museum of Modern Art, March 2 nd – April 19 th , 1936, organised by the museum founder Alfred H. Barr. Cited in (Lowry, 2012, p. 358).....	144
Figure 62 Hand-drawn draft of the previous figure diagram from the Cubism and Abstract Art catalogue 1936 by Alfred H. Barr Jr. Cited in (Lowry, 2012, p. 362).....	145
Figure 63 Miguel Covarrubias, The Tree of Modern Art – Planted 60 Years Ago. Published in Vanity Fair 40, no.3 (May 1933). Cited in (Lowry, 2012, p. 363).....	145
Figure 64 Visualisation of the Internet in 2003 as a complex network graph by The Opte Project (2003)	160
Figure 65 Visualisation of the Internet in 2010 as a complex network graph by The Opte Project (2010)	161

Figure 66 ClusterBall: Visualising Wikipedia, by Chris Harrison (2007)	161
Figure 67 a collections record of an Egyptian coffin from The British Museum Online Collection.....	172
Figure 68 a collections record of an Egyptian coffin from The British Museum Online Collection showing the name of the person who sold the object to the museum and date acquired	173
Figure 69 British Museum biography of Henry Salt, who removed artefacts from Egyptian graves and sold them for profit to The British Museum and other private collectors	173
Figure 70 Andre Malraux with his 'Museum without Walls', (1950)	175
Figure 71 British Council Turkey, Museum Without Walls, Does it feel cosy? Rita Aktay, Rikita Biswas (2021)	177
Figure 72 British Council Turkey, Museum Without Walls, Does it feel cosy? Rita Aktay, Rikita Biswas (2021)	177
Figure 73 British Council Turkey, Almost There, Seyhan Musaoğlu, Tatiana Kochubinska, Teona Burkiashvili (2020)	178
Figure 74 British Council Turkey, Almost There, Seyhan Musaoğlu, Tatiana Kochubinska, Teona Burkiashvili (2020)	178
Figure 75 home page of USEUM with images ordered by user rated popularity (Valeonti & Valeonti, 2015).....	180
Figure 76 Detail of Google Arts & Culture Search for 'Human'	182
Figure 77 Detail of Google Arts & Culture Search for 'Touch'	183
Figure 78 search based on the colour red, Google Arts & Culture (Google Arts & Culture, 2012)	184
Figure 79 grid view of Aereo, An experimental bird's eye view of the digital collections from the State Library of New South Wales (Giraldo, 2020).....	186
Figure 80 grid view of Aereo, An experimental bird's eye view of the digital collections from the State Library of New South Wales (Giraldo, 2020).....	186
Figure 81 grid view of Aereo, An experimental bird's eye view of the digital collections from the State Library of New South Wales (Giraldo, 2020).....	187
Figure 82 zoomed in grid view including selected image, of Aereo, an experimental bird's eye view of the digital collections from the State Library of New South Wales, (Giraldo, 2020)	187
Figure 83 corresponding collections database entry from the State Library of New South Wales (Giraldo, 2020) ...	188
Figure 84 Art Emotions Map Experiments with Google by Nicolas Barradeau, Romain Cazier, Alan Cowen and Dacher Keltner (Keltner, et al., 2021)	189
Figure 85 Surfacing Women in Smithsonian History, Elizabeth Harmon and Lynn Cherny (Harmon & Cherny, 2022)	190
Figure 86 Curator Table by Cyril Diagne and Simon Doury (2017).....	191
Figure 87 Curator Table by Cyril Diagne and Simon Doury (2017).....	192

Figure 88 Curator Table by Cyril Diagne and Simon Doury (2017).....	192
Figure 89 Curator Table by Cyril Diagne and Simon Doury (2017).....	192
Figure 90 Free Fall, Big Bang, by Cyril Diagne and Nicolas Barradeau (2017)	193
Figure 91 Free Fall, Wave, by Cyril Diagne and Nicolas Barradeau (2017)	193
Figure 92 Free Fall, Wave, by Cyril Diagne and Nicolas Barradeau (2017)	193
Figure 93 t-SNE Map by Cyril Diagne, Nicolas Barradeau and Simon Doury (2018)	194
Figure 94 t-SNE Map by Cyril Diagne, Nicolas Barradeau and Simon Doury (2018)	194
Figure 95 View of Tags by Cyril Diagne & Gaël Hugo (2017).....	194
Figure 96 The Museum of The World, the British Museum, Google Arts & Culture (2020)	195
Figure 97 Timeline of Modern Art, Tate and Framstore (2016).....	196
Figure 98 Local Projects, 'Please Touch the Art' Cleveland Museum of Art, (2013)	197
Figure 99 in Echoes around the World, Local Projects create an audio and visual tapestry from the testimonies of 417 people describing where they were when they heard about the September 11th attacks on the World Trade Centre, Local Projects, (2014).....	198
Figure 100 UMass Amherst Interactive Wall, Local Projects, (2017).	199
Figure 101 'The Curator', Ready Player One, Steven Spielberg (2018)	201
Figure 102 Exterior of Stan VanDerBeek's Movie-Drome (1965)	202
Figure 103 Interior view of Stan VanDerBeek's Movie-Drome (1965).....	203
Figure 104 Interior view of Stan VanDerBeek's Movie-Drome (1965). Photographed by Peter Moore.	203
Figure 105 Ken Isaacs, Knowledge Box, Life Magazine, (1962).....	205
Figure 106 Ken Isaacs, Knowledge Box, Life Magazine, (1962).....	205
Figure 107 Ken Isaacs, Knowledge Box (1962), (Socks, 2016).....	206
Figure 108 Ken Isaacs, Knowledge Box (1962), (Socks, 2016).....	206
Figure 109 LGBTQ+ VR Museum, Antonio Foster, Thomas Terkildsen (2021)	208
Figure 110 Museum of the Fossilised Internet (Ivens, n.d.) Developed and available on Mozilla Hubs.	208
Figure 111 Laser scanning test at Birmingham Museums Trust Collections Centre (Manton, 2018)	227
Figure 112 Laser scanning test at Birmingham Museums Trust Collections Centre (Manton, 2018)	227
Figure 113 Laser scanning test at Birmingham Museums Trust Collections Centre (Manton, 2018)	228
Figure 114 photogrammetry test at Birmingham Museums Trust Collections Centre (Manton, 2018)	228
Figure 115 photogrammetry test at Birmingham Museums Trust Collections Centre (Manton, 2018)	229
Figure 116 MCE Test using photogrammetry models from Birmingham Museums Trust camera collection (Manton, 2018).....	229

Figure 117 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)	231
Figure 118 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)	232
Figure 119 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)	232
Figure 120 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)	233
Figure 121 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)	233
Figure 122 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)	234
Figure 123 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)	234
Figure 124 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)	235
Figure 125 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)	235
Figure 126 MCE Prototype developed for digital planetarium dome in Unity Game Engine (Manton, 2018).	236
Figure 127 MCE Prototype developed for digital planetarium dome in Unity Game Engine (Manton, 2018).	236
Figure 128 MCE Prototype developed for digital planetarium dome in Unity Game Engine (Manton, 2018).	237
Figure 129 Shared Pasts: Decoding Complexity Logo, Designed by Intercity. (Manton, 2019).	245
Figure 130 Electron Microscopy Scan of Caster Sugar by Plymouth University. (Manton, 2019)	249
Figure 131 An Electron Microscopy Scan of a single grain of sugar by Plymouth University. (Manton, 2019).....	249
Figure 132 screen capture from Shared Pasts: Decoding Complexity AR App showing Sugar 3D object and narrative nodes. (Manton, 2019).....	250
Figure 133 Shared Pasts: Decoding Complexity Exhibition at Arnolfini Gallery, Sugar object trigger, (Manton, 2019). Photo credit: Joe Auborn.....	250
Figure 134 3D object scan of District Officer's Staff at CAMERA, University of Bath, (Manton, 2019).....	251
Figure 135 District Officer's Staff from the Collection of Bristol Museums. Staff was used as a 3D object trigger (Manton, 2019). Photo credit: Joe Auborn.....	252
Figure 136 Statue of Edward Colston (2019). Photo credit: Joe Auborn	253

Figure 137 Shared Pasts: Decoding Complexity prototype launch. In this image, the story nodes have appeared around the statue of Edward Colston (Manton, 2019). Photo credit: Joe Auburn	254
Figure 138 Shared Pasts: Decoding Complexity prototype launch. In this image testers and project team are discussing the app inside the story zone for the Statue of Edward Colston (Manton, 2019). Photo credit: Joe Auburn	254
Figure 139 Screenshot of 3D object marker scanning for AR trigger. Statue of Edward Colston. A previous artistic protest about slavery can be seen at the statue's base (Manton, 2019).....	255
Figure 140 Shared Pasts: Decoding Complexity AR App testing, Pero's Bridge (Manton, 2019). Photo credit: Joe Auburn.....	256
Figure 141 Shared Pasts: Decoding Complexity AR App testing, Pero's Bridge (Manton, 2019). Photo credit: Joe Auburn.....	256
Figure 142 Shared Pasts: Decoding Complexity AR App testing, Arnolfini Gallery (Manton, 2019). Photo credit: Joe Auburn.....	257
Figure 143 Shared Pasts: Decoding Complexity AR image triggers designed by Intercity. They were printed onto postcards for use outside of the story zones (Manton, 2019).....	257
Figure 144 Topping of Statue of Edward Colston by anti-racist protestors at Black Lives Matter protest in Bristol, BBC (2020)	261
Figure 145 Statue of Edward Colston pushed into Bristol Harbour, BBC (2020)	261
Figure 146 Black Lives Matter protest placards arranged around the statue of Edward Colston after Black Lives Matter protest in Bristol, ArtNet (2020)	262
Figure 147 Statue of Edward Colston, with preserved traces of the protest, on public display in M-Shed, Bristol. ArtNews (2021).....	263
Figure 148 Women Reclaiming AI logo. Designed by Intercity. (Aga & Manton, 2018).....	269
Figure 149 Women Reclaiming AI Workshop, Knowle West Media Centre, (Aga, Manton 2018).....	272
Figure 150 Women Reclaiming AI Workshop, The Barbican AI:More than Human, (Aga, Manton 2019).....	272
Figure 151 Women Reclaiming AI archive development in Dialogflow (Aga, Manton, 2018)	274
Figure 152 Women Reclaiming AI archive development in Dialogflow (Aga, Manton, 2018)	274
Figure 153 Women Reclaiming AI Exhibition, Birmingham Open Media (BOM), (Aga, Manton 2019)	275
Figure 154 Women Reclaiming AI Exhibition, ARS Electronica, Linz, (Aga, Manton 2019)	275
Figure 155 Sanctuary Stories visit to Birmingham Museum and Art Gallery (Manton, 2018)	281
Figure 156 Sanctuary Stories visit to Birmingham Museum and Art Gallery (Manton, 2018)	282
Figure 157 Sanctuary Stories event for Refugee Week at Birmingham Museum and Art Gallery (Manton, 2018)	282

Figure 158 Sanctuary Stories event for Refugee Week at Birmingham Museum and Art Gallery (Manton, 2018)	283
Figure 159 Sanctuary Stories event for Refugee Week at Birmingham Museum and Art Gallery (Manton, 2018)	283
Figure 160 Sanctuary Stories project flyer (Manton, 2018)	284
Figure 161 Sanctuary Stories project flyer (Manton, 2018)	284
Figure 162 Coral Manton performing at Algorave at the British Library in collaboration with The Alan Turing Institute, 2019. Photo credit: Antonio Roberts	287
Figure 163 Coral Manton and Alex McLean (aka Yaxu) performing at Algorave at the British Library in collaboration with The Alan Turing Institute, 2019. Photo credit: Antonio Roberts	288
Figure 164 Algorave at the British Library in collaboration with The Alan Turing Institute, 2019. Photo credit: Antonio Roberts	288

1. Introduction & Overview

The methods via which we understand the world around us are undergoing significant structural changes. Architectural knowledge metaphors, such as pillars, temples, and palaces, have been on shaky ground and are dissolving into streams, torrents and clouds. A paradigm shift in the way we approach science and the invention of hyperlinked media has uprooted the tree of knowledge and replaced it with the complex and all-encompassing topology of the rhizome. Enlightenment notions of order and balance through science and rationality have been replaced with visual complexity and network science.

Epistemological institutions, including museums, galleries and libraries, whose approaches to knowledge were informed by scientific rationalism and its desire to extract pattern from complexity, are now engaged in debate on how to meet the epistemological challenges of the information age. The ubiquitous topology of networked communication through the internet and the connecting power of hyperlinks are driving discussions on the role of museums in the contemporary networked society.

1.1. Introduction

Visual complexity in networks is the predominant schema for knowledge in the information age (Lima, 2013). The change in schema from the tree of knowledge to the network has been primarily due to scientific advances enabling better observation of complex systems, including the inner working of neural networks in the brain and the complex and interconnected nature of the Earth's eco systems. Alongside detecting complexity in the 'natural world', humans have developed new network technologies, including the Internet - a global complex information and communication infrastructure made of dense webs of information and knowledge.

Our approach to knowledge is heavily influenced by its medium (Weinberger, 2012). Knowledge pre Internet was defined by the method of recording and sharing it – paper, ink, books, other physical objects and architectures. Knowledge post-digital is determined by the hyper-link and super-fast global communication networks (ibid). In this way, knowledge moves away from a fixed, elitist and reductionist position to a fluid, open and holistic definition; based on Castell's theories of the 'Network Society' (2010), knowledge moves from the 'space of places' to the 'space of flows'.

Since their inception, museums have been architectures in which knowledge (things that are already known) and memory are visually represented. During each significant epistemic shift, from the Renaissance 'theatre of the mind' to the Enlightenment science of encyclopaedism and Newton's 'great clockwork' to Victorian 'grand narratives', museums have been present in not just keeping but shaping the knowledge of the time. A museum makes new knowledge in an act of world-building, drawing a circle around museum and non-museum knowledge. The public museum

was founded in a period of universalisms, the separation of ‘high’ (scholarly) and ‘low’ (folk) knowledge and new scientific methods of tabulating phenomena into fixed classification systems. Modern museums are places where national, regional, and community narratives are assembled and shared. These acts of world-building are a socio-technical process of museum knowledge production through classification, cataloguing, and recontextualising objects in the collection and exhibitions. An object’s meaning is defined differently in a museum collection than it is when in its original or prior context, and this socio-technical act of museum knowledge production tends to be assumed as authoritative and objective.

Museums have been utilising the potential of computing for the organisation and sharing of the catalogue since the 1960s (Parry, 2007). The widespread adoption of the database by museums, or as Manovich calls it, the ‘symbol of the information age’ (Manovich, 1999), has steered museums to adapt cataloguing processes and adopt language and procedures sympathetic to the standardising effect of the database (Parry, 2007, p. 57). The combination of the widespread adoption and impact of the database on museum processes, alongside the symbolic status of the database in contemporary society, has led to an “unprecedented fetishising of the museum database” (ibid). The museum database is so established in museum practice and revered for its knowledge potential that it is now regarded as “the metonym of the museum” (ibid). Contemporary exhibition design has adopted the language of the database, with archives of human records, memories or possessions being presented in memory focused museums, regularly using large scale and immersive projection technologies, which evoke strong emotional responses in visitors – particularly empathy.

New technologies, *Big Data*, *The Cloud* and *Artificial Intelligence (AI)* are changing basic architectural assumptions of how we approach and structure data and visually describe or imagine knowledge. Knowledge has sprung from the physical ‘temple of knowledge’ to the ‘information superhighway’ and has now flooded into ‘the cloud’. The visual complexity of the network has fragmented the hierarchical tree structure and faceted database and is now the dominant metaphor for contemporary knowledge production.

Material semiotics, including actor-network theory, feminist material semiotics and performativity, is based on the recognition of complexity in material and social relationships and describes these relationships as weaves or threads of a web (Law, 2019). Material semiotics can be described as a realisation of Deleuze’s (1987) rhizome theories, and Latour (1996) observed that ‘actor-networks’ in actor-network theory could be replaced by the term ‘actant-rhizomes’. Network science, material semiotics and visual complexity are forming new epistemological assumptions in society and are changing the way we conceptualise knowledge.

Many online communities are vast and global opinion and knowledge-sharing networks in which the anonymous sharing of information of uncertain provenance can be deployed to capture users’ attention. It is feared that rather than individuals online seeking to know more, they are starting to know less and from questionable sources. The widespread adoption of the internet and social media has enabled new relationships and communities to form, in which knowledge, alongside trust, is highly negotiated.

New museology emerged in the 1980s (Vergo, 1989). It is a discourse around the social and political roles of museums calling for a redistribution of power in the defining of knowledge in heritage. It has become an intellectual and practical movement, particularly interested in new types of museums that question the hegemony of classical epistemological traditions, prioritising communities, human stories, and ideas over the traditional privileged status of the museum collection and catalogue (Desvallées & Mairesse, 2010). This epistemological shift has led to intense questioning and debate on the role of museums in society, both from inside and outside the sector. This drive for change within the museum sector has led to a call to examine museums' current epistemology and establish a new one (O'Neill, 2006).

This research inquiry is situated within the present epistemological re-evaluation of museums from within and outside the sector. Current museological re-evaluation focuses on discourses in power and authority in knowledge, decolonisation of collections and catalogues, and recent developments in constructivist learning principles. The impact of global communication technologies contextualises philosophical discussion in museology in the information age. However, there is a noticeable lack of literature regarding the effects of networked computing¹, the networked society, and the network as a widely adopted knowledge metaphor on museum epistemology. New knowledge presented in this thesis will enhance literature in museology and new media practice and offer some practical tools for creatively

¹ One noticeable exception is Ross Parry in *Recoding the Museum* (2007), however his book focuses on the way museums approached the adoption of computing but not as a question of epistemology.

engaging with visual complexity, networked knowledge paradigms and community building practices in museums. Conclusions drawn from this thesis contribute to current research into the framing of a new epistemology for museums through key insights in:

- The potential for museums to embrace complexity and networks in their visual language and epistemological practices.
- Methods for extended reality technologies to present a new museum architecture as a monument to knowledge in the networked society, situated in the 'space of flows'.
- The value of discursive design methods applied to reimagining the museum infrastructure and questioning assumed knowledge and epistemic 'behind-the-scenes processes', focusing on non-hierarchical and community-based practices, through creating opportunities for speculation and discourse.

The practice-based research contained in this thesis manifests as five prototypes that apply discursive design methodologies to speculating on a new epistemology for museums based on community-driven and networked knowledge processes. The primary aim of each prototype is to generate discourse on the future of knowledge in museums. This discourse is reflected in the evaluation of each prototype. The prototypes are:

The Museum Collection Engine (MCE): is an interactive network visualisation that enables users to search the collection, using keyword searching based on information in the collections database and image recognition tags, and return a networked visualisation of graphically inter-linked objects. This prototype explores

complexity in collections, the epistemological value of presenting collections as networks and the potential for museums to use traditional architectures (domes) to showcase collections digitally, creating new forms of knowledge monuments.

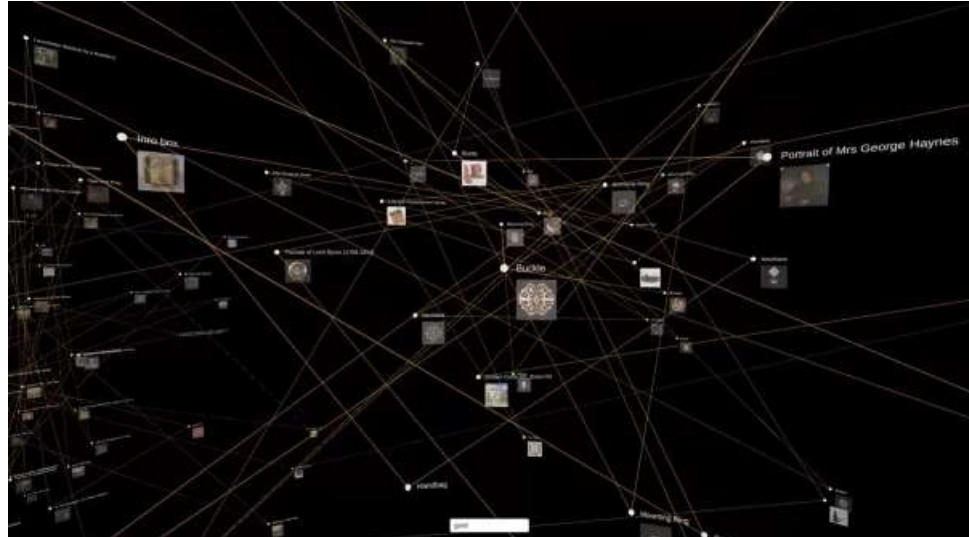


Figure 1 Museum Collection Engine (MCE) network visualisation installation (Manton, 2018)

Shared Pasts: Decoding Complexity: An augmented reality (AR) application allows users to experience different narratives connected to historical artefacts and locations visualised through floating nodes. A recommendation system suggests following narrative nodes, based on which story paths have been chosen less, by graphically joining them with a link. This prototype explores complexity and community curation.

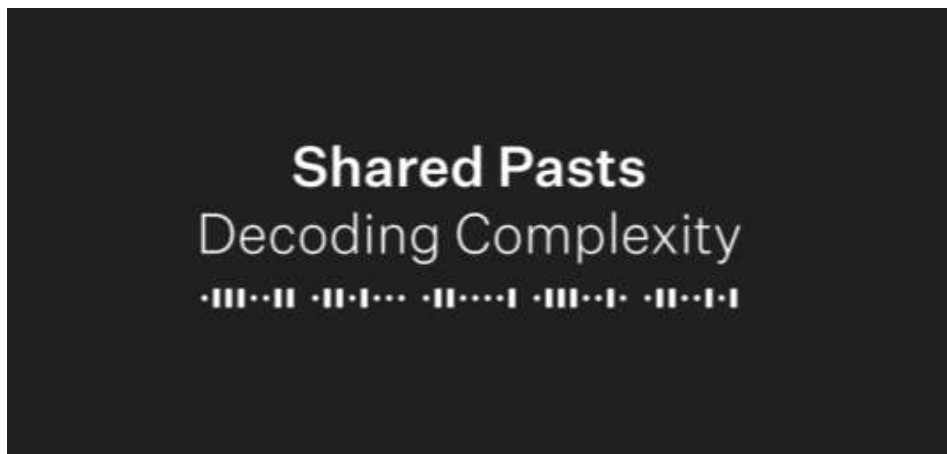


Figure 2 Shared Pasts: Decoding Complexity app logo, designed by Intercity. (Manton, 2019)

Women Reclaiming AI (WRAI): is an activist artwork that manifests as an AI voice assistant or chatbot. The chatbot is co-designed by a community of 100+ women, non-binary and genderqueer people. This prototype investigates the potential of folksonomy and participatory design methods for creating new types of community developed archives that represent alternative voices to the mainstream.



Figure 3 Women Reclaiming AI logo, designed by Intercity. (Aga & Manton, 2018)

Sanctuary Stories: is an oral history project programme which explores the potential for underrepresented communities to contribute their histories to the museum collection equitably and reciprocally.

British Library Algorave: was an event that used the visual language and techniques applied in live-coded performances to generate discourse on the code-space or behind-the-scenes infrastructure of the library.

1.2. Key Terms

The following is a list of key terms used within this thesis and a description of how these terms are applied. Other terms and related definitions less fundamental to the practice are outlined where appropriate within the text or footnotes:

Museum:

Museum is an umbrella term for several different cultural heritage institutions. The term museum can refer to subject-specific museums, e.g. The Pen Museum, Birmingham, heritage sites like The Roman Baths in Bath, and historic houses, e.g. Soho House, Birmingham. For this research inquiry, the term museum refers to a general museum, e.g. Birmingham Museum and Art Gallery or Bristol Museum and Art Gallery. A general museum usually manages a broad collection split into subjects or disciplines, including social history, art, natural history, and world cultures.

Museum Epistemology:

A key focus of this thesis is framing a new museum epistemology. I follow O'Neil's definition of museum epistemology as "a method for asking what and how the museum knows, identifying ways of knowing that are problematic and seeking solutions in new frameworks of knowledge" (O'Neill, 2006). Museum epistemology will be further expanded on in 1.8.1. the section titled *The Shifting Role of the Museum*.

Knowledge:

Paula Findlen describes museums as "sites of knowledge" (2018) as, traditionally, they are engaged in research, public education, and knowledge transmission. Museums store knowledge in collections and the catalogue and create new knowledge through recontextualising objects through classification and interpreting objects' meanings in exhibitions.

Information Age:

The Information Age (also known as the Digital Age, New Media Age, and Computer Age) is a historical period initiated by the invention of information technology, networked communication, computing and the internet. In this research inquiry, I use this term in reference to an epochal shift driven by the development of networked communication and the internet and when referring to the present day.

Community:

Community is an elusive term that lacks specific meaning, yet it is used a lot in the context of museums. There is no such thing as a definitive museum community. However, for use in this research inquiry, the terms community or communities refer

to groups of people with a sense of belonging to the museum, potentially through active visiting, geography, or personal connection to the collection.

Complexity:

Complexity refers to an epistemological shift in our understanding of the world that coincides with the development of the Information Age. Complexity is a recognition of the interconnectedness of modern society and knowledge across science, social systems, and communication systems. For Lima (2013), complexity marks a shift in organising knowledge into rigid, centralised and hierarchical tree structures to networks becoming the dominant visual schema for knowledge in recognising the diversity, interconnectivity and hyperlinked knowledge throughout the internet. Complexity for Sadar (2010) is linked to her concept of post-normal times in which the world has been transformed by substantial technological development, including the internet and globalisation. She regards complexity as a natural by-product of our interconnectivity, problems and global scale and a new awareness of our positions in complex eco-systems through the developments in science and understanding of climate change.

1.3. Museums and Me

I have over a decade of experience working in museums, galleries, libraries and archives. My professional roles have included exhibitions curation, interpretation development and education, alongside early-career jobs in gallery invigilation, as an archive assistant and library and information assistant. I am unusual in that I started working in the sector on leaving school aged seventeen, and carried on while working through my university education in arts and digital media, and eventually became a qualified curator and worked planning exhibitions for Birmingham Museums Trust.

On leaving school, I got a job in a Coventry City Council Library, from where I was seconded to Coventry City Archives as an archive assistant to help with cataloguing a large backlog of records before the archive was to be moved and the building was demolished to make way for a new one. One of my lasting memories of this role was the ritual of entering collection and item data into the archive management database and preparing each item and collection for storage in the archives in the basement. I vividly remember in my training, the archive manager standing over me as I would input new items into the catalogue, prompting me to use the correct standard fields, language, word order and specific use of punctuation for each record I was manually entering into the database software. After this training was complete, each day, I sat with boxes of documents, performing the same ritual - making a record for each item, numbering the item according to its position in the collection, performing basic conservation tasks (removing metal staples and paper clips and sewing up pamphlets with natural thread) before wrapping the documents in archive paper, tying the paper shut with cotton thread, placing them in a brown cardboard archive box, labelling the

box and carrying it into the basement for storage on the right shelf. One day by chance, I opened a file ready to catalogue containing letters of the petition for the closing of a school and within the file, I saw a handwritten letter by my mother. As I prepared it for the archive, I remember it dawning on me that the basement of documents contained my history and my family's history – and we could draw connections between ourselves and the records.

From then on, I was fascinated by physical containers for knowledge, the draw full of microfiche with all of the signed planning permission records for the city and the boxes containing all of the births, deaths and marriages records for the UK. I considered how people are physically linked to these places in a network of people and events. I imagined lines of connection emanating from the basement into the city. Later in my career, when I became an exhibitions curator for Birmingham Museums Trust, I became fascinated by the potential of the digital planetarium dome for data visualisation, and I imagined mapping all of the complex and multi-layered connections present in the collection in the same way stars are visualised. As I had already developed some practical work for the dome for my master's degree, I decided to bring my practice as a new media artist and museum curator together. The fruits of this decision are presented in this thesis.

1.4. Methodology

Following the definition by Candy (2006), this research is practice-based. It centres on creative practice as the primary method of knowledge development. The creative artefacts produced in this research form the basis of the contribution to knowledge. The practice-based approach is situated within the broader interpretation of discursive design proposed by Tharp and Tharp (2018). The practice is contextualised by the historiography approach to establishing a contextual framework for understanding epistemology in museums.

1.4.1 Contextual Framework

This research inquiry is interdisciplinary in its approach, grounded in both my practical experience as a museum professional and my practice as a digital artist and technologist. It is further contextualised by contemporary museology and New Media theory. As is evidenced in the thesis, artistic engagement with collections using digital tools is not uncommon. However, my professional background in museums and digital arts practice provided unusual access to both disciplines. Generally, a museum would commission a digital artist to work with collections or archives, and the curators would mediate access and define the parameters of the project. In this research, I had privileged access to two worlds at once, the inner workings of the museum and digital arts practice.

The research contained in this thesis draws from over a decade of professional experience working in the museum sector, my knowledge as a qualified museum curator and time spent immersed in collection centres through two residencies. The

first residency was at the Museum Collection Centre of Birmingham Museums Trust. The second was a PhD placement followed by a Research Affiliate position at the British Library, for which I was resident at both the St. Pancras (London) and Boston Spa (Yorkshire) library sites. Time spent immersed in behind-the-scenes spaces, engaging with the unseen mechanisms of the stored physical knowledge, has been essential in contextually framing this research.

I have adopted a historiographical approach to developing a contextual framework for my practice-based research, which has involved a historical investigation into changing knowledge organisation and visualisation schemas used by museums and knowledge institutions. This historiography is developed in chapter two of this thesis. It uses Foucault's concept of 'episteme' as a theoretical framing device, inspired by the work of Eilean Hooper-Greenhill in her book *Museums and the Shaping of Knowledge* (1992). Each of Foucault's epistemes is used to examine a pivotal period in the development of museums, and Manual Lima's research into knowledge visualisation archetypes, *circles, trees, and networks* (Lima, 2013; 2014; 2017) are mapped to each episteme to contextualise the ways in which knowledge was conceptually shaped. The renaissance episteme and circles represent the origins of the museums and the enclosing of knowledge; the classical or enlightenment episteme and trees represent the establishment of the first public museums and the scientific approach to classification and cataloguing; the modern episteme and networks frame an exploration of contemporary museums and the changing faces of knowledge in the information age.

1.4.2. Discursive Design Practice

Tharp and Tharp describe discursive design as “a broad categorization where the primary design intention is not utilitarian in the typical sense but rather to communicate particular ideas and rouse reflection” (ibid, p.7). Artefacts produced through this process are “embedded with discourse” and are “tools for thinking” that “raise awareness and perhaps understanding of substantive and often debatable issues of psychological, sociological, and ideological consequence” (Tharp & Tharp, 2013, pp. 406-407) Tharp and Tharp draw their concept of ‘discourse-through-design’ from Foucault, and define discourse as a system of thought or knowledge. My approach to this research has been to draw on professional knowledge as a qualified curator and museum worker and immerse myself in the archive to create digital artefacts that question how knowledge is conceived of and represented in museums. Using discursive design methodologies has enabled me to approach design and making as a tool for reflection on pressing issues in museology, knowledge organisation and visual representation.

Tharp and Tharp use the term ‘discursive design’ as a genus for a spectrum of design approaches (as illustrated in 4) which places discourse at the centre of design to generate reflection and discussion with audiences. The practice-based research described in this thesis considers future and alternative methods for museums to engage with communities and collections. Therefore design methodologies that

consider new and counter-narratives for museum practice in digital culture within discursive design will be foremost, including design activism² and speculative design³.

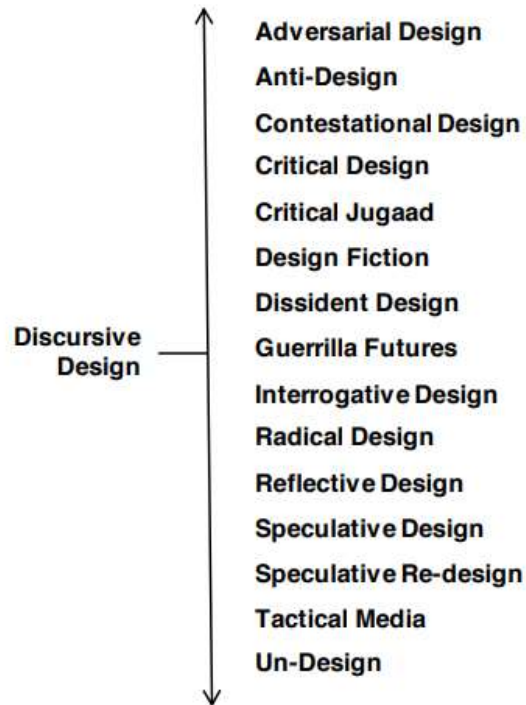


Figure 4: The 'Genus' and 'Species' of discursive design (Tharp & Tharp, 2018, p.84)

² Design activism originated in Alastair Fuad-Luke's publication, *Design Activism: beautiful strangeness for a sustainable world* in which he describes design activism as 'design thinking, imagination and practice applied knowingly or unknowingly to create a counter-narrative aimed at generating and balancing positive social, institutional, environmental and/or economic change' (Fuad-Luke, 2009, p. 27)

³ Speculative design is described by Dunne and Raby as an act of "creating an idea of possible futures [using] design as a medium to stimulate discussion and debate amongst designers, industry and the public about the social, cultural and ethical implications of existing and emerging technologies" (Dunne & Raby, 2013, pp. 2-3). It is a method applied to "collectively redefining our relationship to reality" (ibid).

1.4.3. Evaluation of Discursive Design Practice

The evaluation of practice within this thesis is based on discursive design methods for measuring the effect and impact of design. A notable aim of the discursive design genus, through design activist methods, is to create some kind of change in thinking. Tharp and Tharp write:

“The goal is not necessarily to change society but to get individuals or collective audiences to reflect and think in a way that is somehow useful to themselves or others.” (Tharp & Tharp, 2018, p. 289)

Furthermore, assessing the effectiveness of discursive design is “more concerned with discursive designers having impact than measuring impact” (ibid, p. 285). Discursive design is not focused on developing scales for evaluating the impact of a designed artefact; however, “audience reflection is the baseline requirement for successful discursive design” (ibid) and evaluating the mental response of people is necessary for the impact of discursive design to be considered. Therefore, I will apply reflection methods on discursive design processes and outcomes through observations and dialogue with participants, collaborators, and audiences via informal conversations at prototype testing exhibitions. Focus groups will measure the changes in thinking resulting from engagement with designed artefacts. “Discursive design always strives for a mental response from the audience” (ibid, p.289) and this mental response will be unique to the designed experience. Therefore, the evaluation of the participant, audience, collaborator or designer's cognitive response is unique to the intentions of each project and based on the discursive proposal and framework for discourse and future speculation.

1.5. Research questions, aims and objectives

The practice-based research inquiry within this thesis is driven by a desire to rethink museum epistemology for the Information Age. The research aims are motivated by changing attitudes within the museum sector, influenced by new museology theory and practice; artists, historians and activists engaged in discourse and practice on decolonisation and post-colonial theory; queer, feminist and post-colonial archival and material semiotics scholarship; and changing attitudes to knowledge catalysed by technical advances in computing, particularly the development of the Internet.

This research inquiry exposes the issues caused by inherited discriminatory and rigid forms of knowledge management embedded within museum infrastructures. This infrastructural understanding provides the grounding for new modes of knowledge visualisation that reflect contemporary networked knowledge frameworks and social complexity. Central to these aims is designing new forms of engagement with museum collections, using current digital technologies embedded in design activist processes and community building.

These aims underpin the research questions of this inquiry. The first question forms the foundation of the contribution to new knowledge through the exploration of visual schemas that support internal and external understanding of museum knowledge; and how contemporary knowledge mediums, based on networked communication, provide opportunities for a new museum epistemology that acknowledges complexity and fluidity in knowledge networks:

How can a new museum epistemology embrace and reflect the complexity of current knowledge in a networked society?

This question is focused on building a theoretical foundation grounded in the history of knowledge representation in museums and museum epistemology to understand how museums can move towards a new epistemological understanding that reflects contemporary networked knowledge communities.

The findings from this question form the basis for the second question, which engages in practice-based and community focused speculative and discursive design processes in creating five prototypes. Each prototype acts as a probe, investigating museum knowledge and providing critical insights into envisioning a new museum epistemology that uses digital technology to engage with changing approaches to knowledge in the information age:

How can discursive design methods be used to reimagine museum epistemology for the Information Age?

The findings from the practice-based outputs from the discursive design process will form the response to the third question. The third question is based on the first two discursive design prototypes, the *Museum Collection Engine* and *Shared Pasts: Decoding Complexity*.

Can digital knowledge visualisation create new museum knowledge monuments for the networked society?

The three research questions outlined above generate the following objectives for this practice-based research inquiry:

Objective 1:

Develop a contextual framework for understanding the development of knowledge organisation and representation schemas in museums. This contextual framework provides the basis for the design of practice-based prototypes.

Objective 2:

Use the above contextual framework to understand and visualise complexity in museum collections and develop new insights into using digital technology to support contemporary approaches to engaging with heritage.

Objective 3:

Museums actively design their internal and external spaces to represent knowledge of their region. In this way, as an entire construct, a museum can be described as a monument to knowledge and representing monumental knowledge. Discursive design strategies are employed to visualise museum knowledge in new ways - in digital architectures, creating new knowledge monuments that utilise networks as a cultural symbol to reflect complexity and interconnectedness in contemporary relational and community-based knowledge.

Objective 4:

By exploring folksonomy methods in knowledge organisation and creation, the research engages community building and co-designed collective archival processes that empower communities to participate in defining their collective heritage and cultural identity.

Objective 5:

Research insights challenge current museum practices from within and are based on professional knowledge and experience of working in museums and time spent immersed in the storage centres of Birmingham Museums Trust and the British Library.

1.6. Chapter Outline

This thesis is structured into three core chapters. The first chapter presents the research questions and discursive design methodology. It establishes the context of the research inquiry by discussing a series of core concepts relating to knowledge in the museum.

The second chapter provides a contextual framework for understanding how museum knowledge is constructed and visualised. The historiography presented in this chapter has been essential to understanding the foundational principles of knowledge in the museum, which has been used to ground the practice in this thesis. This chapter is structured using Foucault's (1970) concept of the episteme and three fundamental visual schemas or symbols for knowledge suggested by Manuel Lima (2013; 2014; 2017) – the circle, tree and network. Exploration of the network in epistemologically reframing the museum is the central hypothesis for this thesis. The network in chapter two is linked to a discussion on contemporary challenges museums face.

Chapter three describes the practice-based research conducted to explore the questions of complexity, community curation and digital knowledge monuments and build insights towards a new museum epistemology. Each prototype in chapter three is contextualised by the research presented in chapter two. The documented discussion

of each prototype in chapter three forms the basis of the contribution to knowledge and conclusions presented in chapter four.

1.7. Limitations of Research

The author recognises the following limitations in the research presented in this thesis:

The descriptions of museums in the context of this research focus solely on museums in the West, concentrating mainly on British museums. Most museological discourse focuses on the development of European or western museums, considering the museum to be a distinctly western product of modernity that has been exported to the rest of the world as a symptom of the West's colonialist agenda. However, the author recognises that collecting is a universal human activity and many cultures have methods for curating heritage artefacts within particular architectures (Kreps, 2003). The decision to take a Eurocentric approach was based on a desire to focus the research on a singular model for museums, focusing on Britain based on the author's experience working for museums in the UK and a lack of expertise in museums outside of the British context.

1.8. Framing Museums

The following sections establish a framework for understanding museums' key epistemological features and challenges, beginning with establishing what a museum is and its role in society. Other vital topics presented are related to the

business of knowledge in museums, from organisation to production and dissemination.

1.8.1. Shifting the role of the museum

To address changing epistemology of the museum, first, the accepted definition of what a museum is should be considered – however, this is easier said than done...

Museums have occupied prominent positions in public spaces in the United Kingdom for over 250 years. Today, they are more popular than ever. Globally, the number of museums has increased from around 23,000 two decades ago to over 55,000 today (Rocco, 2013, cited in O'Neil, 2016). Museums are now so ubiquitous in our civic spaces that Mark O'Neil, former Head of Glasgow Museums, describes them as “a universal institution deployed across cultures, like schools, shops or police” (O'Neil, 2016, p. 13). They are believed to symbolise confidence, prosperity and sophistication in their geographic region and have been used by governments as tools for economic regeneration (ibid, p. 18). In the UK, government data indicates that each year around 50% of the population visit museums – a figure that has risen from 42% in 2005 (Department for Digital, Culture, Media & Sport , 2022). So, museums are established institutions, widely used by the public and growing in popularity, yet, as O'Neil shows, there is a challenge within the museum sector in defining the museum's role in society. He writes, “It seems there is no societal or professional consensus about what museums are for” (O'Neill, 2006, p. 96), and he uses the international and UK museum definitions to evidence this.

The accepted international definition of museums is provided by the International Council of Museums (ICOM), part of UNESCO:

“A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment” (ICOM, 2019).

The UK Museums Association definition:

“Museums enable people to explore collections for inspiration, learning and enjoyment. They are institutions that collect, safeguard and make accessible artefacts and specimens, which they hold in trust for society” (Museum Association, 1998).

Both definitions lack precision and raise more questions than they answer. For example, how does an institution define the ‘heritage of humanity’? How does a museum service society’s development? Which people do museums enable to explore collections? Collections of what? Who chooses what artefacts are held ‘in trust for society’?

O’Neil writes of both definitions:

“While these do address the basics of why people visit museums, the activities museums carry out and their social purposes, are so vague as to be mostly tautological: museums are museumy institutions which provide the benefits and pleasures that are typical of museums” (O’Neil, 2016, p. 16).

O’Neil further references analysis of the mission statements of 40 leading UK museums for additional evidence of vagueness in museum definitions.

a contemporary philosophical critique of museums as instruments of control and ideological hegemony.

An essentialist view of the museum, as argued in Hein's book *Museums in Transition* (Hein, 2000), proposes the museum as an authoritative, politically neutral, and timeless institution - a place for collecting and contemplation of material objects led by the trusted connoisseurship of the curators. The essentialist museum has a civic role in presenting artefacts but does not encourage public debate or promote discussion of wider social narratives. The essential view of the museum is of an institution whose primary role is preservation and research. As O'Neill states:

"This school of thought see museums as having a permanent and essential nature which is not subject to change or development... museums are a general good for society because they provide non-instrumental experiences 'for their own sake', i.e., precisely because they have no social purpose. These experiences are distributed fairly because the same experience is provided on an identical basis to everyone." (O'Neill, 2006, p. 96)

However, the essentialist outlook is by no means accepted by all. Watson argues that "there is a widespread agreement that museums are political" (Watson, 2007, p. 10) and therefore hold a social purpose. Activist campaigns, including *Museums Are Not Neutral*, aim to "expose the myth of museum neutrality" (Museums Are Not Neutral, 2022) and demand that Western European museums take ownership of their colonial past and stop hiding behind the myth of neutrality. Richard Sandall, Co-Director of the Research Centre for Museums and Galleries at Leicester University, whose research primarily focuses on museums and social justice, reflects on the shift in the role of the museum:

"Recent decades have seen a radical reassessment of museums' roles, purposes and responsibilities. No longer primarily inwardly focused on the stewardship of collections, museums are increasingly expected to direct their

attention towards the needs of their visitors and communities... museums then, have been required to develop new goals that respond to local and global social concerns, to articulate and justify their value in social terms.” (Sandall, 2006, p. 5)

Sandall refers to the adaptive approach to museums and the necessity felt within the sector to reform traditional museums processes to become more outward-facing and community-focused and decolonise museum collections and practices. The adaptive museum model is based on a belief that it is only by providing a service to the community the museum represents, that the museum justifies its existence (O'Neill, 2006; Sandall, 2002). O’Neil describes the adaptive museum:

“For [the adaptive] museum, the basic functions of conservation and preservation are fundamental, but derive their meaning primarily from the services the institution provides to society as a whole, in the present and in the future.” (O'Neill, 2006, p. 97)

O’Neil asserts that people holding the ‘ideological’ view of museums consider “both [essentialist and adaptive] rationales are naïve covers for the ideological role of museums in supporting power structures” (O'Neill, 2006, p. 97). However, he also recognises that adaptive museum practices are influenced by ideological analysis:

“Adaptive museums view ideological analysis as providing an intellectual rationale for seeing museums as contingent and historical, rather than absolute institutions which, alongside strong elements of continuity, are and have been constantly changing. Museums which are trying to reformulate their ideals to help them adapt to a rapidly changing world, to come up with better answers to the question of what they are for, often draw on this new thinking” (O'Neill, 2006, p. 98)

He cites theorists shaping the ideological critique of museums (for example, Bennett, 1995; Foucault, 1986) who have influenced leading advocates for social inclusion in the sector, notably Hooper-Greenhill (Hooper-Greenhill, 1992; Hooper-Greenhill, 2000) who uses Foucault’s episteme to structure an investigation into the

museum's contemporary role in society through a critical review of past and current practices (Hooper-Greenhill, 1992), an approach I apply in the next chapter.

O'Neil marks the "epistemological shift", over the latter half of the 20th Century, that has led museums, alongside other disciplines in the arts and humanities, to question the values of "Enlightenment, utilitarian social improvement and art and knowledge-for-their-own-sake idealism" (O'Neill, 2006, p. 98). This shift is based on changing epistemic beliefs (beliefs about knowledge and knowing) brought about by new technologies, including the internet, movements including epistemic decolonisation (Mungwini, 2019) and the deconstruction of the hegemonic Western knowledge system. Response to epistemological changes and critique of established museum practices has led to a 'new museology' (Vergo, 1989), unpinning the practical implementation of the adaptive view of museums.

The concept of 'new museology' was developed in the 1980s with the intention of unravelling established (old) museum processes, traditional hierarchical structures, and inherent bias embedded within knowledge institutions. An edited book titled *New Museology* featured many of the leading voices in this movement (Vergo, 1989). New museologists looked to embed community representation in museum practices and pull museums from the myth of neutrality to become places of socio-political discourse (Greenhalgh, 1989). New museology scholars aim to shift focus from traditional museology based on museum *methods* to museology determined to re-examine and re-establish the role of the museum in society and to introduce theoretical perspectives into museum studies and wider museum practices (Vergo, 1989, p. 3; Ross, 2004, p. 84).

Since the late 20th century, there have been significant changes in the museum sector. Throughout the industrialised world, the number of museums has more than doubled, and museums are more popular than ever before (Ross, 2004). There has also been an expansion in the types of material museums collect and display, reflecting and appealing to a broader social stratum and not just representing the world view of the ruling classes (Ross, 2004, p. 85). A more democratic climate appears to be emerging from the old atmosphere of exclusiveness and closed intellectualism (Ibid,p. 85).

In the 2000s, the UK New Labour Government saw a change in viewpoint on the cultural value of museums as an institution capable of supporting the creation of a more inclusive society.

“Museums can help visitors reflect on their place in the world, their identity, their differences and similarities ... Museums can provide a tolerant space where difficult contemporary issues can be explored in safety and in the spirit of debate.”
(Department for Culture, Media and Sport 2005: 11)

These ideals led to a huge ‘Renaissance’ funding programme for regional museums in 2002, the first strategic investment by the UK central government in English regional museums that put education and inclusion at the core of their service to the public (The Council for Museums Archives and Libraries, 2003). The funding project led to the launch of a ‘manifesto’, authored by the Directors of National Museums and other key leaders in the museum sector, indicating the completion of a major shift in museums to a new epistemological model focusing on education and service to communities. “Through a wide range of programmes and practice, museums act as leading agents in the nation’s move towards social and ethnic inclusion.”
(National Museums, 2004)

New museology, adaptive museum practices and changes in political-economic policy have directed significant changes in the museum sector and the public understanding of museums. This drive to redefine the museum's role in society prompted ICOM to compose a new definition of museums for the 21st Century. At the General Assembly of the 25th ICOM Triennial Conference in Kyoto 2019 a new definition proposed by the Executive Board of ICOM was to be voted on by members. The proposed new definition was:

“Museums are democratising, inclusive and polyphonic spaces for critical dialogue about the pasts and the futures. Acknowledging and addressing the conflicts and challenges of the present, they hold artefacts and specimens in trust for society, safeguard diverse memories for future generations and guarantee equal rights and equal access to heritage for all people.

Museums are not for profit. They are participatory and transparent, and work in active partnership with and for diverse communities to collect, preserve, research, interpret, exhibit, and enhance understandings of the world, aiming to contribute to human dignity and social justice, global equality and planetary wellbeing.” (ICOM, 2019)

The new definition led to a heated debate, exposing ideological fault lines between essentialist and adaptive viewpoints within the museum sector. The vote was postponed for an 18-month review process. The Museum Association reported a rift within ICOM exposed by the desire to change the definition:

“The conservatives seem to be happy with the existing definition and want no change; the reformers wish to see a definition that recognises the social roles increasingly played by museums.” (Museum Association, 2021).

This lack of agreement between ‘traditional’ and ‘new museology’ viewpoints within the sector exposes how committed many museums are to traditional practises of collection based knowledge and how contemporary social and technical changes are impacting how museums ‘know’ themselves and their role in a changing culture.

O'Neil proposes approaching the problem of a lack of coherence in defining the role of the museum as an epistemological issue – “as a lack of coherence is a problem of knowledge” (O'Neill, 2006, p. 98). O'Neil suggests a museum epistemology as “a method for asking what and how the museum knows, identifying ways of knowing that are problematic and seeking solutions in new frameworks of knowledge” *ibid*, p.98). O'Neil's outline proposal for a new museum epistemology recommends a framework for interdisciplinary working - mixing visitor and community knowledge, curatorial knowledge of objects and being mindful of the distribution of power and institutional bias by sharing authority “amongst curators, educators, designers, audiences and communities” (*ibid*, p.112). He believes a new epistemology “would view knowledge as containing many perspectives and involving continuous discovery and revisions on the basis of rigorous exploration of evidence, rather than as a reified, universal definitive body of fact” (*ibid*). His proposal focuses on storytelling, and confronting “controversial issues inherent in some objects” - not avoiding them by claiming neutrality (*ibid*).

The museum's role in defining collective cultural identity, the ideology behind 'adaptive' museology, the drive for alternative definitions for museums, and a proposed new museum epistemology are all grounded in efforts to democratise, mitigate bias, and share power. 'New museology' is situated in contrast to 'essentialist museology' and its inward-facing and exclusive epistemic approach. Yet, in the new epistemology, we still find intermediaries in telling people's stories and recording cultural heritage – and similar questions surface: Whose perspectives are included? Who coordinates community engagement? The curatorial team and museum funders still retain significant power in the telling of history, even as mediators rather than

authorities. Can museums be described as democratic when museum collecting and cataloguing practices are not transparent, and most of the collection remains hidden?

The new ICOM definition for museums is inspirational. However, it feels like an aspirational definition of what museums should be rather than a definition of what museums currently are. I am inspired by the statement “inclusive and polyphonic spaces for critical dialogue about the pasts and the futures” (ICOM, 2019). This is what I personally would like to see the sector achieve. This practice-based thesis explores how digital technology can help the sector achieve some of these goals while being mindful of some of the “conflicts and challenges of the present” (ibid) within the sector. I also question how the museum’s role in society is changing based on the advent and adoption of digital technologies and raise some key considerations.

Key points:

- Museums are going through a period of uncertainty regarding their roles in society.
- There is an ideological rift forming between essentialist and adaptive museum practitioners, which has led to struggles in establishing a definition for museums that reflects changes in the sector.
- There is a need for a new epistemology for museums that reflects relationships with knowledge in contemporary society and new museology.
- A proposed new epistemology for museums would view knowledge as polyphonic and containing multiple perspectives and be subject to continuous development and revision.

1.8.2. The unseen machinery/knowledge infrastructure of the museum

Museums are information and knowledge infrastructures that attempt to keep, quantify and define our collective cultural identity through the collecting and interpreting of objects identified as culturally significant. For most visitors to museums, exhibitions are how they understand the purpose of the institution. The general visitor is unaware of the behind-the-scenes mechanisms of the museum – or knowledge infrastructure.

Most museums exhibit less than 5% of their collection at one time. For example, the British Museum exhibits roughly 80,000 objects to the public on its Bloomsbury site (The British Museum, 2019). This is around 1% of the collection. Almost 4.5 million objects in 2 million records are accessible to the public through the online catalogue (The British Museum, 2020) offering the visitor unmediated access to each object record. However, attempting to get an overview of the museum through the online catalogue is an immense and difficult challenge. The British Museum was one of the first public museums established in the UK and has been operating for over 250 years. It is a national museum, meaning its collection is not owned by private individuals - it belongs to and is funded by the public. Yet, for most people in the UK and internationally, the collection and organisational processes necessary to maintain it remain mysterious.

Museum collection storage facilities are, for many people, wondrous places to visit. Birmingham Museums Trust's Museum Collection Centre is regularly open to the

public, and the object storage solutions employed by the centre allow the easy visual study of artefacts by visitors (see figures 6 and 7). On entering the collection store, you witness row after row of fascinating objects, and a visitor may spend many hours pondering how this heterogeneous assemblage of things came to be in this place and at this time. But as visitors are not given easy access to information on how an object came to enter the collection, who collected it, who catalogued it and what processes were used, the position of the object within the collection remains mysterious, and its significance can only be assumed.



Figure 6 Collections storage at the Museum Collection Centre (Birmingham Museums, 2017)



Figure 7 Birmingham Museums Trust Collection Centre Warehouse (Birmingham Museums, 2017)

In Hannah Turner's research on the socio-technical history of the museum catalogue and how knowledge organisation practices in museums have affected the understanding of Indigenous cultural heritage, she uses the metaphor of the "black-box" to expose the effects of museum cataloguing and knowledge management systems based in colonialist ideology (Turner, 2015). She situates her research into the unseen mechanisms behind the museum as a study of information infrastructure. Her principal sources for the concept of the information infrastructure and context for the 'black-box' metaphor are the work of Geoffrey Bowker, Susan Leigh Star and Paul Edwards (Bowker, et al., 2010; Edwards, et al., 2009; Star & Rudleder, 1996).

The study of infrastructure is often used to address large-scale, complex, multifaceted material networks that enable human activity worldwide. Infrastructure “evokes vast sets of collective equipment necessary to human activities, such as buildings, roads, bridges, rail tracks, channels, ports, and communications networks.” (Bowker, et al., 2010, p. 97). Bowker and Star extend conventional understanding of infrastructures to include “the technologies and organisations that enable knowledge work” (ibid, p. 98), determining an infrastructure is “fundamentally a relational concept; it emerges from people in practice, connected to activities and structures.” (ibid, p. 99).

The information infrastructure generally refers to computational services, data repositories, and networked communication associated with the internet and has evolved into an “essential, ubiquitous service for delivery, access, and exchange of information” (ibid, p. 107). It is virtually impossible to imagine the functioning of contemporary society without global information infrastructures. These invisible infrastructures are so big and engrained in our society that we ascribe a “casual magic” to them (Bowker & Star, 1996, p. 5). The information infrastructure is in the background of all contemporary activity. Yet, its workings are ordinarily invisible to us and taken for granted, and only exposed when it breaks down or becomes an object of contention (Bowker & Star, 1999, pp. 2-3; Star & Rudleder, 1996). The museum has its own information infrastructure, from organisational processes and curatorial decision making to the collection catalogue or database.

To study infrastructures is to probe something so imbedded in knowledge management practice “that it becomes situated in technologies, in the standards that

structure them, and even in things such as classification schemes” (Turner, 2015, p. 29). In *Sorting Things Out* (1999), Bowker and Star examine the social impact of information infrastructures to reveal how classification schemas are linked to power and authority that fundamentally structure our world. They use Foucault’s (1970) concept of order and archaeology and the implementation of order in categorical discourse to address the politics of classification schemes. Bowker and Star define a classification system as a “spatial, temporal, or spatio-temporal segmentation of the world” (Bowker & Star, 1999, p. 10) or a set of metaphorical or literal “boxes”, organised into categories and hierarchies, into which “things can be put to then do some kind of work – bureaucratic or knowledge production” (ibid, p.10). In the exercise of segmenting, prescribing, naming and describing, “acts of classifications can be socially or ethically charged” (ibid, p. 25). Bowker and Star recognise classification systems as “powerful technologies”, and when embedded and working, they become “relatively invisible without losing any of that power” (ibid). They argue that “classifications should be recognized as the significant site of political and ethical work that they are. They should, in a word, be reclassified as key sites of work, power, and technology” (Bowker & Star, 2000, p. 147).

The power to name is a potent one. The power imbued in museums to communicate, conserve and exhibit the “heritage of humanity” places them in a lead role in ordering, classifying and ultimately quantifying our cultural memory. Within the study of museum collections as places of cultural memory, these metadata organising activities are “where the power of representation in cultures can be seen” (Acker, 2021, p. 438). Amelia Ackers writes:

“When information architects design systems to name, classify, and manage data, whether they are engineers and developers or librarians and archivists, metadata structures not only support access points for retrieval; they are gateways that influence identity, understanding, and authority around the things that can (or cannot) be named.” (Acker, 2021, p. 439)

Bowker and Star encourage the need to question the category of the “ordinary” (Bowker & Star, 2000, p.152) inherent within classification and standardising systems in order to understand “their politics and histories” (ibid, p.156). This requires an “infrastructural inversion”, also described as a “gestalt switch”, which requires “taking what have often been seen as behind-the-scenes, boring, background processes to the real work of politics and knowledge production and bringing their contribution to the foreground” (ibid, p.156).

In the field of museology and cultural memory, the museum holds the ubiquitous position in civic spaces as the infrastructure responsible for defining, keeping and communicating our shared cultural heritage. A museum is a virtual space, a “spatio-temporal segmentation” or “box” in which the work of defining the “heritage of humanity” or geographic, cultural identity is done. The “behind-the-scenes” or black-boxed processes of the museum infrastructure are the work of cataloguing the collection (Turner, 2015) and can be understood in the context of information science or informatics (Bearman, 2008; Maroevic, 1998, p. 141). The decision of what to collect, keep, and the metadata practises of museums are acts of quantification and, therefore, should be “understood as an interpretive and creative practice of world-building” (Wernimount, 2021, p. 474). Creating a knowledge organisation scheme is a “formative and world-building exercise” (Turner, 2017, p. 473), and in any act of segmentation or world-building, it is necessary for the functioning of the whole system to put other worlds aside. “Knowledge frameworks are defined by their boundaries

[and] museum knowledge is no exception” (ibid). Contemporary museums are social institutions and places of discovery, inspiration, emotional connection and education. Overall, staff within contemporary museums recognise their role as actors for social change and are committed to social justice (Hollows, 2019). “Yet, all museums and galleries that care for objects rely on pre-existing or pre-defined categories that have shaped a relationship to these objects” (Turner, 2017, p. 473).

Curator Declan McGonagle argues that contemporary curators are dealing with the inherited model of the museum, “a model inherited from within the timeframe and conventions of thinking and behaving over the last two centuries [that] insists on the intrinsic value of the artwork and privileges its objecthood” (McGonagle, 2008). McGonagle suggests that museums prioritise the preservation of objects over the experience of people seeing them – so museums generally prioritise objects over communities. He asserts, “the concept of art cannot be separated from its experience... but our institutional models of practice and governance are still predicated on the idea that the art ‘object’ is the art and exists autonomously of the experience” (ibid) As he eloquently puts it:

“Our inherited model of museum, its nature and purpose, and its ‘ownership’ is just as much a product of the Enlightenment world view and the focus on collecting in order to catalogue – in order to know – in order to possess, ultimately to dominate and control the world, as was the Enclosure process. [...] The Enlightenment proposed that the world was knowable, in certain ways, of course, and could be measured and catalogued and that it was white Western Europe’s responsibility to do the measuring and the cataloguing. Western European nations set about this task by attempting to obliterate or render any pre-existing ‘other’ systems of ‘knowing’ invisible or at best valueless – in order to establish a manifest narrative.

The current form of economic and technological globalisation we are experiencing now seems like the full manifestation of that world view. Museums habitually reflect this model of thought and behaviour by the

continuing discussion of building a narrative, incremental art historicism and even the discussion of 'gaps in the collection'." (McGonagle, 2008)

The problem posed by the 'inherited model of museums' and the doubts or unwillingness of how to deal with it is critical to the contextual framework of this thesis. To consider a new epistemology for museums, the established ones must be understood. As museums engage more with contemporary technology and networked knowledge infrastructures, the museum infrastructure is undergoing its own 'gestalt switch' moment. Questions about the language museums use in classification, alongside questions about what information is included, omitted and suppressed, are driving debate around the future of knowledge management in museums and the role of museums in knowledge creation.

Key points:

- The concept of the information infrastructure can be applied to critically examining museums and museum practices.
- Information infrastructures refer to the behind-the-scene mechanisms of organisations. They are generally invisible unless they break down or are sites of contention.
- Information infrastructure is a relational concept that emerges from people in practice, connected to activities and structures.
- To examine an information infrastructure is to question power in relationships.
- A museum can be described as a spatial and temporal segmentation of the world in which socially and ethically charged acts of classification take place.

The knowledge produced in these acts of classification is powerful and has a lasting impact.

- Museums have an inherited model based on discriminatory practices that privilege certain types of knowledge.
- The museum information infrastructure is being examined by scholars and practitioners. To understand the museum as a knowledge infrastructure, it is necessary to understand its development.

1.8.3. Colonialist Knowledge Infrastructure

The dazzling knowledge infrastructure and the visual appeal of museum collections obfuscate the colonialist ideology on which the museum is built. The Western European emphasis given to preservation and conservation, and the role museums play in defining the national narrative through Western materialism and obsession with objects, limits the opportunities for meaningful change or the realisation of new models of museums.

Defining the position of the museum in society is a post-colonial question. Based on the origins of the museum and what those origins represent to many cultures, it is impossible to engage in any meaningful discourse on the role of the museum in society without speaking about colonialism (Francis, 2019). As new

museology scholarship and social activism⁴ aimed at surfacing contested histories have argued, the history of museums is intrinsically linked with Western European colonial expansive consumerism (for example, Bennett, 1995; Francis, 2019; Hall, 1999; Hooper-Greenhill, 1992). A fundamental role of early public museums was to educate and support European narratives of white supremacy through producing knowledge schemas and hierarchical depictions of world cultures (Hooper-Greenhill, 1992). The museum was designed to have a civilising effect and produce self-regulating and proud citizens who would identify with, and believe in, a shared heritage and national narrative presented by the museum (Duncan, 1995). These narratives were legitimised by acquiring objects and the scientific⁵ cataloguing methods of the time and shared with the public through exhibitions. In his book *'The Brutish Museum'* (Hicks, 2020) Dan Hicks, Curator of World Archaeology at the Pitts Rivers Museum, exposes the necessity of “physical[ly] dismantling (...) the white infrastructure of every anthropology and ‘world culture’ museum” (Hicks, 2020, p. xiii). Like Turner, he challenges the technologies and behind-the-scenes processes of the museum catalogue used to “stabilize and reproduce certain narratives, and to repress and diminish others” (Hicks, 2020, p. 6) Hicks writes:

“The technologies of the museum and the archive – the museum label, the zip-lock bag, the conservation lab – are analogous interventions... Among the outcomes of these technologies are provisional and contingent stoppages in

⁴ Organisations such as “Museums Are Not Neutral” lead by La Tanya S. Autry and Mike Murawski, <https://www.museumsarenotneutral.com/>, and “Decolonize This Place” <https://decolonizethisplace.org/>

⁵ David Jenkins (1994) and Eilean Hooper-Greenhill (1992) argued that ordering of museum collections, particularly anthropology, has been modelled on the natural sciences according to Darwinian principles of evolution and based on hierarchical tree structures.

time, rendering fragments of objects, which are wrought as cadences.” (Hicks, 2020, p. 7)

As a curator, he recognises the dazzle workers and visitors experience when confronted by behind-the-scenes museum spaces. The awe at the impressive scale of the collection in storage and how this extraordinary space melds material objects, time periods, and the scientific apparatus of conservation. This physical infrastructure can create assumptions of validity and trust in the historical dataset of the catalogue. He warns:

“In the artificial, darkened secondary landscape of the museum, let us understand this place not as some dazzling gathering of the flotsam and jetsam of the colonial past... The memory here which must be recalled to allow other pasts to re-emerge, to be no longer silenced, is a memory of loss through extraction.” (Hicks, 2020, p. 8)

The museum knowledge infrastructure acts to obscure the colonial origins of the collections and archaic pseudo-scientific history of knowledge organisation (Hooper-Greenhill, 1992) on which the museum infrastructure is built. A human being’s ‘Will to Order’ (Huxley, 1959) which Huxley describes as the fundamental urge we have to “bring harmony out of dissonance and unity out of multiplicity”, means we are drawn to spaces like archives and libraries. We have an immediate enjoyment of the phenomenon of ordered knowledge; we want to trust this order and give these institutions high status in our civic spaces. We are therefore unlikely to want to disorder or disperse a collection. Yet, we know that many collections are built on the theft and misappropriation, not only of objects but of land and people. The recent enthusiasm for ‘decolonisation’ in museums creates new dangers of “obfuscation, of tokenism, of the co-option of activists...” (Hicks, 2020, p. 9). Hicks argues that a collection cannot be decolonised by simply changing the narratives in exhibitions.

Objects must be repatriated from where they were stolen. The West must confront the histories of those unrecorded or misrepresented in our grand narratives. It is only through addressing the knowledge infrastructure of the museum, understanding the social history of the development of the museum catalogue, carefully reviewing individual records and collecting practices that people can begin to create a new model for museums (Adler, 2016; Turner, 2017; Hicks, 2020).

Key points:

- Museums in the West are built on colonialist ideology, epistemology and consumerism.
- Activist voices from within and outside the museum sector are calling for change and a new model for museums acknowledging the damage done by the discriminatory knowledge infrastructure of the museum.
- The dazzle of the museum collection in storage, and technologies of knowledge management and conservation, can obscure infrastructural issues and discriminatory practices.

1.8.4. Museum Knowledge

Museums are widely regarded as knowledge institutions which record the heritage or collective memory of people. They also create new knowledge through assembling objects into collections and weave narratives through exhibitions and

classification and cataloguing processes. But how do museums generate knowledge?

What and how do they know?

Conventional museum knowledge is inherently linked to the objects which they preserve. A museum object is a heritage object, removed from its original context and transferred into a new museum reality. In the new museum reality, the object becomes a document of its original reality – or the reality from which it was removed (Maroevic, 1998, p. 162). In the museum, the object does not generally exist as a single object but rather as an object within a collection of objects. The collection as a whole is regarded as superior to the individual object (ibid, p.170). The collection is the sum of the constructed museum reality, and the objects within it have been assembled and recontextualised to form a new 'museum reality' or 'museum knowledge.'

Traditionally the relationship with knowledge in the museum has been internalist and didactic. The museum's role was to collect and display items to punctuate established cultural narratives. It was not seen as necessary or even potentially wise to include communities or visitors in this decision making process. The visitor learned about the heritage presented by the museum through reading exhibition text and studying assemblages of objects. As the visitor was excluded from the formation of knowledge, it was assumed that all visitors had the same experience. With new museology and the development of adaptive museums, the visitor is becoming more important in the business of knowledge management and creation in the museum (Hooper-Greenhill, 1999; Hein, 1999). Through mass digitisation projects and online collection websites, the public has greater access to the collection than ever before. New exhibitions and associated collecting activities are now often planned

through community consultation.⁶ Constructivist learning methods are esteemed in museums, and this is evident in the professionalization of museum education teams and their relationships with the curatorial teams in exhibition planning (Hooper-Greenhill, 1999).

It is now generally recognised that knowledge in museums is created in multiple ways. Knowledge is generated every time a person interacts with an object, and this experience is different depending on multiple factors both in the personal knowledge and experience of the visitor and the curation and interpretation in the exhibition. Knowledge is also created through contextual information presented in exhibitions, interpretation text and images, the exhibition design and the choice and arrangement of other objects on display. In this way, objects are encoded with multiple layers of meaning each time they are removed from storage and viewed. Knowledge is produced through object classification, cataloguing and creation of attached metadata. To understand what it means to represent knowledge in the museum, first, we need to recognise that our knowledge of the world is socially constructed and dependent on relationships between human and non-human actors (Latour, 2005). When a museum represents what it knows about an object, it is defining what the person who first collected, analysed and recorded the object knew about it. This process may then be layered with more recent curatorial research and

⁶ For example the Heritage Lottery Funded Collecting Birmingham project, that supported the 'Collecting Birmingham: Who Is Birmingham? Exhibition at Birmingham Museum and Gallery, and 'Your Birmingham' in the exhibition *Birmingham, Its People, Its History*.

new discoveries. In documenting a museum object, the curator is writing the history of its interactions with other objects, people, places, events and actions; and through the lens of multiple time periods and contextual ways of knowing (Bearman, 2008, p. 38).

The museum's inherited, internalist and authoritative model does present some significant challenges when approaching a new epistemology for the sector. Museums work on the foundational belief that the world can be known, represented and displayed through the recording, storing and displaying of key historical artefacts. It is in this belief that the museum spaces draw boundaries between the world inside the museum (objects) and the world outside the museum (the public). It is in this relationship that museum knowledge appears authoritative and objective, and the museum holds epistemological authority. Many museum scholars and practitioners recognise the potential of contemporary philosophical theories for changing the way we understand knowledge in the museum. Theories including material semiotics and performativity are influencing changes in epistemology within the museum sector due to the potential for interpreting the complexity of relationships between people, objects, classification and the institution – and how these relationships are acted out in shifting dynamics of power. Material semiotics is a set of approaches to social analysis that includes actor-network theory, feminist material semiotics, social and cultural anthropology and post-colonial studies (Law, 2019). Material semiotics suggests that practices in the social world are understood as webs or weaves of relational and material threads, and there is no single social structure or pattern within this web because these social and material weaves come in different forms. Material semiotics centres the importance of complexity and multiplicities in our understanding of the world and the way that webs are formed by different actors and realities – and how

they can produce forms of domination as well as revealing methods of resistance (Law, 2019, p. 1). This theoretical approach poses particular challenges for museums, as museums are in the business of fixing heritage into patterns of meaning. How can a museum prepare for and present this level of complexity in an exhibition and in its record-keeping? Material semiotic relationships are *performative*, meaning they *do* things, and networked actions between webs are constantly formed and reformed as all knowledge is considered to be local and enacted through everyday practices of socio-technical relationships or networks. How does this position of constant flux and situated knowledge change approaches to classification and preservation? Museums are bound by hierarchical and faceted recording keeping – how can this reflect complexity?

Museums have traditionally been regarded as institutions that display factual and neutral or unbiased representations of culture and knowledge. The overpowering architecture of the museum atrium, the power to display often unique and otherwise inaccessible objects, and the authoritative yet anonymous presence of the curator's voice in object labels and the catalogue, alongside the weight of hundreds of years of tradition, further the position of the museum as an authoritative and objective source of knowledge. When acquisitioned by a museum, objects are stabilised, fixed by the language of classification and in this act, become signifiers and cultural representations within the museum's knowledge. Material semiotic concepts of performativity and situated knowledge criticise theories of disembodied scientific objectivity – that are foundations of the inherited museum model. Waterton describes "performativity" in the archive as a means to express that,

“objects and categories are only really present in ‘the doing of them,’ they have to be continually performed to exist at all” (Waterton, 2010, p. 650).

In this sense, objects and their given categories are only coming to being when actively observed. Karen Barad proposes an agential realist framework for examining the world and a relational understanding of what Barad calls the “intra-action” between subjects and objects in the world, or “phenomena”. Barad writes:

"A phenomenon is a specific intra-action of an 'object'; and the 'measuring agencies'; the object and the measuring agencies emerge from, rather than precede, the intra-action that produces them." (Barad, 2007, p. 128).

Barad, and other material semiotics theorists, propose alternative ontologies for museums that oppose traditional boundaries in knowing. New museology scholars now agree that concepts and categories like “data”, “objects”, and “facts” are localised and temporal and that there are multiple alternative and overlapping worlds of knowledge. These alternative ontologies present epistemologies which recognise the knower as intimately bound up in and affecting the object. Barad argues that the “thing” that we examine is enacted in entanglement with how we look at it. Barad’s concept of performativity accounts for the messy relationships between actors and objects and the complexity with which phenomena should be viewed.

Key points:

- Museum reality is a representation of museum knowledge.
- Knowledge in museums is changing from internalist to community-focused.
- The relationship between the museums and their communities is being recognised as a site of knowledge.

- Knowledge in museums is built on colonial and paternalist ideologies.
- People view museum knowledge in multiple and overlapping ways.
- Material semiotics help us to consider complexity in museum epistemology and infrastructure.

1.8.5. Museum space

To reimagine museums first we must question what museum space is. Museums are often regarded as ‘magical’ spaces. They are imagined as ‘portals’ or ‘gateways’ to other places and other times. The ICOM definition of museums calls them a place that conserves the ‘heritage of humanity’, but that is impossible in a single space.

The philosopher Michel Foucault has had a profound influence on new museology - even though he rarely discussed museums directly (Hetherington, 2015). Foucault’s most quoted observation on museums is his piece on heterotopia:

“Museums and libraries have become heterotopias in which time never stops building up and topping its own summit, whereas in the seventeenth century, even at the end of the century, museums and libraries were the expression of an individual choice. By contrast, the idea of accumulating everything, of establishing a sort of general archive, the will to enclose in one place all times, all epochs, all forms, all tastes, the idea of constituting a place of all times that is itself outside of time and inaccessible to its ravages, the project of organizing in this way a sort of perpetual and indefinite accumulation of time in an immobile place, this whole idea belongs to our modernity. The museum and the library are heterotopias that are proper to western culture of the nineteenth century.” (Foucault, 1986, p. 26)

Heterotopia, from the Ancient Greek, means “other place”, a term Foucault used to describe certain cultural, institutional and discursive spaces that have more layers of meaning than are immediately apparent. These can be described as worlds within worlds or parallel worlds. He defined heterotopias as places in which “all the

other real sites that can be found within culture, are simultaneously represented, contested and inverted” (Foucault, 1986, p. 24) or a space that presents an illusory version of the world that questions the ‘real’ order of things. A museum, according to Foucault, is a ‘heterotopia of time’ and encloses and preserves, in one space, objects from all time and exists in and outside of time.

The concept of the museum as a container for the ‘heritage of humanity’ conjures an impossible space - a place that can stop time and represent all time. In this world-building exercise, boundaries must be created as the physical storage container for the ‘heritage of humanity’ is not infinite. Objects are chosen to punctuate a grand narrative rather than give a complete rendition of history. Therefore, the museum space creates new meanings and the objects within them “twist in meaning between two worlds, the world of their origin and the world of significance created by display” (Sheldon, 1986, p. 168). Sheldon Annis, researcher in urban planning, describes the museum as a dream space, a container for intriguing items, shapes, patterns, and sounds. He describes the experience of being in a museum:

“The visitor moves forward, and against this abstract backdrop appears a changed panorama of suggestive things – things stripped of their primary use and natural context by cleverly laid out to suggest other times and places. The viewer’s mind and eye subrationally seize upon certain objects that jolt memory or recognition and provoke internal associations of fantasy, desire and anxiety.” (ibid, p.169)

So we can understand the museum as an alternate or dream space. A space that attempts to hold memories alongside creating them. A museum is a constructed space and can be both physical and digital. A museum is an immersive space – a space we go into to experience our past. The dream of museum space is compelling to our

imaginations. However, its dreaminess must be constantly tempered by recognition of its limitations and revaluation of its contents.

Key points:

- Museum space can be described as an alternative reality in which a particular type of knowledge is created and stored.
- The concept of the museum as a storage container for the 'heritage of humanity' is an impossible space.
- Museums are engaged in world-building and creating different representations of our own reality.

1.9. Opening the Black-Box:

The impact of movements to decolonise public institutions, new museology, and recent advances in computing and network technologies have changed the way we 'know' museums and what museums think they 'know' about themselves. There is undoubtedly significant momentum for rethinking the role of museums in society from within the museum community, heritage-based activism and academic research. In this chapter, I have framed a discursive design methodology for this research and focused on crucial framing points for understanding the shifting museum epistemology. I have situated the analysis contained in this thesis within social movements looking to rethink museum epistemology from inside and outside the museum sector. I have focused on considering a new epistemology for museums within the context of infrastructure studies.

Advances in digital technologies have led to more museums placing their collections online, opening the ‘black-box’ to the public. Declan McGonagle (2008) recommends looking to new technologies to build commonalities. He argues that we should:

“generate, articulate and consolidate new customs around the idea of museum as ‘public’ institution, to reconsider a named museum as a set of negotiable functions and relations which can be present in more than one way, in more than one place, at the same time, only one of which would be the ‘Temple’⁷ model [...] Maybe the existing networks of museums should, firstly, be regarded and tested as ‘New Common Land’ nourishing viral rather than glacial forms of engagement and participation so rather than new ‘hardware’ we consider new ‘software’ for the instruments we already have to hand, but with reconsidered functions and relations.” (McGonagle, 2008)

The potential for new technologies to transform the way museums connect their collections and communities is a major focus of this thesis. However, past epistemological underpinnings of the museum infrastructure should be examined before a future epistemology can be considered. The next chapter contextualises the museum knowledge infrastructure within a history of knowledge organisation and representation framed by Foucault’s concept of ‘episteme’.

⁷ Temple meaning, ‘Temple of the Muses’ which is expanded on later in the thesis.

2. Museum historiography through the concept of the episteme:

The concept of the episteme serves as a useful theoretical framing device and organising rubric for this chapter. The framework for this chapter is inspired by Eilean Hooper-Greenhill's methods, and takes a historiographical approach to exploring how museums have developed, with a focus on conceptual and visual methods for organising knowledge in museums, framed by Foucault's Epistemes - Renaissance, Classical and Modern.

Eilean Hooper-Greenhill's book *Museums and the Shaping of Knowledge* (1992) attempts to question the "present-day givens of museums" (ibid, p.9) by understanding how the existing way of constructing knowledge in museums came about. She does this through applying insights from Michel Foucault, particularly the concept of "episteme". For Foucault, the act of ordering and classifying is connected to the production of knowledge, and the definition of what is rationale and what is true is rooted in relationships of domination and subjugation (Foucault, 1970). Epistemes are the unconscious, but positive and productive set of relations within which knowledge is produced and rationality is defined (Foucault, 1974, p. 191). Foucault suggests that what counts as knowing is dependent on different contextual interactions, including the social, political and cultural (ibid). These elements work with and against each other in a constant state of flux, so that meaning is constantly defined and redefined (Hooper-Greenhill, 1992, p. 12). Epistemes are loosely connected to different time periods (epochs) identified by an overall consensus in the intellectual activity of those periods (ibid). Each episteme has different characteristics, and what and how we 'know' is defined within an episteme, and what we 'know' and the path to 'knowing' is

different in different epistemes. Foucault describes three major epistemes, the Renaissance, the Classical and the Modern. Each of these is characterised by an epistemological shift or upheaval. These epistemic ruptures and changes in knowledge have corresponded with major developments in museums as knowledge keeping and producing entities.

Hooper-Greenhill (1992) uses Foucault's epistemes as provocations to understanding the historiography of the museum and to question modern museum practices. She focuses her attention on the classical or "enlightenment episteme" - a time in which museums adopted scientific taxonomies and knowledge became "a pure tabulated relationship of words and things" (Hooper-Greenhill, 1992, p. 192). She argues that knowledge became a commodity that museums offer and that each episteme through time would allow for certain kinds of collections or arrangements of objects to be more desirable than others. I use the same structure for my own investigation, however my focus is on the way museums conceptually organise and visualise knowledge.

I further structure the historiography using Manual Lima's research into the development of knowledge visualisation through history. He focuses on three key forms - circles, trees and networks. I use this to contextualise ways of knowing and representing knowledge in museums. I use Lima's exploration of visual complexity to examine how museums can represent knowledge in the information age, reflecting on technologies like the internet and the database, which Lev Manovich calls the "symbolic form of the computer age" (Manovich, 1999, p. 2) and "a new way to structure our experience of ourselves and of the world" (ibid).

Key points:

- Foucault's concept of 'episteme' provides a useful framing tool for the development of knowledge organisation and visualisation in museums.
- The renaissance episteme aligns with the origins of museums, the classical with the development of scientific methods for classification and the modern with contemporary museum epistemology.
- Manuel Lima's key visual schema's for knowledge visualisation can further be applied to framing the development of the museum – circles (renaissance origins), trees (classical scientific classification and cataloguing methods), and networks (museums in the modern networked society).

2.1. Circles, Trees, Networks

Manuel Lima's three key knowledge visualisation schemas are applied to the history of museums within this chapter. Each form is aligned with one of Foucault's epistemes and a major shift in the development of knowledge organisation and visualisation in museums.

Manuel Lima identifies three major forms for knowledge visualisation - circles, trees and networks (Lima, 2013; 2014; 2017). I have aligned each form to examine knowledge representation in museums in each one of Foucault's epistemes. As Foucault states that the apparatus of epistemes can co-exist and interact with each other at the same time (Foucault, 1980, p. 80), so I recognise that the visualisation forms of circles, trees, and networks do exist simultaneously and regularly intersect

with each other. These symbols used in knowledge visualisation are an apparatus for examining the museum as a site of knowledge representation and not a strict chronological or organising tool.

I have applied the circle as a key symbol for the founding architectures of museums, aligning with the Renaissance episteme, representing our perception of the world around us and the circle of memory. The earliest visual designs for museum collections were imagined as immersive spaces, 'memory theatres' or rotunda 'temples of knowledge', in which a person, standing at its centre, would be able to experience knowledge and dominion over all creation with a single look. The circle represents an enclosing of knowledge creating an immersive experience of memory.

I have used the tree symbol as a method for investigating the tabulation of knowledge during the classical or Enlightenment episteme. The tree came to the fore in Enlightenment sciences, as scholars aspired to ordered and balanced encyclopaedic knowledge and universalisms. The tree was used to fix knowledge into universal taxonomic structures and grand narratives. The tree structure separated museum objects into different disciplines and collections based on material and visual difference, classified using hierarchical branching tree structures. The tree has been, and lingers on as, the dominant symbol for knowledge organisation.

The network is the visual symbol of the information age. I have used this to explore complexity in contemporary society, and how museums can embrace and represent this complexity. I apply this to contemporary museums, rather than the beginning of Foucault's modern episteme. Visual complexity marks a change in the way we understand science - from Newton's 'Great Mechanism' and Darwin's 'Tree of

Life' to the complexity we can see in the mapping of brain activity in neuroscience and the webs of activity seen in biological ecosystems. Networks also provide the symbol of contemporary communication and knowledge, based on the new medium of the internet.

Key points:

- The development of museums can be framed by both Foucault's epistemes and Lima's knowledge visualisation schemas.
- The circle form is used to examine the renaissance origins of museums and the enclosing of knowledge.
- The tree is used to examine the classical or enlightenment development of the first public museums and the fixing of museum knowledge to branching knowledge schemas based on emerging scientific methods.
- The network is used as a meme for the information age, and knowledge in contemporary society and museums. The network expresses interconnected and global communication, complexity within the human 'social' and non-human 'natural' systems, and networked information infrastructures that are the behind-the-scenes mechanisms of present-day societies.

2.2. Circles

Circles are among the most meaningful and impressive shapes ancient humans were exposed to. The bright and circular silhouettes of celestial bodies appear in the arts of almost every human culture. We look at circles in the cross-sections of trees

charting the passing of time, we see circles when we look into the eye of another, we study the positions of circles to tell us the time of year, the direction of travel, and our future. Circles have been used to represent a wide variety of ideas, and the circle is a visual metaphor “embraced by virtually every culture that has ever existed” (Lima, 2017, p. 15). Circles represent human community. When we gather for a festivity or around an important object we usually gather in a circle. We associate circles with concepts of eternity, infinity, perpetuity and immensity. Through ‘wheels of the year’, circles represent our cyclic and spiralling relationship with time.

2.2.1. Circles of Knowledge:

The use of circles as metaphors for knowledge is embedded in our sense of social history and approach to learning. Metaphors like ‘circle of learning’, ‘circle of knowledge’, ‘sewing circle’, ‘study circle’ all relate to our innate understanding of learning, knowledge curation and knowledge production. “One of the oldest circle metaphors, the encyclopaedia, acts as a container for the totality of human understanding” (Lima, 2017, p. 35). The ubiquitous use of this enclosing metaphor reflects the innate human desire to quantify things. Ontological metaphors for categorising experiences are made up of human delineated entities or substances. Human understanding of the physical world and the inner and outer of our own bodily experience provide the basis for ontological metaphors giving us the means to understand experience as entities and substances. Johnson & Lakoff explained in their book, *Metaphors We Live By* that “Human purposes typically require us to impose artificial boundaries that make physical phenomena discrete just as we are: entities

bounded by a surface” (Johnson & Lakoff, 2003, p. 26). “We project our own in-out orientation onto other physical objects that are bounded by surfaces. Thus, we also view them as containers with an inside and an outside” (Johnson & Lakoff, 2003, p. 30). Even in knowledge, humans have tended to define a territory – putting a boundary around it as an act of protection, quantification and understanding. The creation of a *musaeum* is a practice of claiming territory, of understanding the phenomenon of ‘knowing’ through enclosing.

Circles were used in many encyclopaedic works (see figures 8 and 9). A circle could enclose a territory of knowledge, reflect a complete whole or universality and provide a taxonomic structure to organise information. Robert Fludd’s 1617 encyclopaedic illustration *Mirror of the whole of nature and the image of art* depicts the system of the cosmos, God, nature, and art in concentric circles and a grid structure (see figure 8).



Figure 8 Robert Fludd, *Integræ Speculum Artisque Imago* 'Mirror of the whole of nature and the image of art' (1617) (Wellcome Collection, n.d.)

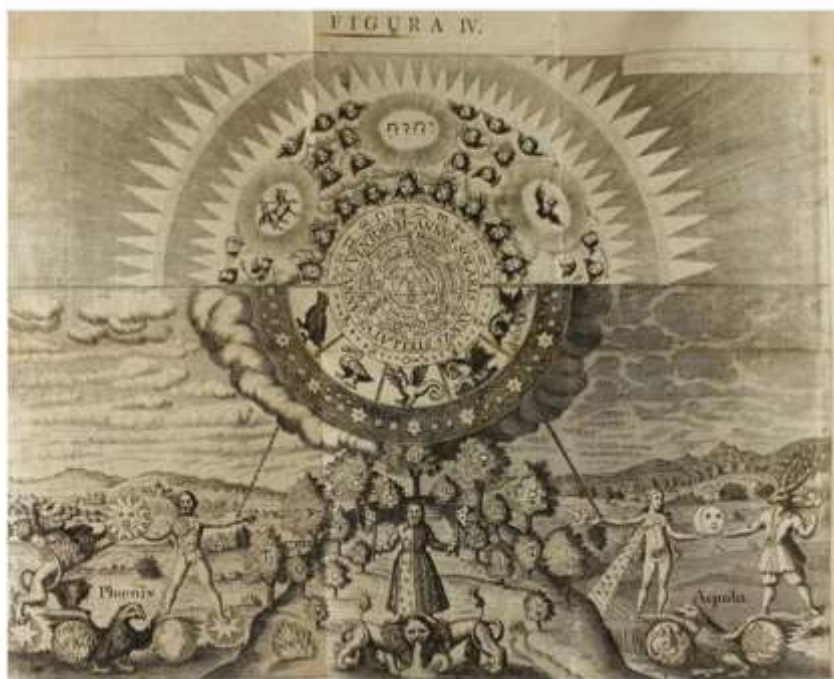


Figure 9 Part of a compilation of alchemical texts and images entitled *Musaeum Hermeticum Reformatum et Amplificatum*, this engraving depicts the cosmology conveyed by *The Emerald Tablet* – a highly esteemed Hermetic text, once translated by Isaac Newton, which was the main source of alchemical thought and practice (Lima, 2017, p. 33)

2.2.2. The origin of museums:

The word museum originates from the ancient Greek term *musaeum*⁸.

Originally *musaeum* had two definitions. Most traditionally, it was a place consecrated to the Muses, a mythological setting home to nine goddesses of creative arts, whose mother was Mnemosyne, the Goddess of Memory – a Titan embodying the matrix of human creativity, invention and idea creation. The second, more specific origin of *musaeum* was the famous library at Alexandria – a research centre and congregating point for scholars of the classical world. Interestingly, the source of the term museums is not a collection of material objects but a place of contemplation or a library. The museum started as a conceptual place to think, a place of philosophy and ideas.

The *musaeum* emerged within an oral tradition. Memory was a critical skill for discourse and maintaining scholarly power. Ancient oratory traditions understood, what modern cognitive psychology now supports, that order is the basis of memory and creating a visual schema for organising the mind helps humans to retain and recall information (Small, 1997). The most efficient information management tool available to ancient and early modern humans was the mind. Sophisticated memory techniques were initially developed by the Greeks and Romans as way of managing the flood of new words produced by the rise of writing and literacy. The rapidly expanding body of texts, now fixed through writing, did not have the tools within them for the search and

⁸ *Musaeum* is the Latin word for the modern English term museum. I shall use the modern English 'museum' only when the distinction has been made from the broader use of the term to a building housing collections.

retrieval of key information. Therefore, the ability to memorise and locate information within the mind became a key area of human development and the basis of knowledge (Small, 1997).

The concepts of both memory, knowledge and place are all foundational to the concept of museums. The *musaeum* was not based on the collection of objects at this stage.

2.2.3. The Renaissance Episteme:

The second half of the Sixteenth Century saw a radical transformation in the intellectual climate, motivated by critical events in the previous century including a re-evaluation of classical culture, the discovery of the New World, and the invention of the printing press⁹. Scholars experienced concern over increasing amounts of information being produced and no structure for this information to be organised. Out of this tumultuous mass of new knowledge, and a desire for intellectual structure, the phenomenon of encyclopaedic¹⁰ collecting emerged (Kuwakino, 2013, p. 303; Garberson, 2006, p. 109). The *musaeum* was a method to comprehend and encapsulate 'the universal nature' of things through the organisation of physical and

⁹ The invention of the printing press in Europe was credited to Gutenberg around 1436, however the use of metal moveable type was known far earlier in Korea in the 13th Century.

¹⁰ The term *encyclopaedic* originates from the Hellenistic Greek for "general education" and "circular." These dual terms sum up the desire for both universal knowledge and creating a container enclosing this knowledge.

mental spaces (Impey & MacGregor, 2017). *Musaeums* were not only perceived as physical places but as imaginary and pictorial manifestations of memory recall practice (Findlen, 2018). Renaissance polymaths looked back to memory methods developed in Classical Greece and Rome, as the mind was still considered the best tool available for information management. The method of *loci*¹¹, also known as the mind or memory palace technique, emerged as a strategy for enhancing memory through the visualisation of imaginary architectures, enabling the recall of information stored in the mind. Findlen wrote that “*musaeum* was an epistemological structure which encompassed a variety of ideas, images and institutions that were central to late Renaissance culture” (Findlen, 2018, p. 160). The Renaissance notion of the museum began as a definition of an imaginary space, born out of a “humanist desire to codify the intellectual experience” (Findlen, 2018, p. 166). *Musaeum* “was not confined only to the tangible; the museum was foremost a mental category and collecting a cognitive activity” (Findlen, 2018, p. 167). Findlen’s research into the social and linguistic construction of the *musaeum* in 16th and 17th century culture explores ways in which the *musaeum* structured significant aspects of the culture at that time (Findlen, 2018). *Musaeum* enclosed a range of natural, human-made, literary, conceptual, and imaginary items organised through the process of categorisation and placement in both physical and mental architectures to represent the extent of human knowledge.

¹¹ The method of *loci* is a memory enhancement technique that combines visualisation with spatial memory of imagined environments in order to quickly recall information.

The *Musaeum* was the axis through which structure of collecting, categorising and ultimately knowing intersected (Findlen, 2018, p. 166).

The 16th Century *musaeum* was constructed around the way that Renaissance people understood knowledge. Resemblance and similitudes were critical tools for understanding. Phenomena was organised into likenesses, objects mirrored one another, and things were connected in great 'chains of being.' Knowing was based on interpreting, rather than observing and demonstrating. Renaissance polymaths drew classifications relating objects and phenomena together, imposing adjacencies that created new resemblances, in what Foucault's called a "semantic web of resemblance" or "the vast syntax of the world" (Foucault, 1970, p. 20). *Musaeums* contained diverse assemblages of items, with artificial objects displayed next to natural history specimens, alongside paintings, text and symbols. Collections were arranged to present a circular and harmonious representation of the world (Olmi, 2017). A person was supposed to be able to stand at the centre of the circular space and experience knowledge and dominion over all creation. Conceptually collections were designed as 'mind palaces' and 'memory theatres', objects were considered fluid and could have multiple meanings and complex relationships with others in the circle (ibid). The Renaissance *musaeums* can be placed as focal points for establishing organisational tools for knowledge and discourse, through organising objects or phenomena through resemblance, and the practice of drawing things together in order to tell them apart. This incredible organisation of knowledge through a spatial arrangement in physical and mental spaces is the origin of all museum practice.

In a similar way to the establishment of medieval universities (e.g. the University of Oxford, (1167)), the formation of the *musaeums* or museums, was “an act of enclosing knowledge, limiting access to knowledge, exerting a form of control over knowledge and providing a means for a small elite to acquire this knowledge for the purposes of leadership of a spiritual, governance or cultural nature.” (Hall & Tandon, 2017, p. 8) Knowledge was the territory of elites, and the people with access to the ‘temples of knowledge’ were the “knowers” and the people without access were the “non-knowers” (ibid). Those who traditionally kept knowledge for their communities had their knowledge relegated to “witchcraft, tradition, superstition, folkways or, at best, some form of common sense” (ibid). New knowledge institutions, came into being at the time of the rise of European science and global navigation, as the hegemony of mostly white Eurocentric knowledge spread around the world.

Boaventura de Sousa Santos, distinguished professor in sociology, describes Western thinking as an “abyssal thinking” as it consists of a “system of visible and invisible distinctions” (Sousa Santos, 2007). Santos argues:

“The invisible distinctions are established through radical lines that divide social reality into two realms, the realm of “this side of the line” and the realm of “the other side of the line”. The division is such that “the other side of the line” vanishes as reality becomes nonexistent, and is indeed produced as nonexistent. Nonexistent means not existing in any relevant or comprehensible way of being. Whatever is produced as nonexistent is radically excluded because it lies beyond the realm of what the accepted conception of inclusion considers to be its other. What most fundamentally characterizes abyssal thinking is thus the impossibility of the co-presence of the two sides of the line.” (ibid)

This process of the dispossession of other knowledge is a process that Santos has called epistemicide. He argues that “a massive epistemicide has been under way for the past five centuries, whereby an immense wealth of cognitive experiences has been

wasted” (ibid). The enclosing of knowledge and the creation of “accepted knowledge” are key components in establishing museums, alongside other cultural institutions.

The enclosing of knowledge within a circle favours some types of knowledge by placing it inside the circle while other knowledge is devalued and relegated to a position outside the circle. This is a crucial tension of the Western Europe museum model that privileges one type of knowledge over another. Renaissance *musaeums* were dazzling and intriguing spaces, yet they drew lines between valued and non-valued knowledge.

2.2.4. The Wunderkammer:

Another term for the *musaeum* or *museo* favoured in Northern Europe was the *Wunderkammer* and *Kunstkammer* or ‘Cabinets of Curiosities.’ The ‘cabinet’ was a purely physical space for showcasing a wide variety of objects and artefacts, favouring the eclectic, esoteric and bizarre (see figures 10-12). The name ‘*Wunderkammer*’ gives the impression of a whimsical practice aimed purely at entertainment and, while this is true in part, the miscellaneous nature of the collection was “essential elements in a programme whose aim was nothing less than universality” (Impey & MacGregor, 2017, p. 1) and the desire to establish the position of ‘Man’ in the grand scheme of things (Impey & MacGregor, 2017, p. 2). The private collection, or ‘cabinet’ served not only as a tool of intellectual mastery but a showcase of economic power (Turner, 2017) and entertainment (Stafford, 1994; Delbourgo, 2019).

Understanding the museum as a spectacle as well as a practical tool is critical. The curation of a collection was simultaneously research and entertainment married with the desire to build a reassuring sense of proficiency over the known world. The phenomenon of the 'knowledge experience' or 'knowledge spectacle' is an essential aspect of our relationship with museums. In their book on the birth of visual education and the museum, Stafford wrote: "The cabinet of curiosity existed ambiguously in between entertainment, performance, and practical instructions. Browsing nature for possible possessions was akin to shopping. Infinity could be made manageable in consumable chunks." (Stafford, 1994, p. 218).

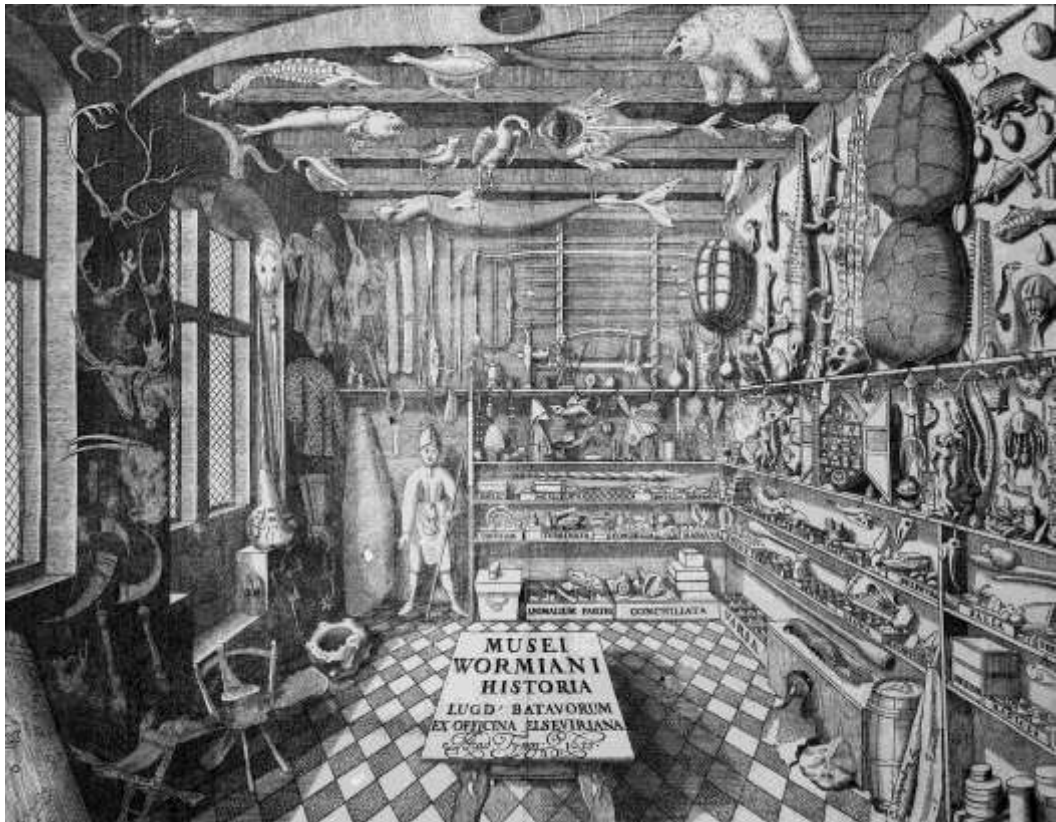


Figure 10 Curiosity cabinets and universal knowledge as depicted by the Danish Collector Olaus Wormius in Museum Wormianum (1655)



Figure 11 Fold-out engraving from Ferrante Imperato's *Dell'Historia Naturale* (Naples 1599)



Figure 12 Lorenzo Legati, *Museo Cospiano*, (1677)

2.2.5. Theatres of Knowledge:

Wondrous and expanding collections, such as the *Munich Kunstkammer*¹², founded by Duke Albrecht V and conceived as a central repository of knowledge about the world, required dedicated buildings to store their wonders. Samuel Quiccheburg, an artistic advisor to Albrecht V and the *Munich Kunstkammer*, wrote the first theoretical text on museology, published in 1565 (Quiccheberg, 2013). The text functioned as a manual that describes the ideal museum and instructions on how to assemble an encyclopaedic collection. The translation of the full title of the treatise reveals the scale of ambition:

“The inscriptions or titles of a vast theatre, containing the individual subjects and excellent images of the things of the universe, such that one may with reason also call this a repository of artificial and extraordinary things, of every rare treasure and precious furnishing, of buildings and pictures, that are examined and collected together here in this theatre, in order that through the repeated inspection and study of them, one may obtain in rapid, easy and certain fashion singular knowledge and a marvellous practical experience of all things.” (Quiccheberg, 2013, p. 61)

Theatres were the dominant architectural metaphor applied in Renaissance discourse on collecting and memory (West, 2003). Quiccheberg’s treatise is not concerned with a theatre as a metaphor. In this treatise Quiccheberg turned the metaphorical concept of the *musaeum* into an actual and detailed building design in which various objects and images were displayed. He intended for anyone who studied

¹² The *Munich Kunstkammer* was the first ‘cabinet’ to have declared valuable objects to be handed down through princely households in perpetuity and to be open to not only princes and ambassadors, but to interested artists and academics (Seelig, 2017), moving closer to the modern museum model.

the collection of artefacts in the space to acquire knowledge in a 'rapid, easy and certain' manner. He saw the museum building and collection as a place to stimulate new learning and expand humanity's useful knowledge (Quiccheberg, 2013, p. 6). Quiccheberg was influenced by Giulio Camillo's *L'Idée del Theatro* or Memory Theatre and referred to this as a 'museum' (Quiccheberg, 2013, p. 78). Quiccheberg praised the theatre for its 'semi-circular construction' (see figure 13).

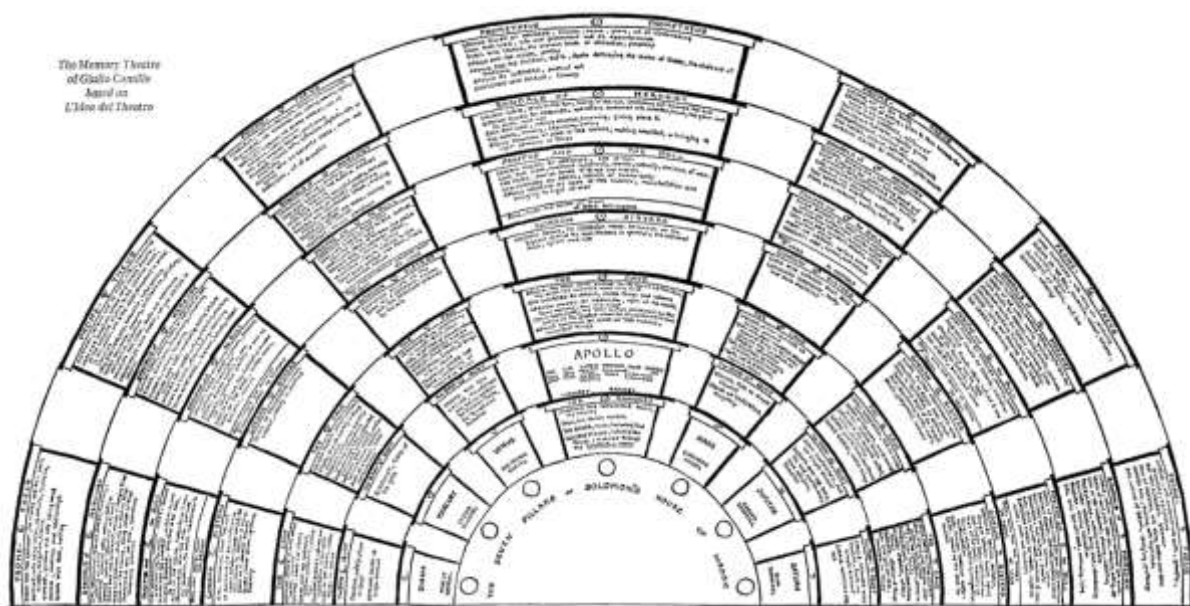


Figure 13 Memory Theatre in 'L'idea del theatro', 1550, by Giulio Camillo illustrated by Frances Yates in their book *the Art of Memory* first published in 1966 (Yates, 1999)

The use of the amphitheatre in the case of the Camillo's 'Memory Theatre' (figure 13) shows the construction of an immersive space in which a person can, with a single view, see the necessary areas of knowledge to feel a 'proficiency' of a 'universal' range of topics. The same immersive design is seen in the *Wunderkammers* (figures 1 – 3). The desire to recreate the world in miniature and expand the mind into a physical space to aid learning is apparent in these early *musaeums*. Figure 5 is a circular 'memory wheel' created by Giordano Bruno at a similar time to Camillo's memory

palace (see figure 14). The arrangement of the wheel uses images or symbols to create an 'artificial memory' (Yates, 1999, p. 39). The origin of the *musaeum* is intertwined with the Hermetic philosophy¹³, alchemic and occult symbology that permeate these diagrammatic memory structures. While these principles of magical thinking appear foreign to us now, the design processes of creating an external memory remain a key element in our understanding of the museum.

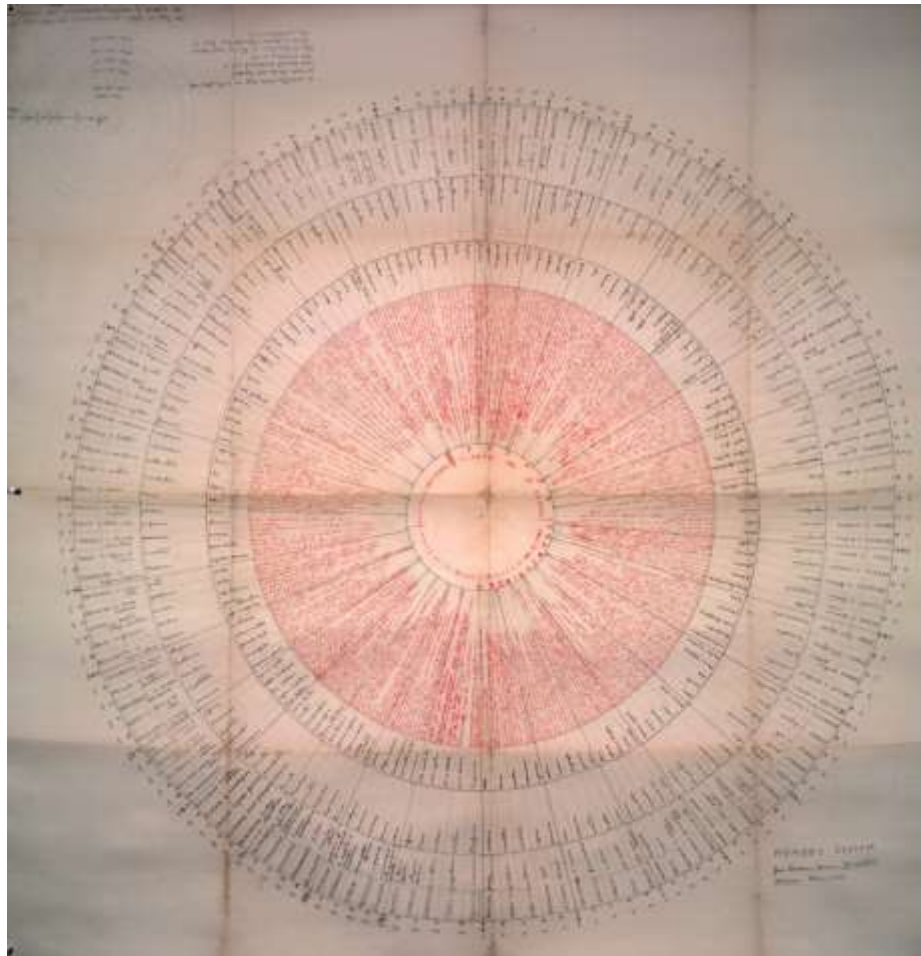


Figure 14 Francis Yates reconstruction of the Memory System or 'Memory Wheel' from Giordano Bruno 'De Umbris Idearum', Paris 1582 (Yates, 1999)

¹³ Hermetic philosophy is a synthesis element from several ancient religions (including Egyptian, Greek Pagan, Alexandrian Judaism, Sumerian) into a philosophical system with alchemy and magic. Hermetic philosophy had a significant influence on scholarly and scientific thinking in the Renaissance.

2.2.6. Ideal Architecture for Museums:

Architecture played a critical role in the reorganisation of knowledge at the dawn of the modern age (Kuwakino, 2013, p. 303) and in understanding memory and recollection (Yates, 1999). The Renaissance period saw the emergence of architectural metaphors (e.g. 'pillars of knowledge'), which implied that orderly physical spaces, including geometric gardens, theatres, and temples, could form the basis for the organisation of knowledge (Kuwakino, 2013; Fabianski, 1990). In their journal article on the architecture of ideal musea in the 15th – 18th Century, Marcin Fabianski demonstrates that the ideal form of a *musaeum* was traditionally circular or round, linking it to the temple of memory and knowledge (Fabianski, 1990). The domed rotunda is a recurrent theme for *musaea* in both art and literature, alongside architectural designs and illustrations.

In 1585, Bartolomeo Del Bene authored the poem, *Civitas Veri sive Morum* 'The City of Truth', describing a utopian view of an ideal Renaissance city based on an Aristotelian ethics tradition. The publication was illustrated by Thomas de Leu, demonstrating the architectural ideals encapsulated by the city design. The poem describes a month-long journey through the city to the five temples in the centre. To enter the city, a traveller must pass through one of five architectural portals, each linking to one of the senses. In the Aristotelian tradition, the senses were where thought was derived and from where an individual can perceive and identify physical things. Figure 15 shows a map of the city, figure 16 and 17 show the portal of touch. The traveller journeys through streets of virtue and vice to reach a rocky mound at the city's centre, representing the soul. The summit of the mound is reached via sets of

staircases reflective of Aristotle's concept of the three internal senses: common sense, imagination and memory. On the mound are temples devoted to knowledge, art, science, intelligence and wisdom (Fabianski, 1990; Stimac, 2020) (see figure 18 and 19). 'The ideal,' as considered in Renaissance thought, can be seen in museum building designs from the 18th Century to the present day (Fabianski, 1990, p. 126).



Figure 15 Bartolomeo Del Bene (1585) *Civitas veri si morum* 'City of Truth': City Plan (Stimac, 2020)



Figure 16 Bartolomeo Del Bene (1585) *Civitas veri si morum* 'City of Truth': Portal of Touch identified on city plan (Stimac, 2020)



Figure 17 Bartolomeo Del Bene (1585) *Civitas veri si morum* 'City of Truth': Portal of Touch (Stimac, 2020)



Figure 18 Bartolomeo Del Bene (1585) *Civitas veri si morum* 'City of Truth': mound at the centre of city (Stimac, 2020)



Figure 19 Bartolomeo Del Bene (1585) *Civitas veri si morum* 'City of Truth': Temple of Intelligence (Stimac, 2020)

Museum buildings emphasised a relationship to idealised temples of sciences and arts found within art and literature through domed rotundas placed at pivotal points (Fabianski, 1990, p. 107). Domed rotundas were surrounded by projecting wings and key examples include *The Great Court* of the British Museum (figure 20) or the domed entrance of the Altes Museums in Berlin (figure 21 and 22). This design trope can still be seen in many contemporary iconic museum buildings, often used to enhance the effect of entrance halls and exhibition rooms, for example, Guggenheim Museum rotunda (figure 23). As in Camillo's 'Memory Theatre', the circular shape can also be used in architecture for constructing a knowledge visualisation. The Rotunda Museum in Scarborough, which opened in 1829, was designed based on the specifications of William Smith, known as the 'father of English Geology' (see figure 25

– 28). The round shape was conceived as a space to physically map the relationships between different species.



Figure 20 The Great Court of The British Museum. Photo: Nigel Young Foster + Partner (The British Museum , 2020)



Figure 21 Altes Museum, Karl Friedrich Schinkel (1830). The Altes Museums is situation on 'Museum Island' in Berlin. Google Culture has a web exhibition dedicated to the domed halls on Museum Island (Google Arts & Culture, 2020)

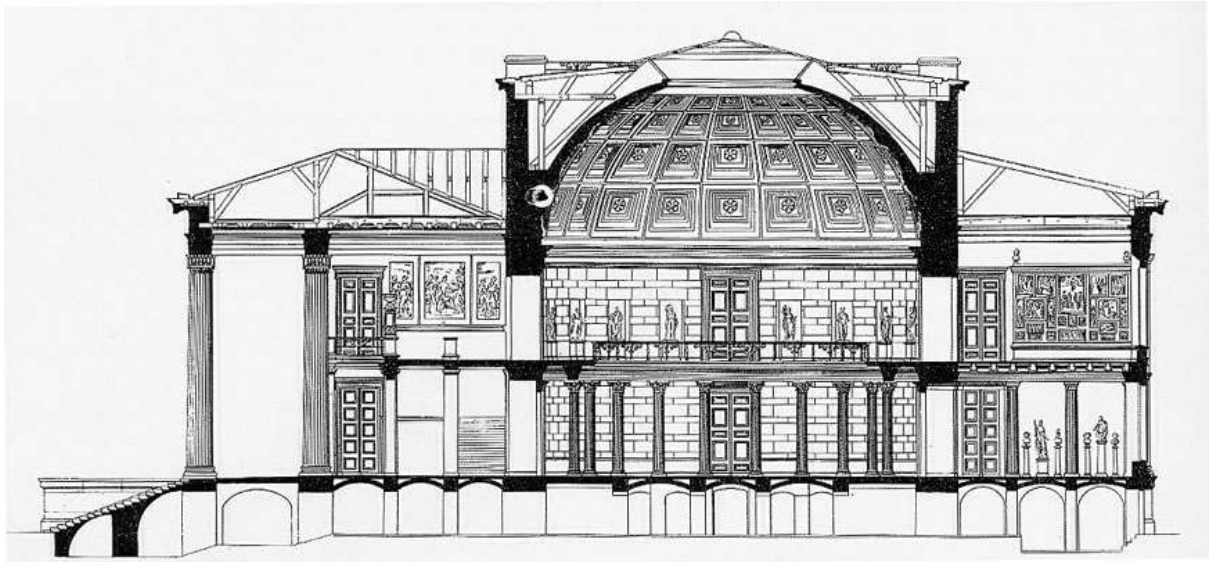


Figure 22 Altes Museum, Karl Friedrich Schinkel (1830), transverse section



Figure 23 Guggenheim Museum rotunda and "oculus" (Guggenheim, 2014)



Figure 24 Birmingham Museum and Art Gallery 'Round Room' (Birmingham Museums, 2017)

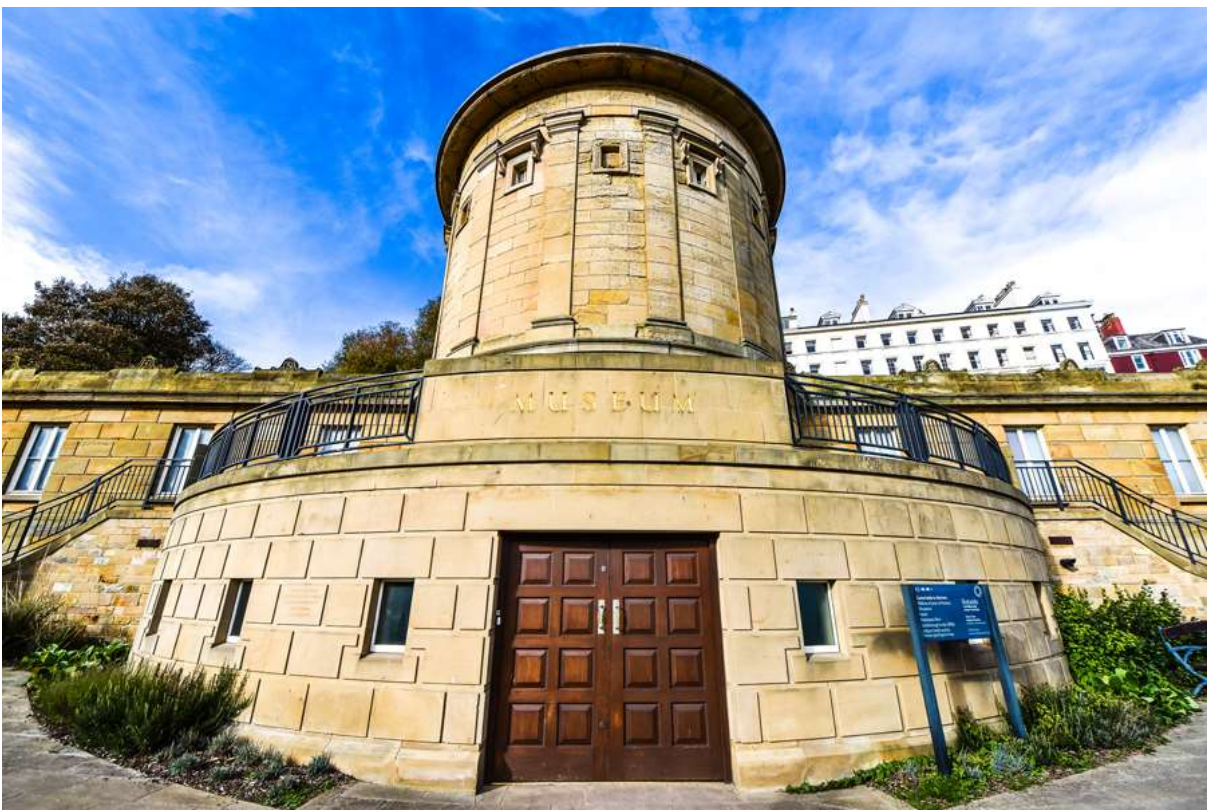


Figure 25 Rotunda Museum, Richard Hey Sharp, Scarborough, 1829. (Scarborough Museums Trust, n.d.)



*Figure 26 Rotunda Museum, Richard Hey Sharp, Scarborough, 1829. Refurbished in and reopened in 2008
(Scarborough Museums Trust, n.d.)*



*Figure 27 Rotunda Museum, Richard Hey Sharp, Scarborough, 1829. Refurbished in and reopened in 2008
(Scarborough Museums Trust, n.d.)*



Figure 28 Rotunda Museum, Richard Hey Sharp, Scarborough, 1829. Collection of William Smith (Scarborough Museums Trust, n.d.)

2.2.7. Immersive Knowledge Architectures, Libraries:

From the late sixteenth century well into the nineteenth century, the typical arrangement for libraries was known as the wall-system. Books were arranged on floor-to-ceiling cases and organised into subject areas. Any furnishings were low and in the centre of the room to not affect the viewer's sweeping gaze of the books.

Garberson wrote of this system:

“Persons entering or circulating in this unbroken space thus perceive the room and its furnishings as an uninterrupted whole and can survey the books arrayed against the walls with one continuous sweep of the eyes” (Garberson, 2006, p. 105)

The wall-system is described as the ideal architecture for its grandeur but also its functionality, this optimum arrangement allowed for all books to be perceptible in a

“single-look” (Garberson, 2006, p. 105) (for example see figures 29, 30 and 31). In a time when memory functioned as the “internal search and retrieval mechanism” (Garberson, 2006, p. 112), an orderly arrangement of books organised spatially into disciplines provided both a conceptual and physical framework for knowledge.

Gaberson explains:

“Ordered arrangement promoted not only retrieval, or the location of individual books within the mass, but also study, by demonstrating the place of each book in the whole of knowledge.” (Garberson, 2006, p. 106)



Figure 29 Panoramic photograph of the Reading Room at The British Museum, 2006. (The British Museum, 2018)



Figure 30 Abbey Library, Göttweig, Austria. Johann Lucas von Hildebrandt (1718). Photo credit: (Royan, 2009)



Figure 31 Library of Strahov Monastery, Prague, Jeroným Hirnheim (1679). Photo credit: (Royan, 2009)

The library provided readers with a visual representation of current knowledge, but also a spatial system for information retrieval, acting as a memory aid. Similar metaphors to *musaea* were applied to libraries – both architectural and ‘circle of knowledge,’ as in any encyclopaedic endeavour of the time needed the structure and spatiality of a planned physical space and the boundaries the circle provided. The wall-system was used in many of the world’s most celebrated libraries. Multiple online lists rank the ‘world’s most impressive libraries’¹⁴ focused on great wall systems of floor-to-ceiling books facing inward creating an immersive visual space. Marc Le Corur, one of

¹⁴ A selection of websites, however any online search will offer multiple examples.
 Forbes: <https://www.forbes.com/sites/sandramacgregor/2019/11/03/top-six-of-the-worlds-most-beautiful-libraries/?sh=632646336f22>
 The Guardian: <https://www.theguardian.com/artanddesign/gallery/2018/jul/31/libraries-world-most-beautiful-in-pictures>

the curators of MoMA's 2013 Labrouste¹⁵ exhibition, wrote, "The public could not enter [the stacks] but [could] sense their importance by the gigantic size of the glass opening (nine meters high) within the converging walls of the hemicycle and by the sculpted medallions of great authors above the bookshelves all shown in profile facing the stacks" (Marc, 2013, p. 159) (see figure 32 and 33). The visible stacks rendered the collection of knowledge it embodied monumental (Mattern, 2016). Many modern libraries, including *Book Mountain Library* (see figure 34) and *Tianjin Binhai Library* (see figures 35, 36 and 37), by architects MVRDV, use the display of books in the same way – to create monuments to knowledge.

¹⁵ Architect of the Bibliothèque Nationale Richelieu reading room. See Figure 33 Bibliothèque Nationale Richelieu, Reading Room (Wikimedia Commons, 2017)



Figure 32 Bibliothèque Nationale Richelieu, Reading Room (Wikimedia Commons, 2012)



Figure 33 Bibliothèque Nationale Richelieu, Reading Room (Wikimedia Commons, 2017)

Figure 34 (photograph of Book Mountain, Netherlands) has been removed due to Copyright restrictions.

Figure 34 Book Mountain, Netherlands (MVRDV, 2012)



Figure 35 Tianjin Binhai Library, China, (MVRDV, 2017). Image: (Wikimedia Commons, 2017)

Figure 36 (photograph of Tianjin Binhai Library, China) has been removed due to Copyright restrictions.

Figure 36 Tianjin Binhai Library, China (MVRDV, 2017)

Figure 37 (photograph of Tianjin Binhai Library, China) has been removed due to Copyright restrictions.

Figure 37 Tianjin Binhai Library, China (MVRDV, 2017)

Within the home, personal obsessions with collections and showcasing shelves can be seen online by searching the popular hashtag '*shelfie*'. Using this hashtag social media users post images of their bookshelves. The shelves photographed are often full of books, however collections of games, model figures, plants, vinyl records and dvds are also popular. This leads to the question - what pleasure do we get from seeing a visual representation of an accumulation of 'knowledge'? Is it just a means of showing off our cultural capital or a deeper visual connection with 'what we know'?

The architectural design of the museum and library began as memory aid or extension of the mind. With the invention of the internet, we perceive knowledge as readily available through personal mobile devices and our experience of the ubiquitous data-sphere is often visualised as a 'cloud'. We no longer require libraries and museums for everyday knowledge acquisition. So, what roles do these historic architectures hold in our lives?

Great museums and libraries were not built as purely functional knowledge retrieval spaces, they have always held great symbolic value. Museums and libraries function as monuments to knowledge, testaments to our progression and reassuring shrines to our dominance of the Earth. Museums and libraries can be described as knowledge monuments, enjoyed for the experience of knowledge en masse alongside their educational functions. Examples of buildings designed to celebrate collections of books place the 'knowing' of knowledge at the centre of design (see figures 38 - 41).

2.3. Key points, Circles:

- The *musaeum* emerged from an explosion of new knowledge and the need to create new models for its accessible storage.
- The *musaeum* was understood as both a personal collection of objects in a room, an illustrated diagram of objects or concepts, and a place in the mind for storing knowledge in a spatial imaginary schema for easy future retrieval.
- The physical *musaeum* or 'cabinet' functioned both as a tool for study and an entertainment showcasing economic and intellectual power.
- Objects were arranged based on resemblance and similitudes.
- A *musaeum* aimed at universal or encyclopaedic knowledge arranged in hierarchical geometric or tree diagrams.
- The ideal architecture for a museum was circular and topped with a dome.
- The *musaeum* was a physical and conceptual framework for knowledge, and a visualisation tool in an age when memory skills were critical to public discourse.
- The creation of the museum was an act of encapsulating or placing boundaries around 'accepted' knowledge.



Figure 38 Stockholm Public Library, Eric Gunnar Asplund, Stockholm, 1924-1928 (Wikiarquitectura, n.d.)

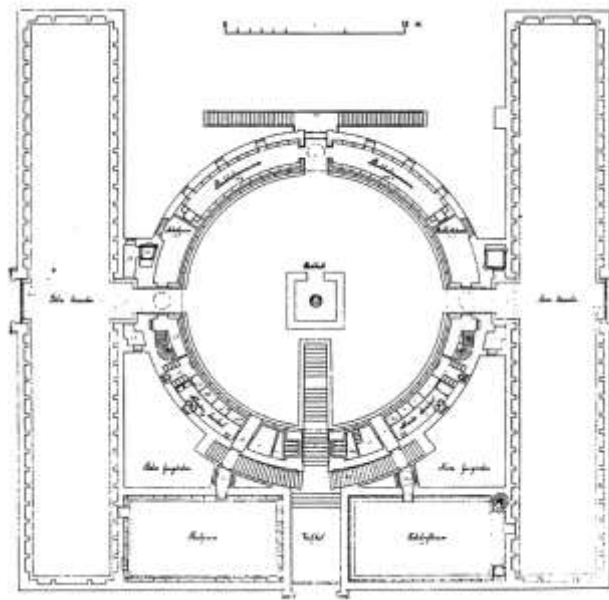


Figure 39 Stockholm Public Library, Eric Gunnar Asplund, 1924-1928. Building Plan. (Wikiarquitectura, n.d.)



Figure 40 Stockholm Public Library, Eric Gunnar Asplund, 1924-1928. Exterior. (Wikiarguitectura, n.d.)



Figure 41 Library of Birmingham Rotunda, Francine Houben, 2013 (Birmingham City Council, 2014)

2.4. Knowledge Monuments:

Carol Duncan describes museums as “ceremonial monuments” (Duncan, 1991, p. 90), she uses this term to “emphasise the museum experience as a monumental creation in its own right, a cultural artefact that is much more than what we used to

understand as ‘museum architecture’” (ibid). She argues that the temple like architecture of the museums, containing heterogeneous objects are mapped using specific taxonomies, suggesting their character as secular ritualised spaces in which “some kind of performance takes place” (ibid, p. 91). Duncan maintains, the ritual of the museum visit is performance in which people follow a prescribed route, read a list of chosen texts, and engage in a structured experience that establishes identity and restores order to the world through instruction (ibid).

Beyond the public-facing spaces of the museum, the behind-the-scenes spaces have their own rituals, from the recording of information into the database to methodical acts of conservation. The wondrous museum store is a monumental creation of a different kind, an ‘Aladdin’s cave’, ‘treasure trove’ or grotto, the dataset feeding the museum knowledge, which symbolises knowledge as well as maintains it. Open access storage has been growing in popularity since the 1980s when it first emerged in Canada, where a series of museums began displaying curatorial records alongside objects, with the aim of a more democratic and transparent approach to exhibitions (Ames, 1985; Hooper-Greenhill, 1992, p. 201). The collections data was made accessible through print-outs directly from the museums database collated in books positioned near relevant objects (ibid). ‘Visual storage’ is a growing trend in museums, the *What’s In Store?* Gallery in the Herbert Art Gallery and Museum in Coventry gives visitors the simulated access to the behind-the-scenes of the museum through a gallery designed to look like a museum store with unmediated visual access to the objects (see figure 42). The gallery contained large map draws containing entomology collections, glass cases full of taxidermy and a wall devoted to different grandfather clocks.



Figure 42 What's In Store Gallery, The Herbert Art Gallery and Museum, Coventry (2018)

Visual storage is a method of maximising public access to the collection that would otherwise be hidden from view in storage facilities. Visual storage cases tend to contain little to no explanatory material compared to traditional museum exhibitions. They display the scale and range of individual collections, and give a taste of the expanse of the museum collection as a whole (for example see figures 43-45).

As so little historical information or interpretation is offered with open store displays, what is the function of these displays for the viewer? Hooper-Greenhill calls knowledge in modern museums a “commodity” (Hooper-Greenhill, 1992, p. 192), and these browsing collections, carefully organised and displayed for maximum visual appeal do appear to function more as visual candy than useful tools for learning about the past. This raises the question, why do museum goers enjoy the experience of knowledge en masse? Is it the dazzling visual appeal of collections of singular objects

that together indicate human development and an ordered and progressive vision of the world? Does the public fetishize stored knowledge, and monuments to human endeavour? Can museums stores, without curated and mediated exhibition narratives, be described as monuments to the accumulation of knowledge?



Figure 43 Visual storage in the porcelain galleries, Victoria & Albert Museum, Wikimedia Commons (2013)



Figure 44 Visual storage in the porcelain galleries, Victoria & Albert Museum, photo credit: Sarah Stierch (2013)



Figure 45 Pinterest search for museum storage returns impressive images of collections of similar items. Pinterest (2021)

2.4.1. The British Library – Inside a knowledge monument:

Within the period of my PhD, I undertook a placement at the British Library exploring the potential for the EThOS¹⁶ e-Theses online service to include non-written data types, e.g., film, scientific data, artistic works, and digital experiences etc., creating the possibility of accessible multi-modal theses. For this placement I requested to work half of the time at the Boston Spa site, in West Yorkshire, and the second half at the world-famous main library building in St. Pancras, London. My request was based on my interest in witnessing the library operations at the two very different sites - one aimed mainly at storage and research, and the other having a wider remit including exhibition and tourism. Through spending time at the two sites, I became fascinated by the architecture housing two key collections, The King's Library Tower at St. Pancras, and The National Newspaper Archive at Boston Spa. The King's Library (see figure 49) is an architectural monument to knowledge, its presence is central to the experience of the library in St. Pancras. The National Newspaper Archive building (see figure 54) is equally as monumental, yet the design appears purely functional and is not on display to the general public. Both are large scale collections of international significance and of huge importance to the library. In this section I will discuss both libraries and their affordances as monuments to knowledge.

¹⁶ The EThOS online service aims to provide an aggregated record of all doctoral theses awarded in the UK. I published a report of the placement in UCL Press Academic Book of the Future publication. Available here: <https://ucldigitalpress.co.uk/BOOC/Article/1/65/>

2.4.1.1. The King's Library:

The King's Tower library is a six-storey-tall glass tower that houses the library of George III who reigned from 1760 to 1820. At the time of George III's death, it was one of the largest libraries in Europe with nearly 64,000 printed books and 14,000 pamphlets, together with manuscripts, maps and topographical views dating from the mid-15th to early-19th centuries (British Library, n.d.) Among its volumes are the Gutenberg Bible, a first edition of *The Canterbury Tales* and one of the earliest scientific books in English *Micrographia* published in 1665. The library had multiple homes before the creation of the British Library. One of the early locations for the library was a purpose-built domed octagonal room, commissioned by George III, in Queen's House (formerly Buckingham House). The library was a working library and open to scholars. The wall-system can be seen in figure 46 and shows an immersive room in which the King could survey the extant knowledge in a subject area, at the time, by gazing across the spatial arrangement of the book bindings.



*Figure 46 Buckingham House: the Octagon Library of George III, watercolour and body colour over pencil, (1818)
(Royal Collection Trust, n.d.)*

Following George III's death, his son George IV donated the collection to the British Museum in 1823, insisting that the books should be displayed "entire, and separate from the rest of the library... in a repository to be appropriated exclusively for that purpose". When the material arrived, the British Museum Library's printed book collections immediately doubled in size. So, between 1823 and 1827, a separate gallery – the King's Library – was built to store George III's books. Housed in what is now the Enlightenment Gallery of the modern-day British Museum. The King's Library gallery adopted the same wall-system, with two tiers of shelves displaying the books up towards the ceiling (see figure 47).



Figure 47 The King's Library Gallery in the British Museum, now the restored Enlightenment Gallery, engraving (1834) (British Library, n.d.)

Following the establishment of the British Library, the King's library moved to its current home in 1998. The King's Library Tower sits in the centre of the atrium of the British Library, St. Pancras (see figure 48). The tower is imposing and the visitor must circumnavigate it to access the various facilities and reading rooms in the library. The architect, Colin St. John Wilson, likened it to a "magic object" and the Kaaba in Mecca (Wilson, 1996), a black building which pilgrims circle at the pinnacle of the Hajj. Wilson describes the present tower design of the King's Library as being a direct result of the advent and adoption of the computer (Wilson, 1996). In the 1975 design the central atrium was to be a catalogue hall surrounded by the King's Library "as if it were wallpaper" (Wilson, 1996). Later it became clear to the library that the physical catalogue was going to disappear into the computer, resulting in a large void in the centre of the library. The architect then changed the plan to "turn the King's Library not into wall-paper but into an object"; a "major visual, monumental, jewel to the crown" (Wilson, 1996). Wherever you are in the entrance hall the collection can be

seen. The architect intended for the tower to emerge from the massive collection basements, which visitors do not see, creating a bridge between the collection in storage and the public facing library. He describes it as “a manifestation to you that the treasures are underground” and likens it to the magic of a cinema organ appearing from below (Wilson, 1996).

The decision to use the space to create a monument to physical knowledge at the start of the takeover of computers in research is poignant. The King’s Library no longer faces inward, to be viewed in a single gaze reflecting the extent of knowledge but faces outward to point to the mass of new knowledge accelerating the scale of the collection and ‘what we know’. The ‘knowledge object’ or ‘monument’ is a phenomenological link to the collection we cannot see and the knowledge imprint of the library.



Figure 48 The King's Library Tower at the British Library's St Pancras site. Photo credit Clive Sherlock. (British Library, 2014)

2.4.1.2. The National Newspaper Building:

Boston Spa is the British Library storage facility based in West Yorkshire. The site is utilitarian in appearance due to its original use as a government owned ordinance factory for the supply of munitions in World War II. It is a mixture of state-of-the-art storage buildings and converted munitions buildings repurposed for storage. It houses many of the library's collections including Document Supply, the UK Web Archive, and the UK Newspaper Archive. The UK National Newspaper collection spans three centuries and comprises local, regional, and national newspapers from across the UK. The archive contains more than 60 million newspapers and continues to grow at some 1200 titles every week that are received by the library through legal deposit (British Library, 2014). The building itself is a state-of-the-art storage facility, newspapers are retrieved and returned by robotic cranes as the building is low-oxygen, due to conservation requirements, and not habitable for human workers. Accessing the newspapers for research is done through the Boston Spa reading room where newspapers are on microfiche or in bound volumes retrieved from the archive, or increasingly made accessible online through the British Newspaper Archive website and massive digitisation programmes (The British Newspaper Archive, The British Library, n.d.) (see figures 49 – 54)

While on my placement at Boston Spa I witnessed regular group tours taking visitors to see the library storage stacks, including a viewing platform to see automated item retrieval in action. I was fascinated as to why people travelled, to a remote site in West Yorkshire, to see the spectacle of stored knowledge. Critical to this experience is the sheer volume of items in storage. Libraries and museums use data to show the impressive scale of collections to 'wow' and inspire audiences. For example, the

achievement of the newspaper archive is shown in mind-blowing statistics. The website enthusiastically proclaims over 60 million newspapers are currently in the collection, 1200 new titles added every week, 33km of newspapers, 167 lorry loads of newspapers (British Library, 2014). This tells the visitor nothing of the importance of the knowledge inside just the scale of the achievement in amassing it. Similar statistics introduce users to online collection websites; the V&A collection website – more than 1.2 million objects (V&A, n.d.), Natural History Museum – 80 million objects (Natural History Museum, n.d.), Birmingham Museums – around 800,000 objects (Birmingham Museums, n.d.). Humans struggle to make sense of large numbers and, as the objects are potentially diverse, how would one imagine what those numbers mean? What would a collection of 80 million objects look like?

The spectacle of mass automated storage and distribution is clearly fascinating for many people¹⁷. The root of the fascination may be found in multiple places - the visual appeal of repetitive patterns formed by racks and shelves, the experience of vast numbers of related and/or eclectic objects, the experience of 'the real' in opposition to digital/digitised knowledge, a reassuring sense of the progress of humanity, or a link to history and ancestors. The place in which researchers interact with the newspapers in

¹⁷ It is worth noting that other storage facilities, for example the Amazon warehouses, regularly operate tours to Amazon fulfilment centres. Interest in mass or industrial storage extends beyond knowledge institutions.

Amazon fulfilment centres offer both in person and online tours of their global fulfilment centres:

In person: <https://www.aboutamazon.com/workplace/tours>

Live online: <https://www.aboutamazon.com/workplace/tours>

Video: <https://amazonfctours.com/navideotour>

the archive, and other written sources, is online through a web repository of digitised items or the physical onsite reading room. The behind-the-scenes or “code-space” (Mattern, 2015) of the library is not designed for human understanding, through simply looking at the collection in storage it is not possible to understand the taxonomy or even the true nature of the collection. Access to knowledge is through the library catalogue via its digital interface, a platform with no implied depth, leaving the user uninclined to look behind the catalogue screen, to see through the nested layers of software and to question the structure of the collection. As there is no clear research purpose to visiting storage facilities¹⁸ - besides the partly fetishistic (Mattern, 2016) - the joy of physical collections can often be viewed as a nostalgia for pre-digital times. The interest in a “code-space” (Mattern, 2015), or ‘under the hood’ of the knowledge machine gives these storage buildings an extra meaning as a physical manifestation of the organisation and distribution of knowledge. Mattern explains:

“The epistemological implications of this aesthetic might seem obvious: these architectural projects put on display, and make empirical, if not always navigable, the wealth of knowledge that their collections represent. Yet, in the digital age, these analogue monuments take on new meaning; they might represent a wistful return to the tangible, or they might be an attempt to render empirical, affective, or phenomenological the taxonomies and algorithms that so palpably, if invisibly, structure our collections—and our everyday lives.” (Mattern, 2016)

¹⁸ It is worth noting that other storage facilities, for example the Amazon warehouses, regularly operate tours to Amazon fulfilment centres. Interest in mass or industrial storage extends beyond knowledge institutions.

Amazon fulfilment centres offer both in person and online tours of their global fulfilment centres:

In person: <https://www.aboutamazon.com/workplace/tours>

Live online: <https://www.aboutamazon.com/workplace/tours>

Video: <https://amazonfctours.com/navideotour>

The 'knowledge object' or 'knowledge monument' of a collection in storage can therefore be understood as a signifier of the library's purpose. The goal of amassing knowledge and making knowledge accessible. It is an inspirational object—a monument to the endeavour of collecting intellectual heritage.

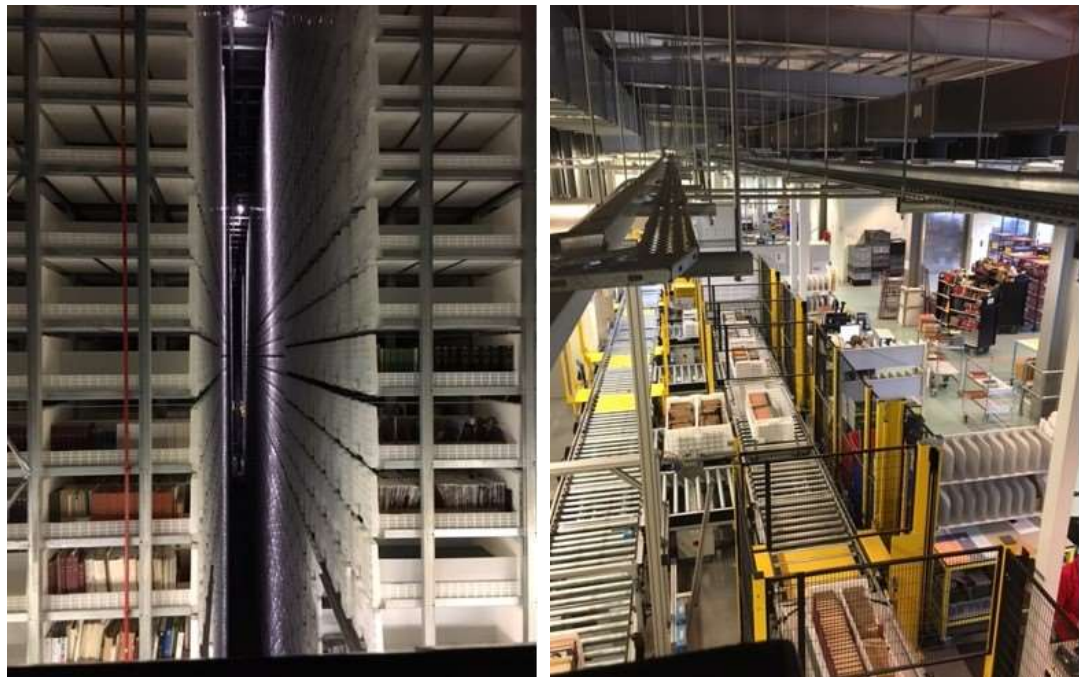


Figure 49 Automated store, The British Library, Boston Spa.



Figure 50 Automated store, The British Library, Boston Spa.



Figure 51 Engineer inspects the storage void of the National Newspaper Building. Photo credit: Kippa Matthews



*Figure 52 The storage void of the new British Library National Newspaper Building at Boston Spa in West Yorkshire.
Photo credit: Kippa Matthews*



*Figure 53 The storage void of the new British Library National Newspaper Building at Boston Spa in West Yorkshire.
Photo credit: Kippa Matthews*



*Figure 54 Plans for viewing platform for new storage vault at British Library Boston Spa, Carmody Grooke, 2021
(Architects Journal, 2021) (British Library, 2021)*

2.4.1.3. Section Summary:

The British Library has developed massive knowledge management systems, meaning the taxonomy of the collection is no longer visible in a single sweeping gaze. The enormity of the complete collection is incomprehensible – if not unknowable. The breadth of knowledge is staggering and so large - the accessibility of the collection is the foremost challenge of the library. ‘Knowledge Objects’ like the King’s Library Tower and the National Newspaper Archive act as a bridge between the digital and the physical, giving the viewer a sense of what is behind the digital catalogue interface.

Beyond the historical significance of the individual volumes they hold, the King's Library Tower and National Newspaper Archive building are monumental symbols of the endeavour of collecting and the goal of representing a comprehensive knowledge collection. Witnessing either of the structures is to stand at a gateway to knowledge, and without attaining any of the understanding within the volumes, to know that human endeavour is recorded, secured, and accessible. Libraries and museums were, and still are, designed as immersive experiences from the 'temple to knowledge' to the contemporary knowledge institution, the physical knowledge architecture is designed to inspire visitors and grant them the promise of access to immense learning.

Knowledge structural design as a visual spectacle has been used in the architectural design of libraries since their inception. The wall-system was used as a search tool and to inspire the reader – laying out a spatial schema of the growing human intellectual sphere. Both 'knowledge objects and monuments' act as a data-visualisation. A graph for the volume of knowledge and a manifestation of the knowledge behind the catalogue search. They are a bridge between the physical and digital processes of the knowledge institution.

Key points:

- The spectacle of stored collections objects are visually appealing to many people.
- The museum can be described as a 'knowledge monument', in that the museum as a whole is both monumental in the scale of knowledge contained

within, the architectural spectacle of knowledge storage and the position in public spaces.

- The technology of knowledge storage can dazzle visitors and obscure problems within the collections.

Key questions:

- As the library collection grows at pace, can technology provide a similar 'knowledge experience' through large scale data-visualisation?
- Can the knowledge institutions use data-visualisation to open black-boxed collections?
- Can a data-visualisation provide a collection search that is both functional and inspirational – immersing the user in knowledge in the way a physical space can?

2.5. Trees

Shaping knowledge as a tree is “perhaps our oldest knowledge about knowledge”¹⁹ (Weinberger, 2006). Traditional taxonomic structures take the form of trees, with hierarchical branches of information spreading out in a forward direction of travel connected by a common root. The tree is an attractive model for organising knowledge due to its relationship with chronology, genealogy, evolution, social stratification and constant and continuing progress. Its symbology is so engrained in our psyche that we use it as a metaphor throughout language, for example ‘the root of the problem’ or a ‘branch of science’.

2.5.1. The Tree of Knowledge:

The foundations of the European epistemological tree model lay in the belief that the world was hierarchically arranged²⁰. This ideal permeated philosophy from

¹⁹ Trees diagrams for understanding knowledge were used before the Enlightenment, they are rooted in the cultural DNA of humans. The symbolic resonance of the tree permeates almost every human culture. Trees represent birth, death, immortality. In mythology and folklore, the tree signifies the interrelatedness of all life on earth, the tree is the *axis mundi*, or world axis, a symbol representing the centre of the world when the heavens connect with the earth, and the tree of life, *arbor vitae*, connecting all forms of creation within the earth’s cycles. In the Bible the Tree of Knowledge symbolises the beginning of human mortal time. Our symbiotic relationships with trees have provided a metaphor for knowledge organisation, a schema that has been used to organise and explain almost every facet of life and remains a key tool for the organisation and archive of information.

²⁰ Examples of this world view are embodied in Aristotle’s concept of *Scala Naturae* translated from Latin as “ladder of being” more commonly known as *The Great Chain of Being*.

Ancient Greece to medieval Christian societies, through the Renaissance²¹ and continued in the outlook of European Enlightenment thinkers (Brace, 2005; Sussman, 2014; Lima, 2013; Lima, 2014). The origin of the word hierarchy is in ancient Greek culture with notions of religious and social rank and power (Bergman, 2021). The tree schema was used to fix, to order and to rank knowledge. During the Enlightenment period, widely characterised as the 'Age of Reason', empirical scientific methods were established as scholars attempted to tabulate knowledge into universal taxonomic structures or 'great mechanisms' (Foucault, 1970). The trend for rationalism manifested in the creation of encyclopaedias in which scholars attempted to take possession of new knowledge and discoveries (Broberg, 1990, p. 47), (for example see figures 55, 56 and 57).

Hierarchies, real or human-made, are used widely to help us organise the world around us through placing items into a general order. Hierarchies in knowledge systems include taxonomies, classifications systems, encyclopaedias, and are the basis

²¹ Renaissance tree schema evangelists included Francis Bacon and René Descartes whose fervent efforts to categorise knowledge produced dense tree classification arrangements. In 1605 Francis Bacon published his work *The Advancement of Learning*, arguably one of the most significant philosophical works to that date. Bacon not only suggests a new science of observation and experimentation but also explores the categorisation of all human knowledge. He organised them into large groupings with various subdivisions. Bacon wrote, "The distributions and partitions of knowledge are not like serval lines that meets at one point; but are like the branches of a tree, that meet in a stem, which hath a dimension and quality of entireness and continuance, before it comes to discontinue and break itself into arms and boughs." (Bacon, cited in Lima, 2013, p. 34) Descartes, know commonly as the 'father' of modern philosophy, explored arboreal schemes in science in many works, most famously *Principia Philosophiae (Principles of Philosophy)* (1644). In a letter Descartes describes his image of the tree of knowledge "Thus, all Philosophy is like a tree, of which Metaphysics is the root, Physics the trunk, and all the other sciences the branches that grow out of its trunk" (Descartes, cited in Lima, 2013, p. 34)

of managing information in computing. They are the logical underpinning of many information management systems, and express class-based relationships that have flexible variants which can be expressed algorithmically or computationally (Bergman, 2021). Tree structures for information storage and retrieval allow the user to browse and filter data through nested file hierarchies.

The properties of a tree include two main elements - “nodes” and “branches”. Relationships between nodes are given family-based terminology – parents, children and siblings depending on their position in the hierarchy. Every finite tree structure has a node with no superior called the root node. Infinite tree structures may or may not have a root node. The tree structure is simple but inflexible because the relationship between nodes is confined to parent-child or one-to-many relationships.

The binary structure of the tree system, in which the properties of an individual item are inherited from each of its parent categories, remains a dominant knowledge organisation structure (Weinberger, 2006). A hierarchical taxonomic structure, like a tree, gives definition to how you understand an individual item within it. When you take the hierarchical structure away, a lot more information must be stored with the item to realise the same benefits as the object must tell you its position by virtue of its own information. By removing a taxonomy, like a tree structure, you increase the complexity of storing information – but you also increase the richness of the data. When data is organised via a hierarchical structure, the data is naturally validated because folder structure references enforce the data integrity. When an unstructured dataset is used there is the possibility of incorrectly inputted information impacting the integrity of the data within it. However, there are far greater opportunities for variety

when the simplicity of the tree structure is abandoned and we stop trying to fit an item into a tree where the system pre-exists the individual item rather than being shaped by it. We have more opportunities to acknowledge complexity and difference when we make a rich palette of data around an individual item – rather than forcing it into a structure through discrimination and fixed language. Furthermore, in a hierarchical tree system, an individual item has only one active neighbour, a hierarchical parent or superior, and the channels of transmission are mono directional and pre-established.



Figure 55 Drawing of the Great Chain of Being from Didacuc Valades, *Rhetorica Christiana* (1579)

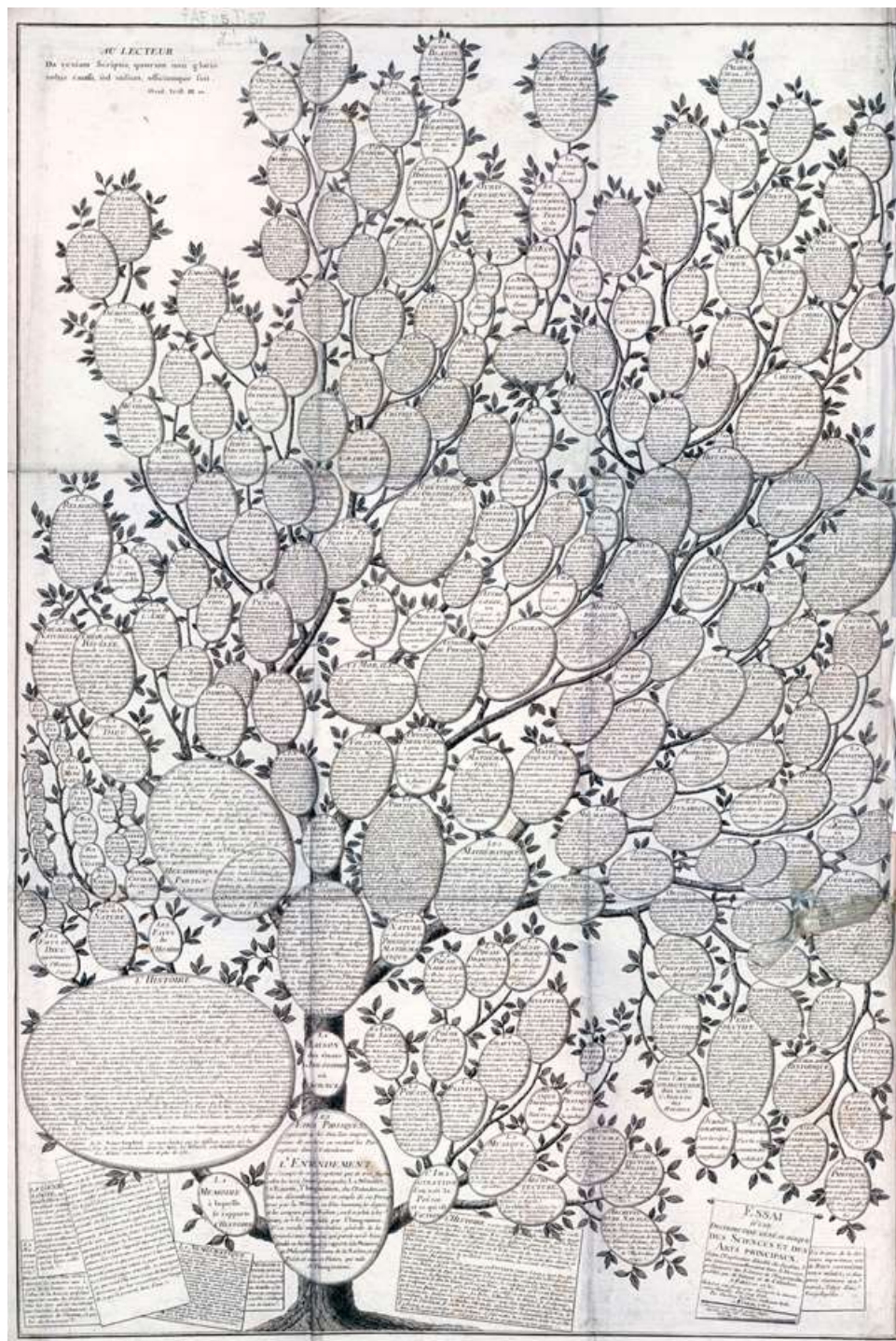


Figure 56 'Genealogical distribution of the arts and sciences' by Chrétien Frederic Guillaume Roth from *Encyclopédie* by Jean le Ron d'Alembert and Denis Diderot (1780)

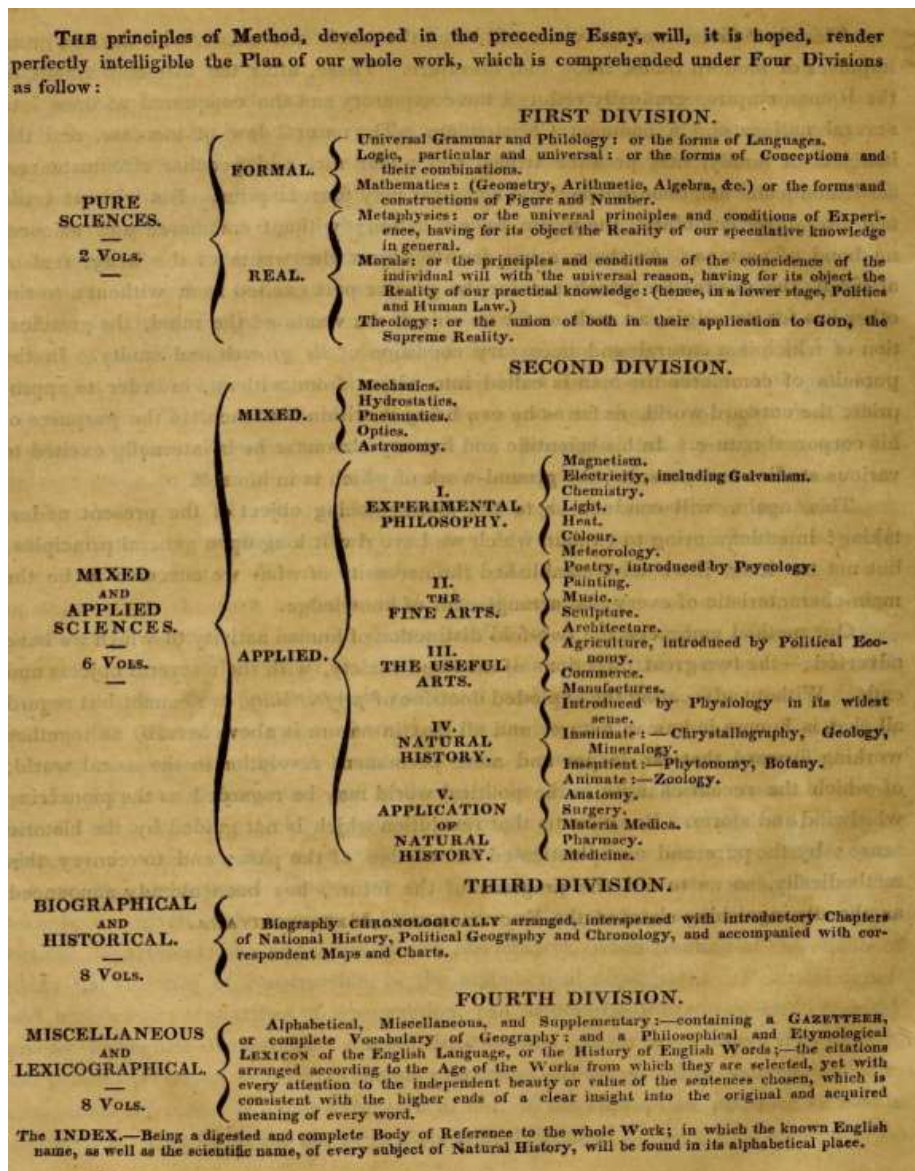


Figure 57 Encyclopædia Metropolitana, Methodology of Classification of Sciences, Samuel Coleridge (1818)

2.5.2. The Classical or Enlightenment Episteme:

The classical episteme, spanning the period we call The Enlightenment or the great 'Age of Reason', is widely celebrated in Western European culture as the foundation of the 'modern world'. It is remembered as a period of rigorous scientific research, as centuries of esoteric thinking were cast aside for modern philosophical

discourse, exploration, individualism and greater intellectual tolerance. The period saw considerable advances in industry, medicine and politics (British Library, 2018).

The classical episteme was the period of empirical knowledge. The Renaissance fascination with symbology and ordering of the world through complex interwoven relationships, resemblances and affinities was now perceived as confused and disordered. Knowledge was based on observation and experience was analysed in terms of order, identity, difference and measurement (Foucault, 1970, p. 52). The basis of knowledge had transformed from relating things to one another through comparisons to discriminating and establishing identity based on difference. During the classical episteme, knowledge was organised, collection objects were separated based on material and visual difference and classified using hierarchical branching tree structures. Foucault refers to the beginning of the classical episteme as the 'age of the catalogue' (Foucault, 1970, p. 131). The 'age of the catalogue' was not just a new way of seeing and articulating knowledge, but a new way of making knowledge through tabulating and fixing history. Hooper-Greenhill explains:

"The circular relationships of resemblance, infinitely variable, and often personal, are replaced by a tabulated, documented, limited canon of order. The dynamic potential of relationships between things and of new ways of interpreting things would vanish in the two-dimensional epistemological space of the 'museum', along with the words that had formerly contextualised material things. Things which had been displayed together to demonstrate the variety and richness of the world would now be displayed apart, linked not to something dissimilar through hidden resemblances, but to something that had the same morphological features, that looked the same, and could be classed in the same family or species." (Hooper-Greenhill, 1992, p. 140)

The catalogue, and science of cataloguing, marked a key moment in the formation of the museum infrastructure. The behind-the-scenes mechanism of the

museum in which curators classified objects, people and experience, creating their own vision of history, was established.

During the seventeenth century, the fashion for collecting grew among European nobility, and the aspiring bourgeois, as societies and institutions began to assemble large collections (Impey & MacGregor, 2017). Founders of the Royal Society (1660) were ambitious in relation to their collections aspiring to a 'complete' collection, one that would enable the construction of a universal taxonomy and accurately mirror the order of nature (Hunter, 2017). Objects would be displayed together in series of things that were visually similar (for example, see figure 58). Different items were organised into separate and siloed collections. A Renaissance museum, or cabinet, would have paintings positioned next to natural specimens, next to stone carvings, next to written text etc. Whereas, in seventeenth century museums, objects would only be stored and displayed with others of its type. The combined display of fish and portraits would be viewed as irrational and something to be avoided (Hooper-Greenhill, 1992; Vander Wal, 2004). So the subject specialisms and the collections we recognise today (fine arts (paintings), fine arts (sculpture), applied arts (ceramics), applied arts (glass), furniture, science, industry, social history etc. etc.) were formed (see figure 59). A complete collection became the ultimate goal of a museum. No longer would medals and coins be displayed with sculpture, as the collection as a complete system was prioritised over individual items. In the drive for completeness, paintings were 'formatised' by being cut down, or extended, to fit into space that was available in the formal system of display (Bazin, 1967). In the same way that paintings were viewed as a series, or as elements making up part of a whole, fragments were not acceptable, and sculptures and other objects were completed

(Bazin, 1967, p. 89). Replicas were used to form complete representations as the idea of a complete series took precedent over the authenticity of the items in it (ibid, p.116).



Figure 58 The Imperial Gallery in Prague, by Johann Bretschneider (1715)

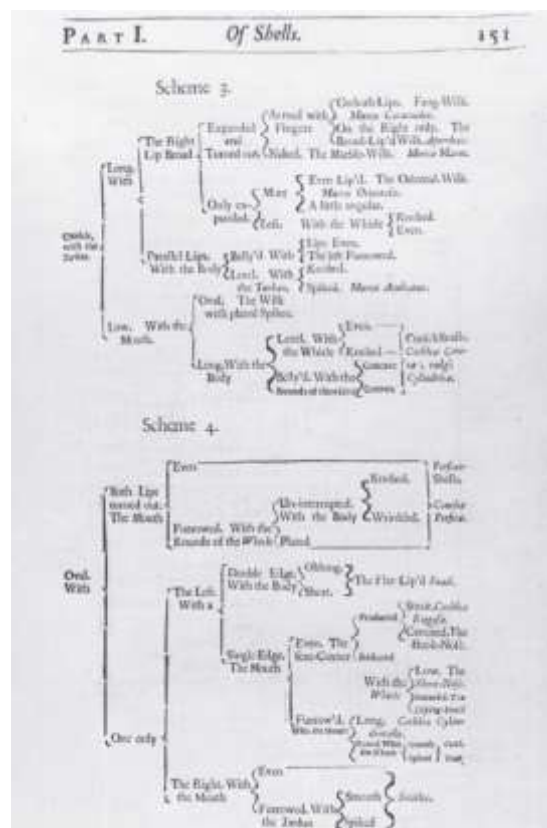


Figure 59 Page from Crew's Musaeum Regalis Societatis (1681)

2.5.3. Discriminating Hierarchies

The Enlightenment remains widely appreciated as a progressive era, seeing major advancements in scholarship, our understanding of the natural world, and in ideals of liberty, freedom and equality. The principle of ‘freedom of thought’ was the philosopher Kant’s foundational ‘enlightenment’ ideal. In 1784, Kant published the essay “Answer to the Question: What is Enlightenment?” in which he wrote, “Enlightenment is man's emergence from his self-incurred immaturity”, Kant declared that enlightenment was ‘nearly inevitable’, if only the public were ‘allowed freedom’ and that ‘enlightenment requires nothing but *freedom*’ (Schmidt, 1989). Kant’s vision of Enlightenment was predicated on the belief that freedom to exercise reason was a ‘fundamental characteristic of humanity’, yet, as in Margot Finn explains²², this characteristic was not extended to all of humanity. Kant’s writings on non-Europeans and women²³ denigrated them and their supposed ‘inability to reason’. Contemporary historians and thinkers have written extensively on the central tension in Enlightenment treatises between elevating universalism and views on gender or race-based difference – e.g (Painter, 2010; Knott & Taylor, 2005; Finn, 2020; Delbourgo, 2019; Wilson, 2008).

²² Margot Finn’s Royal Historical Society Presidential Address (2019) on the Enlightenment Museum and Colonialism.

²³ These essays included *Of the Different Races* (1775), and *Determination of the Concept of Human Race* (1785). Based on his essays many scholars, including Theodore Vial in *Modern Religion, Modern Race* (Oxford, 2016), credit Kant as “inventing” the concept of race.

Many of those Enlightenment scholars who advocated for equality invented a new discourse using hierarchical models of classification and encyclopaedism to invent modern racial classification. Encyclopaedias including Chambers Cyclopaedia (1728) and Denis Diderot and Jean le Rond d'Alembert's Encyclopédie (1751) use physical features to categorize humanity into novel 'racial groups' in a discourse imbued with Eurocentrism and spurious moral judgements (Vartija, 2021). Through their use of hierarchy and tree schema as a tool for attempting new understanding of the position of humanity in a long natural history under the auspices of science (see figure 60), Enlightenment scholars created the means by which humans were discriminated against, subjugated and enslaved. Key Enlightenment and imperialist scientists used the tree diagram to promote theories of white supremacy and structured classification of inferiority through hierarchical studies of humans (Weikart, 1993; Sussman, 2014, p. 40). The desire to manufacture hierarchical orders for humans that favoured the white European authors, fuelled colonialist policies and were used to justify global atrocities (Sussman, 2014). Theories including the 'Degeneration Theory of Race' created our notion of race today and its continuing violence is felt throughout the world.

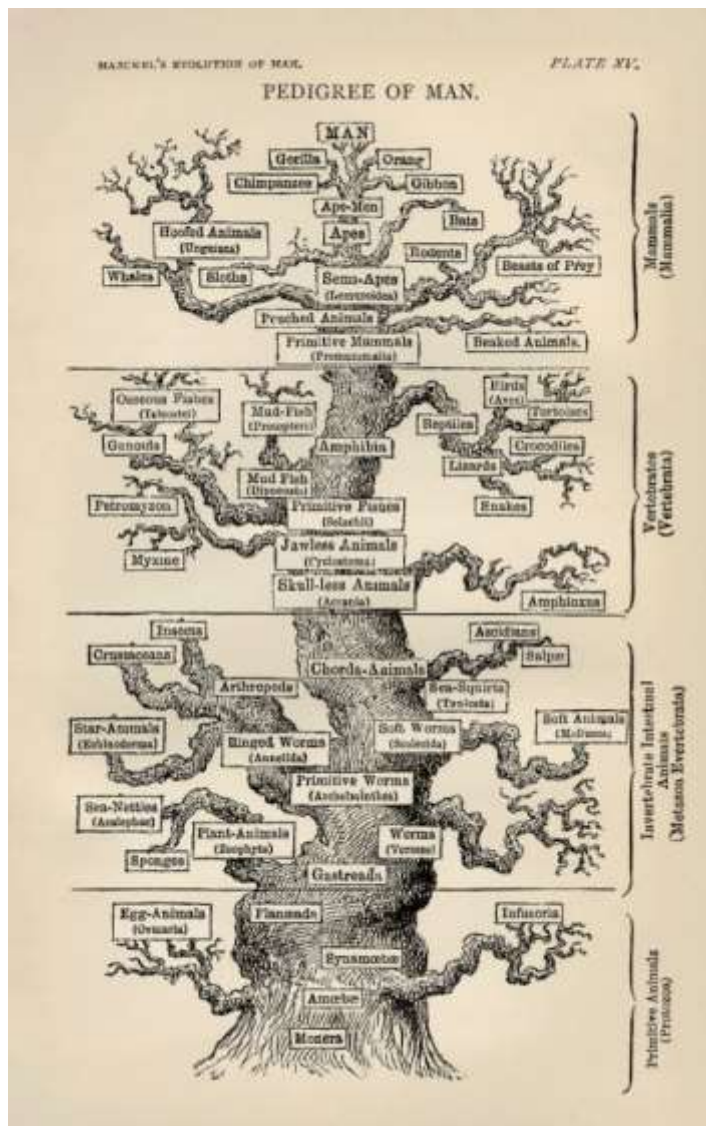


Figure 60 Ernst Haeckel, *Pedigree of Man*, (1879)

2.5.4. First Public Museums:

The Enlightenment period saw the establishment of the first public museums (e.g. The Ashmolean and British Museum). It was the period in which great histories were written and museums were flooded with objects (Bazin, 1967 p.7). The repository of the Royal Society shifted in collection practices, from private to public, which gave a sense of permanence to their intended reform of knowledge through developing a 'complete' history. Hooper-Greenhill explains:

“This reform of knowledge was seen as an instrument to create a new ‘truth’, a cutting tool appropriate for a new episteme. A new rational language was to be created that would enable the new rational ordering of things.” (Hooper-Greenhill, 1992, p. 145)

Enlightenment museums were physical, material and organisational structures designed to elicit the free, public exercise of reason through scientific scrutiny of global material cultures (Anderson, et al., 2004; Sloan, 2004). This marked a transitional point between the ‘curiosities’ of the private cabinets and educational mission of the public institutions. However, the museum retained the sense of spectacle the ‘cabinet of curiosity’ afforded (Stafford, 1994, p. 223). The museum was a “stage of marvels and spectacle of rarities”, a “three-dimensional encyclopaedia of curiosities” based on a “visual polymathy” were the notion of the “voracious gaze was first unleashed in the galleries”. (Stafford, 1994, p. 225). Visitors were eager to see the ‘new discoveries’ made by European colonisers and ‘exotic’ artefacts from foreign cultures. The museum was both a place of specialist study and a “spectacle” for the visitor giving the museum the dual function of public entertainment and research (Stafford, 1994). The museum gave legitimacy to the collection and the importance afforded to public education in new scientific theories of the time. Whereas private cabinets owned by individuals were at risk of dispersal after the owner’s death, institutional museum collections gave the potential of indefinite continuity and growth (Hunter, 2017, p. 159). The museum (and museum catalogue) became the architecture for fixing physical knowledge into institutional and publicly recognised taxonomies and narratives.

Renaissance dreams of universal knowledge by assembling the world in microcosm inspired Enlightenment collectors. However imperialism was the political and economic structure through which museum collections were assembled (Finn,

2020; Delbourgo, 2019). Wealthy European consumer culture intrinsic to Grand Tourism, growth in global trade and warfare, and widespread interest in natural sciences drove a fashion for amassing grand collections. Imperialism and the 'successes' of the East India Company and the Trans-Atlantic Slave Trade were central facilitators of this zealous collecting trend. Predatory collectors used the wealth from, and the new trade routes developed through, colonisation to excavate, purchase, loot and con items from across the globe. Bringing these artefacts home to recontextualise them in order to fit into a narrative of European cultural and technological progress and white supremacy. It can therefore be understood that museums were established on the fundamental Enlightenment tension between universal access to knowledge and the deployment of discriminatory human classification to degenerate and erase non-European, non-male, and other non-normative people.

The materiality of objects housed in museums provided empirical basis for nineteenth century notions of civilization as material progress. Museum curators could study the fabric of objects and classify and order them into taxonomies, appearing to work objectively by basing the 'level' of civilised progression on a Eurocentric view of material complexity. Order was imposed on heterogeneity as the artefacts removed from diverse and complex cultures were recontextualized and imprisoned in fixed narratives of Western cultural supremacy (Witcomb, 2003, p. 102). Bennett writes:

"The emergence of a historicized framework for the display of human artefacts in early-nineteenth-century museums was thus a significant innovation... the emergence of a 'historical frame' for the display of museum exhibits was concurrent with the development of an array of disciplinary and other practices which aimed at the life-like reproduction of an authenticated past and its representation as a series of stages leading to the present - the new practices of history writing associated with the historical novel and the development of history as

an empirical discipline... constituted a new space of representation concerned to depict the development of peoples, states, and civilizations through time conceived as a progressive series of developmental stages.” (Bennett, 1988, pp. 88-89)

2.5.5. Grand Narratives:

The Museums Act 1845 was an act of UK parliament act which gave town councils the power to establish museums. The act arose out of middle class Victorian paternalism, rather than a demand from working class people, to promote ‘morally uplifting activities’ for people to do in their spare time. A distinction can be made between previous ‘curious’ museum displays to ordered and educational displays aimed at promoting social order and rationalism based on specialisation and classification (Bennett, 1995). The Victorians established and educated the public on British values based on ‘grand narratives’. Grand narratives are pervasive throughout museums alongside arts and humanities education. For example, the aim of the chronological ‘hang’ of art in museums is to show the progress of art from ‘master to master.’ Many art critics and museums curators of the 19th and 20th centuries were intent on creating aesthetic hierarchies to prove the superiority and value of types of arts over others, including Greenburg’s distinctions between ‘high’ and ‘low’ art (Authur, 2004) and Alfred H. Barr, Jr., the founder of the Museum of Modern Art, New York, 1936 catalogue for *Cubism and Abstraction* in which he attempted to hierarchically prove that abstraction was an “inherent and crucial part of the development of modern art” (Lowry, 2012, p. 358) (See figures 61-63).

The shared ideologies of taxonomy and Eurocentrism across many of the West’s largest institutions creates a rigid form of art history in which the curators’

roles is to fill perceived 'gaps' in the telling of this history, leaving the encyclopaedic narrative more comprehensive than they found it. Art history, as a discipline, secured the power to create and control its own borders, to acknowledge or disallow people and objects, and to consequently transmit values to others (Nelson, 1997, p. 28). With current campaigns to include more diverse artists in this framework, these artists become tagged as spokespeople for a 'group' and imposed classification of 'otherness.' The 'story of art' metanarrative subsumes all art, converting artworks into symbols of their cultural moment on the timeline. The discussion of the chronology of art history is a critical debate amongst art educators and institutions. The Tate Modern famously subverted the schema with its thematic hangs, yet as the 'story of art history' is so ingrained into Western arts education and our experience of the museum, it feels controversial to criticise it.

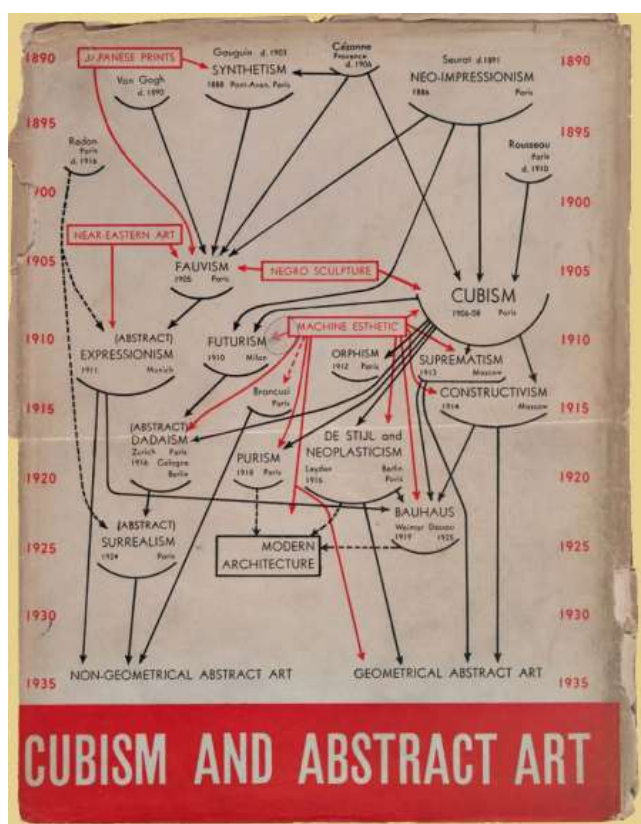


Figure 61 The catalogue for Cubism and Abstract Art, an exhibition at The Museum of Modern Art, March 2nd – April 19th, 1936, organised by the museum founder Alfred H. Barr. Cited in (Lowry, 2012, p. 358)

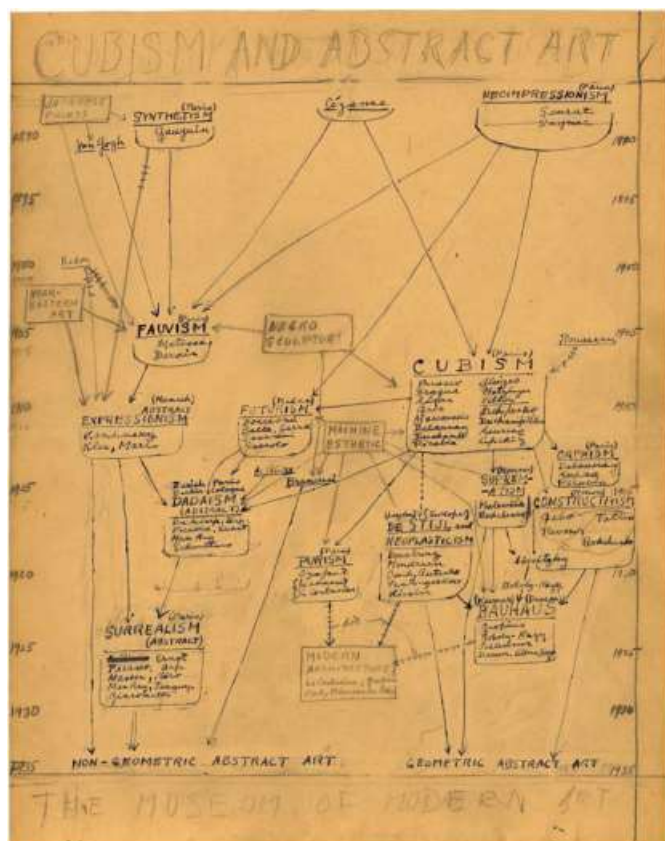


Figure 62 Hand-drawn draft of the previous figure diagram from the *Cubism and Abstract Art* catalogue 1936 by Alfred H. Barr Jr. Cited in (Lowry, 2012, p. 362)



Figure 63 Miguel Covarrubias, *The Tree of Modern Art – Planted 60 Years Ago*. Published in *Vanity Fair* 40, no.3 (May 1933). Cited in (Lowry, 2012, p. 363)

2.5.6. Criticism of Trees:

“We’re tired of trees. We should stop believing in trees, roots, and radicals. They’ve made us suffer too much. All of arborescent culture is founded on them, from biology to linguistics. Nothing is beautiful or loving or political aside from underground stems and aerial roots, adventitious growths and rhizomes.” (Deleuze & Guattari, 1987, p. 15)

Despite its iconic appeal and its use in multiple applications and diverse types of organisational contexts, the tree faces criticism. The rigid, hierarchical and centralised nature of its structure and the authoritarian character of tree metaphors has led philosophers, scientists, designers etc. to look for new schemas to reflect our modern experience of the world.

In 1948 Weaver published an article in *American Scientist* that discussed the problems of simplicity and the rigidity of the tree metaphor to modern science.

Weaver states:

“The significant problems of living organisms are seldom those in which one can rigidly maintain constant all but two variables. Living things are more likely to present situations in which a half-dozen, or even several dozen quantities are either non-quantitative, or have at any rate eluded identification or measurement up to the moment. Thus biological and medical problems often involve the consideration of a most complexly organized whole.” (Weaver, 1948, p. 536)

Lecointe and Le Guyader (2001), in their book *The Tree of Life* describe some of the issues with the tree structure in the study of biology. Two issues are those of Finalism and Essentialism. Finalism envisages a world in which everything flows towards a fixed goal and historically places ‘man’ at the top of the evolutionary tree, indicating that “evolution is mysteriously drawn towards the emergence of man.” (Lecointre & Le Guyader, 2001, p. 17) Essentialism is the view that every entity has a

fixed set of attributes essential to their being and that those attributes assign the entity to a precisely defined group. It suggests beings are absolute and “constructs entities *a priori* and forces the reality of living things to fit this form” (ibid). The view that human history is progressive, and our endeavours ‘flow towards a fixed goal’ is attractive in mapping historical influences and the technical progress of people.

With growing amounts of knowledge across disciplines, and a growing awareness of nature’s complexity and richness, “the great chain of being succumb[ed] to its own weight” (Broberg, 1990, p. 70). The systematic encyclopaedia, in the old sense of the universal circle of knowledge, was breaking up and impossible to maintain. There was a change in metaphors as knowledge trees and circles gave way to metaphors less apt for classification, such as “map” or “net” (ibid). Knowledge constructs changed from geometric to algorithmic, as “stable structures mattered less than quick, irregular information” (ibid).

The tree metaphor is important for multiple applications, including file storage and tracing family history, the Tree of Life metaphor also holds great cultural significance for communities around the world. However, every metaphor has its limits. The restrictive nature of the tree structure cannot reflect the growing amount and complexity of knowledge in the information age.

2.6. Key points, Trees:

- The tree schema is arguably our oldest framework for knowledge, its symbolism permeates cultures around the globe, and its cultural significance should not be underestimated.

- The tree schema was used by Enlightenment thinkers, scientists and museum curators to tabulate and fix knowledge into 'great mechanisms'.
- Things that did not fit onto recognised knowledge tree schemas were either altered to fit or discarded.
- Museums used tree schemas to develop and impose grand narratives, showing the progress of subjects e.g. the history of art as a series of movements.
- Trees schemas are now recognised for their rigidity and lack of coherence within modern frameworks of networked and interconnected knowledge.

2.7. Networks

Manual Lima defines networks and 'Networkism' as the cultural meme of contemporary knowledge visualisation (Lima, 2013), and marks a shift in how we represent knowledge. He claims we are shifting from the core metaphor and knowledge organisation schema of the 'Tree of Life' to the 'Web of Life' (ibid). Lima describes the network as the dominant visual taxonomy for contemporary culture as it evokes complexity, decentralisation, interconnectedness, multiplicity and non-linearity.

2.7.1. Postnormal times, Visual Complexity and Networks

We live in what Ziauddin Sardar calls "postnormal times", an "in-between period where old complexity, chaos and contradictions", as the "spirit of our age, is characterised by uncertainty, rapid change, realignment of power, upheaval and chaotic behaviour" (Sadar, 2010). 'Old' or 'normal' science and culture with its "reductionist, analytical worldview which divides systems into ever smaller elements, studied by ever more esoteric specialism" (Funtowicz & Ravetz, 1993, p. 740) are now being replaced by science that recognises the complexity of the natural world (ibid).

The tree metaphor for knowledge is too rigid for the complex connectedness of contemporary society (Lima, 2014). The tree represents centralization,

authoritarianism and essentialism. The complex interconnectedness of modern times requires a new knowledge metaphor – the network (ibid).

Networks are structural organisation systems that pervade almost every subject, including social communication, neuroscience and computing (ibid). Lima argues for network thinking:

“The complex connectedness of modern times requires new tools of analysis and exploration, but above all, it demands a new way of thinking. It demands a pluralistic understanding of the world that is able to envision the wider structural plan and at the same time examine the intricate mesh of connections among its smallest elements. It ultimately calls for networking thinking.” (Lima, 2014, pp. 45-46).

Manuel Castells, in his book *The Rise of the Network Society* (2010), argues that space in a social form is not a tangible reality but a concept constructed on the basis of experience (ibid, p. xxxi); and that telecommunications and online information systems have allowed us to communicate simultaneously transforming the spatiality of social practices. This new form of spatiality he calls the *space of flows* (ibid, p.xxxii). Castell argues that:

“networks have become the predominant organizational form of every domain of human activity [...] communication technologies have constructed virtuality as a fundamental dimension of our reality. The space of flows has taken over the logic of the space of places, ushering in a global spatial architecture of interconnected mega-cities, while people continue to find meaning in places and to create their own networks in the space of flows” (Castells, 2010, p. xlix).

Knowledge that once existed in the logic of the ‘space of places’ is now generated in ‘space of flows’ and with it the shift in focus of knowledge production and management has moved from the physical to the digital. This poses a significant challenge to museums as the model of the museum is to store knowledge physically in

a physical space. Knowledge has generally been bound by its medium (Weinberger, 2012) and when the medium is physical (e.g. paper, books, canvas, clay etc.) that knowledge cannot easily be changed or edited and its permanence commands authority. The physical output acts as a finite vessel for knowledge which museums and libraries keep. Knowledge in museums and libraries is organised to fit that space and hierarchically structured to enable easy retrieval. For example, there are physical limitations on the amount of items that can fit into one space, and curation or filtering is influenced by those limitations. To retrieve knowledge within a physical space, objects would need to be organised into sections via classification like material, size, subject, discipline.

Another metaphor, closely related to the network, is the rhizome. First proposed by Deleuze and Guattari, in *A Thousand Plateaus: Capitalism and Schizophrenia* (1987), the rhizome responds to the need to recognise complexity, multiplicity and multilinearities in knowledge systems:

“To these centered systems, the authors contrast acentered systems, finite networks of automata in which communication runs from any neighbor to any other, the stems or channels do not preexist, and all individuals are interchangeable, defined only by their state at a given moment—such that the local operations are coordinated and the final, global result synchronized without a central agency.” (Deleuze & Guattari, 1987, p. 17)

The Rhizome model has had a significant impact on postmodern thinking in various subject areas from complex systems theory to non-linear narrative. The most prevalent demonstration of the theory is hyper-text – the fundamental building block of the World Wide Web, arguably the largest man-made rhizomatic structure. In his

original proposal for the World Wide Web, developed at CERN, Sir Tim Berners-Lee

recognised the problems with tree-structured organisational systems. He wrote:

“Many systems are organised hierarchically. The CERNDoc documentation system is an example... A tree has the practical advantage of giving every node a unique name. However, it does not allow the system to model the real world.” (Berners-Lee, 1989)

For his solution for this problem of rigidity, he proposed the emerging technology

Hypertext²⁴, he wrote:

“A web of notes with links between them is far more useful than a fixed hierarchical system. When describing a complex system, many people resort to diagrams with circles and arrows. Circles and arrows leave one free to describe the interrelationships between things in a way that tables, for example, do not. The system we need is like a diagram of circles and arrows, where circles and arrows can stand for anything. We can call the circles nodes, and the arrows links.” (Berners-Lee, 1989)

Berners-Lee’s World Wide Web (Web) has evolved into an open, decentralised and globally distributed data sharing network that links people, organisations and ideas.

Along with the success of this invention our understanding of knowledge has changed from fixed to open, negotiable and collaborative. On the Web, reading became “browsing” or “surfing” and the user was transported across multiple pages of text, along pathways generated by large collections of hyperlinks. Hyperlinks were not generated by a single or small group of people, but millions of authors linking to one another’s work (Halavais, 2008, p. 42). Research and learning in the information age

²⁴ The earliest versions of Hypertext and Hyperlinks that we would recognise today were developed by Ted Nelson and Douglas Engelbart, Nelson’s Project Xanadu set out to create a new, associative way of organising knowledge (Halavais, 2008).

involves traversing networks in the “space of flows” rather than in fixed physical spaces.

The first generation of the Web (Web 1.0) consisted primarily of browsing web pages, connected through hyperlinks, allowing users to move instantly from one resource to another. This experience was similar to visiting a library – except that the whole library was in your living room. You might remember saying something like, “I am going on the Internet” - the internet being a separate place only accessible by a computer, fixed by a phone line at one point in a room. The library was an archetypal metaphor for the early internet (Stefik, 1996; Wyatt, 2021). Like our experience of actual libraries and museums, the Web was considered a place, an alternate reality or ‘cyberspace’, set apart from everyday life.

Our current Web (Web 2.0), often referred to as the Social Web, involves a shift in our experience from the virtual library to the ubiquitous data sphere, made possible by internet connected mobile devices. The term Web 2.0 was introduced by Darcy DiNucci (1999) in her article *Fragmented Futures*: “The Web will not be understood as screenfuls of text and graphics but as a transport mechanism, through which interactivity happens.” The Internet has therefore shifted from a "collection of hyperlinked documents to a hyperlinked Web of Data" (Ding, 2009). The social aspect of Web 2.0 encompasses websites and platforms developed to facilitate and foster social interactions and collaboration. These social interactions form the basis of much online activity including social networking and media sites, blogs, wikis, gaming, education and ecommerce. The user is not limited to browsing Web 2.0 but is an active participant, content creator, and sharer of information.

The hyperlink has also evolved from the highlighted blue text embedded in webpages to in-line links, social tagging, APIs, RSS data feeds, heat mapping, and links that are not based on individual nomination but by aggregation of opinions; for example, Google's search algorithms calculates the popularity of a website, pushing it higher in the search rankings, based on (among other things) the number of linked sites (Turow, 2008, p. 3). Machine learning is providing new types of links based on new technologies including image recognition. With these new forms of linking technologies and a need to sift through ever growing amounts of linked information, questions of fairness in and commercialisation of filtering come to the fore. As Turow says in his introduction to the book *The Hyperlinked Society* (2008):

"For links are not only ubiquitous; they are the basic forces that relate creative works to one another for fun, fame, or fortune. Through links, individuals and organizations nominate what ideas and actors should be heard and with what priority. They also indicate to audiences which associations among topics are worthwhile and which are not. Various stakeholders in society recognize the political and economic value of these connections" (ibid, p. 4).

Through advancing machine learning methods, links are constantly being created between individuals and peer groups through actions taken in networked media, as recommendation systems personalise our experience of information or knowledge on the web. A wide range of critics are illuminating the flaws of a highly interconnected society and the impact of both mainstream and non-establishment digital media exploiting links to gain influence through amassing large amounts of followers by "producing content that reinforces, rather than challenges, their shared points of view" (ibid). More and more, we see evidence of people tending to use the large amounts of information on the web to commune with people who hold similar

world views. Rather than seeking multiple opinions, people tend to visit the same sites, unwittingly narrowing their world view. With the advent of social media and predictive AI technologies, our news now comes to us through networks of likeminded associates and algorithmically generated news feeds. Turow argues that “any discussion of how to promote a healthy society offline as well as online must therefore pay close attention to links” with an aim to “facilitate the widest possible sharing of varied, reliably sourced information in order to encourage specialized groups and society as a whole to confront their past and present in relation to the future” (ibid).

Museums have been experimenting with personalisation systems through the development of museum mobile and web apps that gather user behaviour data, and based on data analysis recommend specific objects and tours. The *Rijksmuseum Amsterdam* has been experimenting with personalised services motivated by a concern that visitors are dealing with “growing information overload” (Aroyo, 2007) due to the scale of collection information offered physically (in the museum) and digitally on their collections website. The research hopes to allow the museum to “maintain a close relationship with its audience – seamlessly fusing the museum experience with the everyday reality of the visitors” (ibid). However museums that use these kinds of data gathering and personalisation technologies must recognise that “personalisation practices shapes and limited the information the individual is exposed to” (Anderson, 2020, p. 17) and this limiting can impact the ability of the visitors to critically engage with new works and debates that may alter their preconceptions and established ways of thinking. The ‘echo chamber’ created by personalising and social media technologies is changing the way visitors engage with museums and museums engage with visitors. Museums engaged in this type of data gathering activities,

moving towards a data-driven infrastructure, are engaging with the tools of “surveillance capitalism” which “aims to predict and modify human behaviour as a means to produce revenue and market control” (Zuboff, 2015). One of the most visible and disturbing outcomes of this predictive experience and information narrowing, is a growing lack of trust in opinions that differ from our own and that of our demographic network. In this context misinformation spreads easily and trust in public knowledge institutions, like museums, is eroded. Anderson warns that:

“For museums, as institutions of knowledge and democracy, this crisis in epistemology is – and must be - deeply unsettling. Many of the once-trusted institutional mechanisms for establishing truth have come into question in light of deep complexity, even as sanctioned and institutional narratives have been contested.” (Anderson, 2020, p. 18)

A crisis of epistemology across all knowledge institutions must prompt museums to look for new and transparent ways to maintain and develop new knowledge. Internalist approaches to knowledge that claim authority based on institutional status lack power within a networked and highly connected online information infrastructure. Now claims must be traced through open research to have integrity in a hyper-connected knowledge landscape.

Internet user growth has been exponential, doubling approximately every 5.32 years (Zhang, et al., 2008). In 2021 there were 4.72 billion global internet users, 60.1% of the global population. In 2020/21 332 million people came online for the first time meaning that internet usage is growing by 7.5% per month. The average daily time spent on the internet by each internet user is 6 hours and 56 minutes and 92.8% of users are accessing the internet via mobile devices (Datareportal, 2021). Out of those internet users 3.6 billion were using social media – a number projected to increase to

almost 4.41 billion in 2025 (Statista, 2021; Johnson & Lakoff, 2003). Internet communities are also creating more new artefacts than ever before, on blogs and photo and video sharing sites. For example, as of May 2019, more than 500 hours of video were uploaded to YouTube every minute (Statista, 2021).

The internet is changing the nature of knowledge in the West. Historically, knowledge has been assumed to exist in an ordered and balanced system. For beliefs to join this system as 'knowledge', they must go through a process of observation and scientific reasoning before they are settled on, and when settled, change from 'unknown' to 'known'. For an idea to be regarded as 'known' it is fixed in some way, this could be written down and published, classified or catalogued. As beliefs change from 'unknown' to 'known', knowledge can be organised into a series of stopping points - e.g. a book that remains fixed until it is revised (Weinberger, 2012). In this system, knowledge has status, authority and longevity.

The internet is the new medium for knowledge, and knowledge will there take on the properties of that medium (Weinberger, 2012). The web is discursive, unsettled, and in a constant state of flux. Anyone can publish online and the value or veracity of knowledge on the web is in the act of disagreement and reaching consensus within communities of collaboration. Since the invention and wide spread adoption of the internet it is now far more likely that you will begin looking for knowledge by typing into a search engine. Knowledge on the internet is filtered by communities, based on links and recommendations. Knowledge on the internet is constantly filtered through communities of content creators, links and recommendation systems. This

filtering process is not reductive as it does not involve deleting other knowledge, rather knowledge is filtered forward (Weinberger, 2012).

Knowledge no longer needs to be physically retrieved or visited in an area of a building. Through fibre optic cables and WiFi networks, knowledge physically located around the world in datacentres and on hard drives can come to the user in seconds. Now anyone can publish to the internet, through collaborative or crowd sourced knowledge platforms like Wikipedia, or blogging sites and social media. Knowledge is validated on these platforms through community driven argument and consensus rather than curatorial expertise. A user engaging with the information provided, can look through the community discussion forums and comments and engage in wider discussion (see figures 64-66).

Nancy Proctor (2010), argues for reconceptualising the museum as a distributed network, structured in the non-hierarchical and distributed image of the internet. She argues that museums' approach to moving online has been to create a "multiplatform museum" or "spoke and wheel museum" model that uses the online services to share traditional museum information. In this model, the museum's communication with audiences is emanating out from a centralised point. She advocates that museums take a more radical approach which she calls the "distributed museum" model. The distributed museum model, inspired by communities of knowledge on the internet, moves away from notions of hierarchy or authority. She argues for a museum model that is conversational rather than didactic and transmissive. Knowledge in the distributed museum is open-ended, open to change and that can therefore stay relevant. Proctor writes:

“design based on the distributed network model turns visitors into curators and creators, docents and ambassadors for our museums by giving them the tools to contribute meaningfully to the development of the museum experience” (Proctor, 2010).

Online and distributed museums could allow for knowledge to be brought to the user from the far corners of the globe. Knowledge can, therefore, remain in its original context, but new virtual assemblages can be made by the user. Knowledge can be constantly formed and reformed based on an aggregate of multiple and diverse opinions. The potential exists for the web to offer museums a way out of the rigid and discriminatory arboreal model and create a new knowledge infrastructure that embraces the complexity of contemporary knowledge. This new knowledge medium could provide the means for collective and community driven heritage.

As Weinberger suggests of the Web:

“The Web is a potential that we’re actively creating and expanding. The potential is the sum of the relationships embodied in links. It is a potential we can traverse any time we’re near a browser. It is a potential that can be explored and “mined.” There is nothing “mere” about this potential. It is, so to speak, a real potential, existing and at our fingertips. Fundamentally, it is a potential for seeing how the world matters to others around the spinning ball we share.” (Weinberger, 2008, p. 189)

The museum draws a circle around knowledge, limited by the medium of knowledge on which it operates, the internet contains multiple and malleable interwoven circles in which knowledge is discursive and relational. Imagine the museum as a web, with nodes in the form of objects, interlinked by relationships with people, time periods and events. The web is constructed through contributions by the wider community, constantly forming new links, building a stronger web. Objects and links form and reform based on the lens through which they are viewed.

So what of the physical museum space in this new digital age? Museums provide boundaries for knowledge, a sense of scale and direction of travel. The complexity of rhizomatic models positions the visitor somewhere in the middle of knowledge, with a highly complicated and shifting topology. As knowledge has moved into 'the space of flows', knowledge in the 'space of places' still has the power to astound and inspire visitors. The museum as a knowledge monument, a place of reflection and immersion, is still a powerful vision. By augmenting the physical and monumental museum architecture with a new vision for knowledge, the space of places can flow with new knowledge.

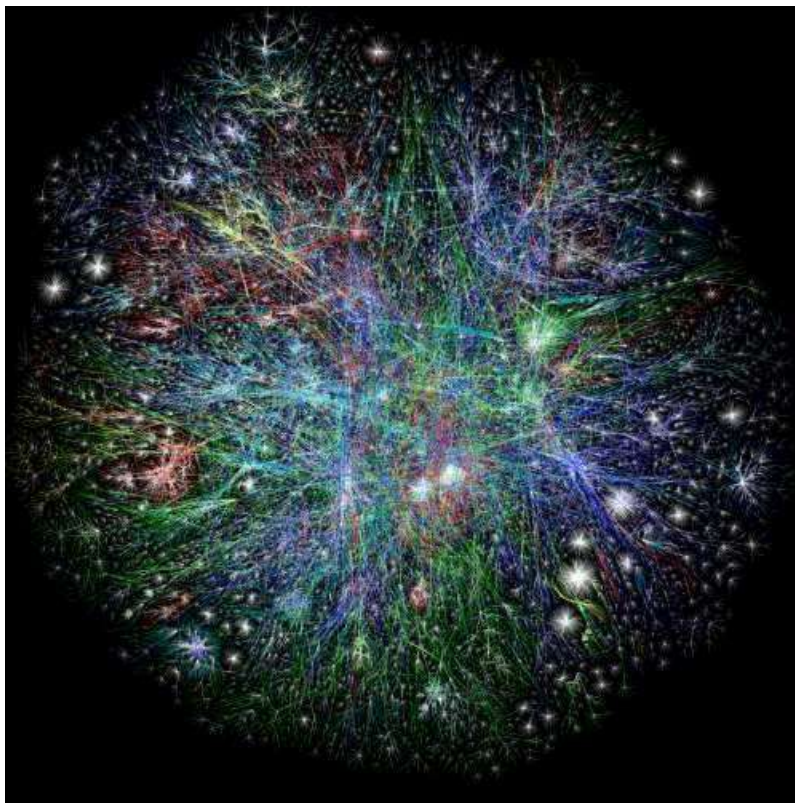


Figure 64 Visualisation of the Internet in 2003 as a complex network graph by The Opte Project (2003)

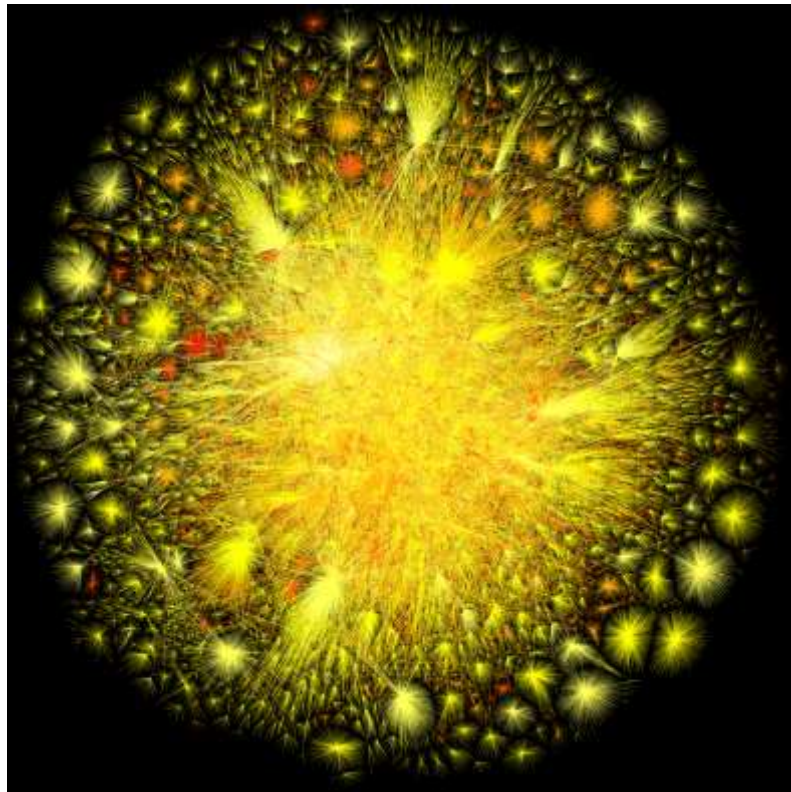


Figure 65 Visualisation of the Internet in 2010 as a complex network graph by The Opte Project (2010)

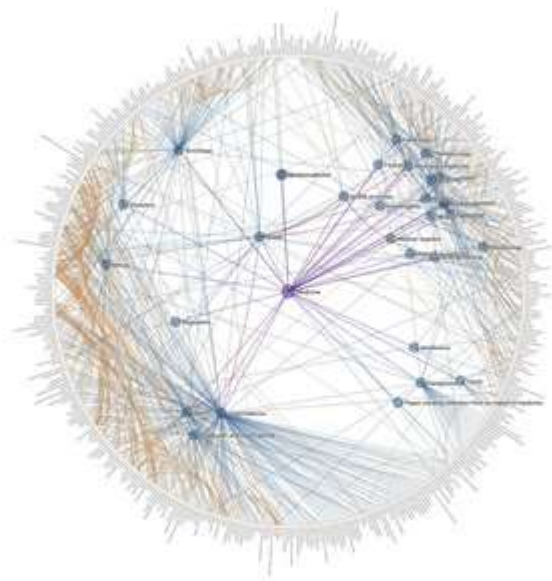


Figure 66 ClusterBall: Visualising Wikipedia, by Chris Harrison (2007)

2.7.2. The Modern episteme

“In the modern age, knowledge is no longer shaped by the secret, enclosed, circulating structures of the Renaissance episteme, nor by the flat, classificatory table of difference of the classical episteme; now knowledge is structured

through a three-dimensional, holistic experience which is defined through its relationship to people.” (Hooper-Greenhill, 1992, p. 214)

Foucault’s modern episteme is marked by the emergence of the human sciences, a science “understood as a form of knowledge which takes knowledge itself, and knowing, as problematic” (ibid, p.197). In this episteme, museum knowledge is not located on a table of objects organised via their materiality, but knowledge is found in human experience, and an object’s relationship to people becomes the focus. As Foucault says “it is no longer their identity that beings manifest in representation, but the external relationship they establish with the human being” (Foucault, 1970, p. 313). The modern age emerged at the beginning of the nineteenth century, however, developments in knowledge did not occur at the same time and in the same way across all knowledge institutes. This section follows Hooper-Greenhill’s framework, using the modern episteme to focus on present day museums (Hooper-Greenhill, 1992, p. 199).

Starting in the modern episteme, the world has been transformed by new phenomena including industrialisation, urbanisation, globalisation, demographic and cultural changes, and the massive impact of the invention of telecommunications, computing and the internet. These substantial changes demand that *a priori* assumptions about the way our society functions are interrogated. Through our networked culture we have become highly aware of complexity in the way we experience and understand the world. Our fixed ideas of hierarchical knowledge are being replaced by complex, shifting systems of thought that we must navigate on a daily basis.

Such complexities are challenging for epistemological institutions, like museums, whose traditional approaches to knowledge were informed by Enlightenment assumptions of systematic organisation of the world through classification and division of objects and phenomena into disciplines or areas of study. As Nicolas Poole writes:

“For centuries, the role of museums has been to digest complexity and express it as pattern. Whether it is a linear hang in an art museum, giving the impression of a coherent progression of art-historical movements or a social-historical display giving the impression of a singular ‘community’ with identifiably-shared beliefs and values — we are temples to the illusion of order and predictability in a complex and chaotic world.” (Poole, 2014)

Museum institutions, previously intent on timelessness, now find themselves in post-normal times (Grinell, 2014) in which a pressing need for acknowledging the complexity of heritage and cultural identity is vital for the future of museums (Bennett, 2004). Previous methods of fixing heritage into extremely limited and overarching narratives, no longer makes sense in a world where knowledge is networked, multifaceted and nonlinear.

Adaptive museum practices and ‘new museology’ reflect the ideological and epistemological shifts marked by the modern episteme, and Foucault’s analysis of the relationship between knowledge and power. For Foucault knowledge and power are intimately tied as power is based on knowledge and those with the power shape knowledge. There remains a concentration of power by institutions, like museums, where hegemonic production of knowledge is determined. Adaptive museums aim to place communities at the centre of curatorial decision making and promote participation in museum knowledge making practices.

As public institutions, museums are now finding themselves challenged to adapt to new complex modes of storytelling. Philosophical and political movements in the latter half of the 20th Century, including postmodernism, structuralism, feminism, civil rights and decolonisation, have challenged knowledge institutions to acknowledge and include diverse and pluralistic narratives within their walls by drawing attention to the hegemonic nature of history presented in museums (Anderson, 2020; Bennett, 2004; Hooper-Greenhill, 2000).

2.7.3. Folksonomies

“The future of the archive is itself a re-envisioning of the future of the museum. The future archive could even be more interesting, more radical, than the future museum. There is something that has become conventional about the relationship of the museum exhibition to its audience, whereas questions of access produce new relationships, new dimensions of affiliation and inspiration for an audience.” (Roth & Mostafavi, 2016)

First-generation online databases for museum websites are characterised by a “strict taxonomy of differentiating expert terms” used by curators to “slice and dice a collection’s records” (Parry, 2007, p. 55). With the advances of Web 2.0, and the social internet, museums are beginning to experiment with community curating and folksonomies. A folksonomy is a user-generated system for classifying and organising online content into different categories by users creating their own metadata, often through electronic tags. The tags were coined ‘folksonomies’ by Thomas Vander Wal as a way to identify this type of bottom-up classification system (Vander Wal, 2004). “Social tagging is one of the major phenomena transforming the World Wide Web from a static platform into an actively shared information space” (Ding, 2009, p. 2388).

Folksonomies provide a means via which to open up the process of classification and an opportunity for museums to move away from top-down taxonomies to bottom-up user-generated tagging. Tagging is a social internet (Web2.0) phenomenon that harnesses the power of crowds and diverse opinions to tag an item in a different way providing multiple access to resources (Ding, 2009, p. 2389) and was first used by social networking sites, including Flickr and YouTube (Huang & Chuang, 2009).

The development of online collection websites, linked to collection databases, has created another avenue for people to explore museum collections, however, without knowing museum terminology, finding the right search words to usefully explore often vast collections can be a frustrating experience for the visitor (Chun, et al., 2006). Online museum collection tagging systems, like Steve.museum (Chun, et al., 2006) allow users to tag images of collection objects using their own terms. These tags would then produce more terms for those searching a collection. An experiment in electronic tagging by the Metropolitan Museum of Art found that approximately 80% of terms submitted by the community were unique – and not used in the museum's documentation (Chun, et al., 2006). It is clear that the use of tagging enables much richer and usable search experiences for users and makes the museum database far more accessible.

The exploration of folksonomies in museums has the potential for great social value however community management and moderation are integral to the process to avoid breaches of trust. Traditional taxonomic structures take the form of tree-like structures, with information organised hierarchically along diverging branches (Weinberger, 2006). In the Enlightenment era of the first public museums, these

structures were used to universalise knowledge as a means to make sense of the natural world (Lima, 2014). In the 1930s a faceted classification system was developed as a more dynamic way of presenting information and allowing the access of information through a variety of paths. This hierarchical system does not rely on preordained branches for the ordering of information, but uses pre-defined terms for classifying and sorting objects. Both of these systems for knowledge management are top-down, centrally owned and rigid. They have been proved to be discriminatory and inflexible as records are held within siloed sub-sections of the collection and organised using biased language systems.

In opposition to the traditional tree taxonomic structure, David Weinberger proposes that folksonomies can be understood as 'piles of leaves' as data is arranged in non-hierarchical clusters of information (Weinberger, 2006). Folksonomies are user-designed and messy, made up of overlapping and ambiguous information. They are non-hierarchical collaborative systems similar to the concept of a rhizome by Deleuze and Guattari:

"unlike trees or their roots, the rhizome connects any point to any other point, and its traits are not necessarily linked to traits of the same nature; it brings into play very different regimes of signs, and even nonsign states... It has neither beginning nor end, but always a middle (milieu) from which it grows and which it overflows... When a multiplicity of this kind changes dimension, it necessarily changes in nature as well, undergoes a metamorphosis." (Deleuze & Guattari, 1987, p. 21)

Folksonomies are fundamentally social, and by developing a folksonomy approach to museum classification the museum can provide improved accessibility for visitors alongside a better understanding of their audience (Cairns, 2011). Current major museum classification schemes utilise a faceted and polythetic classification

approach, meaning that groups of objects share a large number of properties but do not necessarily contain a single property that is essential for that group (Sokal, 1974). The language used to classify an object is based on institutional significance and curator subject specialism. The object is classified based on predetermined and structured institutional vocabularies. The information provided in the catalogue is based on the collection in which the object is acquisitioned. For example, in the Museum Collection Storage facilities for Birmingham Museums Trust I located a Vest Pocket Kodak camera, commonly known as the soldier's camera, for its use documenting life in the trenches of the First World War. On looking at the camera in the collection database I could see it was donated by a member of the Cadbury family. The Cadbury family are a well-known Quaker family in Birmingham, known for their pacifism. They were instrumental in WWI for their contributions in the Friend's Ambulance Unit. However, because the camera was catalogued by the Science and Industry Curator, the language used relates to the engineering of the camera, and its social history was lost. Imagine what the holder of the camera saw. Did they feel compelled to record the suffering in the trenches? How would someone with a pacifist perspective record war differently from other documenters of the time? Fortunately, a folksonomy approach could allow the museum to regain a multiplicity of different interest points around this object creating a far richer historical data set.

While museum objects are acquired and catalogued with a particular institution reading in mind, visitors to museum exhibitions and online collections bring with them their own contextual understanding and interpretations. In a constructivist museum, learners are "not vessels waiting to be filled but autonomous agents with their own agendas" (Alberti, 2005, p. 569). Visitors view museum objects and records through

the individual lens of their own experiences and understandings (Hooper-Greenhill, 1999; Hein, 1999). In the process of social tagging, users are able to add their own words and meanings to the classification of museums' objects that reflect their personal experiences. While traditional museum classification taxonomies produce binary knowledge, the social and collaborative folksonomies reflect the polysemic nature of objects, and the multiple meanings they carry dependent on the apparatus or lens with which they are viewed.

By employing folksonomy methods of classification the museum can empower users inside and outside the museum to generate and contribute their own 'keyword indexing' (Chun et al. 2006; Chan 2007). Traditional top down taxonomies can now be connected to bottom-up folksonomies, and, in this new knowledge space museum, visitors become 'curators of meaning' (Pratty 2006). With these types of social documentation and fluid systems that break down disciplinary boundaries museums may become more comfortable with heterogeneity in collection management and exhibitions.

2.7.4. Online Museums

In Ross Parry's book 'Recoding the Museum' (2007), he explores the impact of computing on museums. He argues that while the introduction of databases to museum cataloguing processes had a hugely positive effect on collection organisation and accessibility, the standardisation of data that came with the move from curators' day books to databases did not reflect the complexity and range of vocabularies developed by different disciplines. The drive for standardisation included dictionaries

of 'approved words' and 'fields' to organise information within the system. Whereas previously curators were able to describe objects in ways that were meaningful to them and their discipline, the automated database system demanded a "less object-orientated and more systems-orientated approach" (Parry, 2007, p. 47). This imposed a new standardised taxonomy to the knowledge infrastructure of the museum, removing the curator's hand from the record and making each record appear anonymous and part of a more extensive commanding system.

Parry argues, "The computer-enabled systemisation of documentation in the 1970s was a rationalising discourse, aiming to bring order to the bricolage of the earlier twentieth-century curatorial practices" (Parry, 2007, p. 51). This new ordering aimed to simplify and condense hundreds of years of curatorial information into a single system. A system that made the behind-the-scenes infrastructure of the museum catalogue, with its millions of records, colonial and discriminatory history, global and given the authority of automation and the database.

"The collections search page of many museum websites, ostensibly unstructured and unmediated places online, create seemingly direct access to the museum collection and pose as authoritative documents rather than highly mediated or designed exhibits." (Turner, 2015, p. 6)

This enthusiasm for en masse online access to the catalogue has led to documentation standards in museums becoming the focus of critique (Parry, 2007). The authoritative status of the museum catalogue has been widely questioned as access to records, built on colonial collecting practices, join the networks of information available online. Databases hold great symbolic power in our modern networked society. As Bowker and Star argue: "Databases in our present information-

dependant and information saturated times are now argued to semiotically, materially and performatively order the world” Bowker has further suggested that “databases may be the most powerful technology in our control of the world and of each other” (Bowker, 2005, p. 93).

Lev Manovich calls the database “a new symbolic form of the computer age” (Manovich, 1999, p. 81), he argues that the online search engine and database provides a non-linear experience in which “the world appears as an endless and unstructured collection of images, texts, and other data records” (ibid). In this sense narrative holds a less privileged role in contemporary search for meaning. The infinite editability of the database, multiple routes for information to be navigated, and the lack of completeness make the database more than just a tool; it is the ‘symbolic form’ of the post-industrial age and a way of thinking. Parry uses Manovich’s notion of the symbolic importance of the database to reflect on how databases have changed modes of thinking in, and about, modern museums. Parry writes:

“Just as the database might be seen to serve as the synecdoche of modern life, so it has also embedded within the function and thinking of the modern museum. At present, the museum’s notion of ‘collection’ is not only structured to accommodate the tools of automation, but is imagined (and frequently presented to its publics) as a database. The logic of the database is now embedded within museums’ management of their collections. To a great extent the computer- oriented systematisation of documentation has led to an unprecedented fetishising of the museum database. Just as once it was the day book, today it is the database that is the metonym of the museum. It may certainly be true to say that at no other time, perhaps, in the history of the museum has its catalogue been avowed with such high status. The veracity of objects is today, seemingly, gauged by the extent to which they are recorded in the museum’s database.” (Parry, 2007, pp. 56-57)

The collections search page on many museum websites gives the user access to individual objects or records through keyword searching. This online resource appears

to give direct and unmediated access to the museum collection. Records are presented as authoritative documents rather than highly mediated or designed exhibits (Turner, 2015, p. 24). With the development and growing use of online museum collections websites and the sector's drive to digitise collections en masse, the museum catalogue (the internal mechanism of the museum) is now directly encountered by the public.

On The British Museum online collection website, users are able to view around two million records. Records are presented as individual pages with accompanying metadata, and the object's position within a collection is only known through its fields. It is here that we can begin to see the problems of information omitted, standardised or recorded through the lens of an individual working within institutional culture, but presented in an anonymised and authoritative form. Figure 67 is a screenshot taken from the first advertised image on the British Museum Collection launch page (The British Museum, 2020). The design, use of database fields and object number suggest the authority of the record. Figure 68 is a screenshot of the same page but further down the object information on the left. Here we see the field holding the name of the person who sold the object to the British Museum, Henry Salt. By clicking the link on Henry Salt's name we are taken to a description of him including academic references, see figure 69. This is all incredibly useful to the researcher and this online resource gives access to more collections information than ever before. However, what is omitted from the record is also interesting. Salt's role as an officer of the British Empire in procuring artefacts, including grave goods, is presented positively but there is no mention of the requests for the repatriation of these items by Egyptians, including President Gamal Abdel Nasser in the 1950s - a major figure in the call for global repatriation (Carruthers, 2019; Gold, 2019). Considering the curator found room

to include Salt's interest in portrait painting, I believe an important controversy regarding the 'procuring' of these artefacts should also have been included.

Moving collection databases online, for open-access research and public exploration, is a radical change in museum processes. The mysterious and revered curator's day book has been opened to the world and users from around the globe can explore diverse collections. However, the potential of this technical innovation has cast light on the discriminatory and limited quality of information within the catalogue. Our tendency to accept the authority of information presented in database form, cements the authority of museum knowledge rather than inviting us to question it.



Figure 67 a collections record of an Egyptian coffin from The British Museum Online Collection.



Figure 68 a collections record of an Egyptian coffin from The British Museum Online Collection showing the name of the person who sold the object to the museum and date acquired

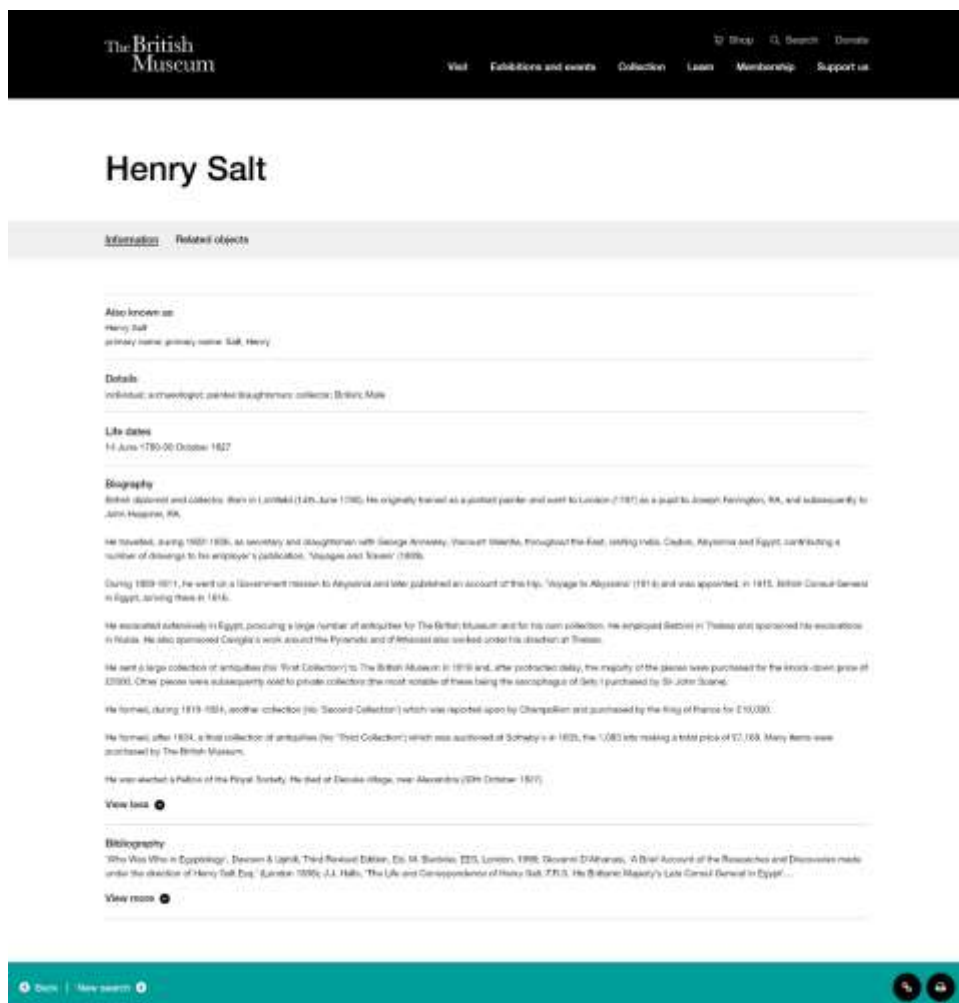


Figure 69 British Museum biography of Henry Salt, who removed artefacts from Egyptian graves and sold them for profit to The British Museum and other private collectors

2.7.5. The Museum without Walls

In the Information Age, the concept of the museum seems strange. To take artefacts from their home cultures or original contexts feels immoral. We no longer send research expeditions off and expect them to return home laden with the cultural artefacts or animal and plant specimens of a foreign land. Instead, they record and document what they see, transmitting the information home through broadcast and online media. With new technologies like digital photography, film telecommunications and the World Wide Web, the role of the museum as the 'cabinet of curiosities' appears redundant. Yet, our obsession with these treasure troves of objects remains. Researchers and practitioners are looking for new virtual technologies to create a museum fit for the contemporary world.

In his famous text *Le Musée Imaginaire* (1974) Andre Malraux envisions an imaginary museum that exhibits the world's greatest works of art under one roof, with no museum building or geographical constraints. He critiques the work of the art museum arguing "the modern art-gallery not only isolates the work of art from its context but makes it forgather with rival or even hostile works" (Malraux, 1974, p. 14) Malraux discusses the problem of museums removing artefacts from their original context, e.g. removing a statue from a religious site and placing it in a museum, permanently divorcing the object from its true purpose. He further argues that artefacts should not be decontextualized for the goal of promoting establishment ideals and grand narratives. He writes, "when painting is put to the service of a fiction regarded as a cultural value, art is inevitably called on to promote an established idea of civilization" (p. 89). Malraux's solution to this problem is using reproduction

techniques, including photography, to bring artefacts together in diverse personal, sharable, and portable collections (see figure 70).



Figure 70 Andre Malraux with his 'Museum without Walls', (1950)

Malraux's *Museum without Walls* was the precursor to many contemporary online museum initiatives, alongside trends for personal curation through digital photography and social media. His vision for a collection selected from all of the world's art is being realised through the current trend for museums moving collections online, alongside multiple new research and museum projects entitled 'Museum

without Walls'²⁵. British Council, Turkey's Arts team, has developed a series of curated online experiences using British Council Collections. They have titled this programme a "museum without walls" based on the fact that exhibitions are designed for "a virtual space that can be accessed by anyone having an internet connection" (British Council, 2021). The British Council's *Museum without Walls* platform encourages the use of emerging technologies and online access to cultural collections, to create a space for experimentation in curatorial practices and develop themed exhibitions that critically engage with debates in contemporary art and technology. This approach has returned surprising and inventive results. For example, the exhibition *Does it feel cosy?*, (see figures 71 and 72) uses a chatbot interface to gather information on user preferences to offer a curated exhibition experience of eclectic yet interconnected artworks looking at "female body, domestic space and planetary ecologies as sites of anxiety, rumination, and kinship" (ibid). While *Almost There* (2020) (See figures 73 and 74) takes users on a spiralling journey through artworks connected via emotional and political discourse on migration, displacement and kinship. The exhibition is engaging and emotional as the work transitions between feelings of 'displacement' and 'location'.

²⁵ Projects including UCL UMEUM.org <https://useum.org/>
Ross-on-Wye's virtual museum <https://museumwithoutwalls.uk/>
British Council's online exhibition platform
<https://www.britishcouncil.org.tr/en/programmes/arts/museum-without-walls>

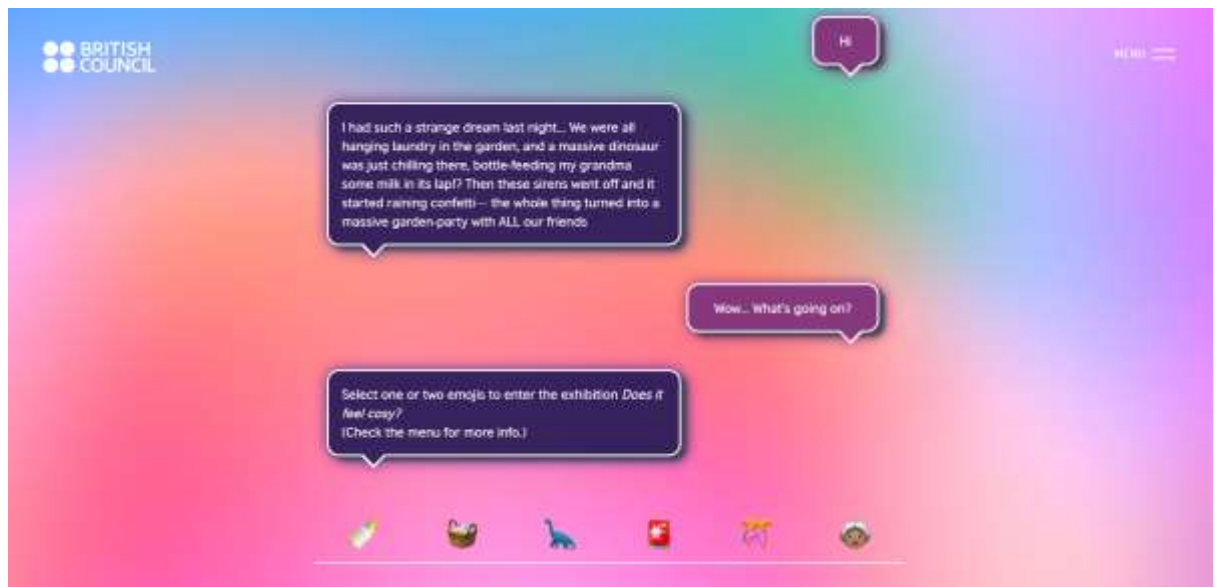


Figure 71 British Council Turkey, Museum Without Walls, Does it feel cosy? Rita Aktay, Rikita Biswas (2021)

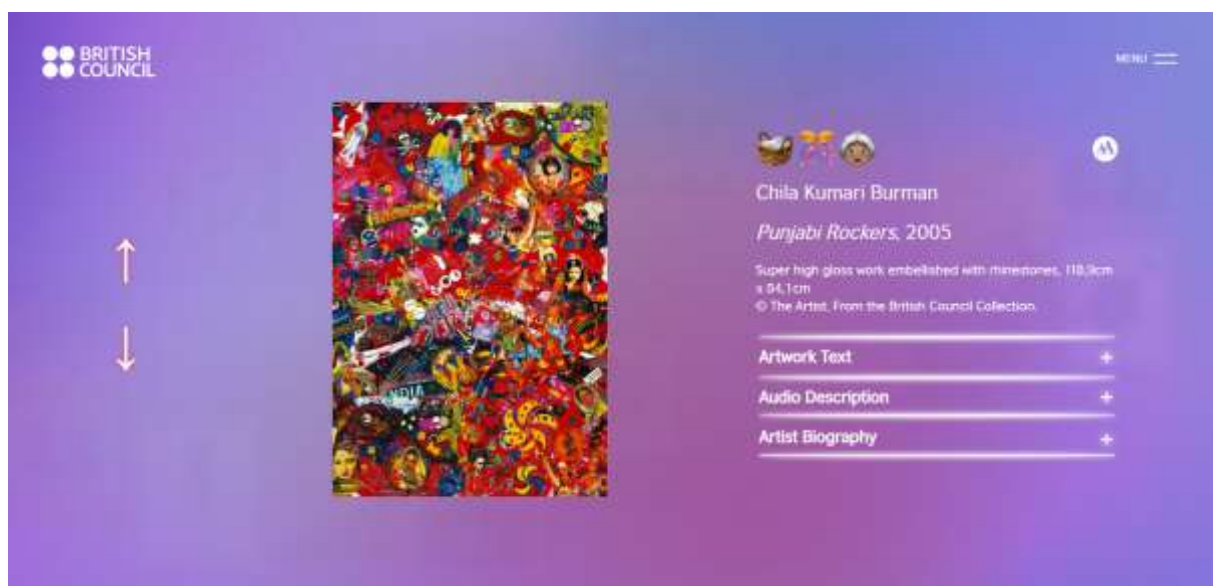


Figure 72 British Council Turkey, Museum Without Walls, Does it feel cosy? Rita Aktay, Rikita Biswas (2021)

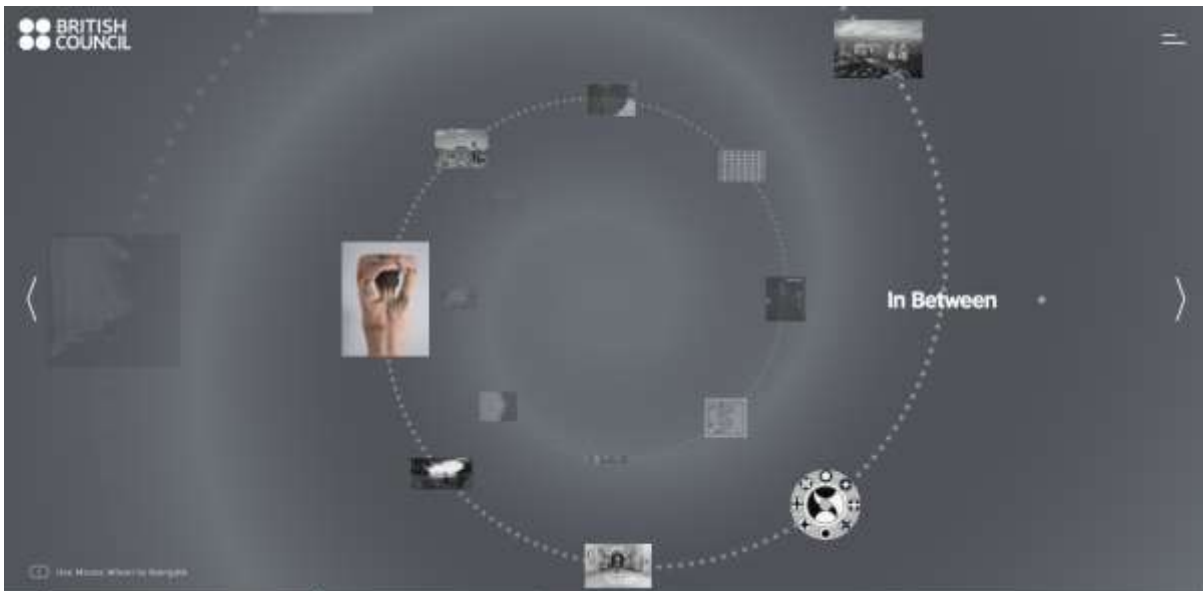


Figure 73 British Council Turkey, *Almost There*, Seyhan Musaoğlu, Tatiana Kochubinska, Teona Burkiashvili (2020)

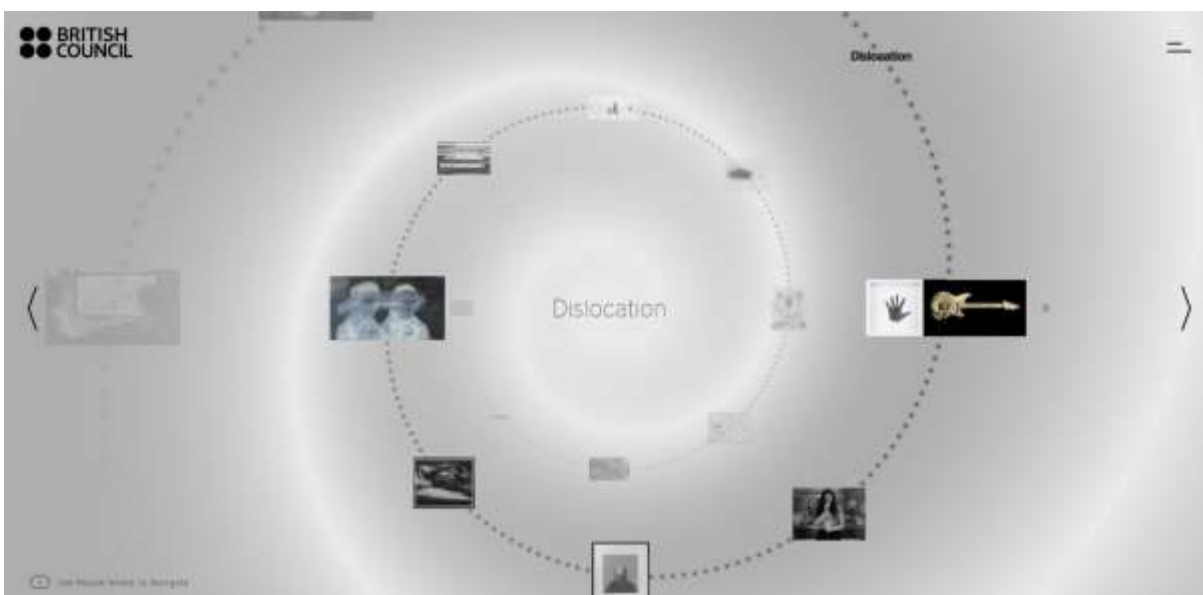


Figure 74 British Council Turkey, *Almost There*, Seyhan Musaoğlu, Tatiana Kochubinska, Teona Burkiashvili (2020)

Other approaches to realising the “Museum without Walls” ethos are based on online artwork gathering experiences, where knowledge is the commodity that the platform offers and democracy is acted within the language of ‘up-voting’ and ‘likes’.

Foteini Valeonti's project *UMEUM* (Valeonti, 2017) aims to 'realise' Malraux's vision, by creating a virtual museum platform that democratises art. The platform contains more than 90,000 artworks, from the collections of cultural institutions alongside works by individual artists, from over 106 countries. The platform contains a diverse range of images, e.g. pictures from the cult television program *The Simpsons*, displayed alongside paintings by Old Masters. The platform claims to feature "one of the first-ever democratically-curated art exhibitions" (ibid). The democratic process is based on a rating system for each work (star ratings and a like button), and through artwork tagging. I am not convinced that Malraux's vision for democratically designed exhibitions was through a crowd-sourced popularity system and 'up-voting' whilst some of the current image recommendations (see figure 75) are disappointingly predictable. Still, the project does demonstrate that democracy in online cultural curation is possible.

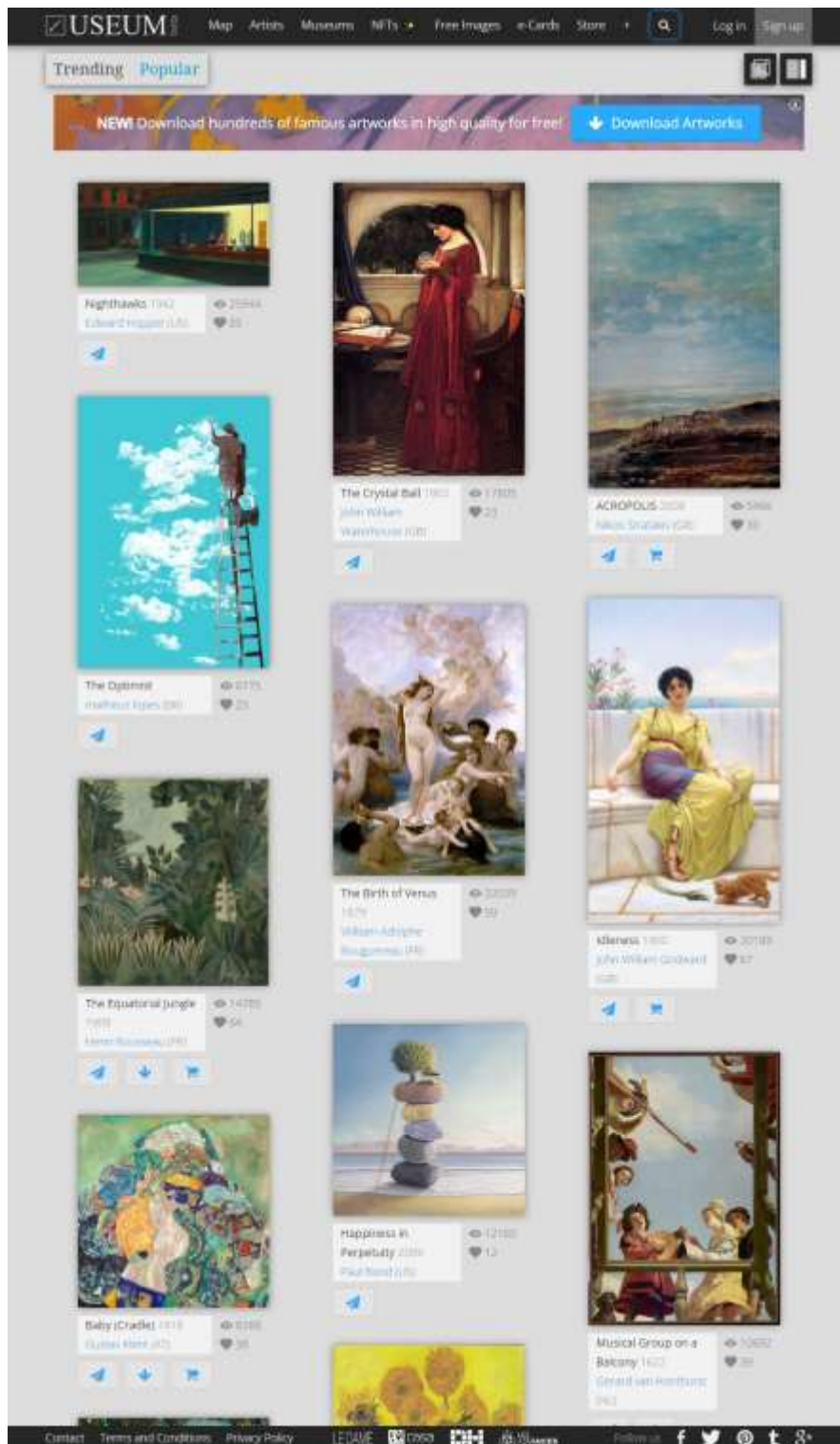


Figure 75 home page of USEUM with images ordered by user rated popularity (Valeonti & Valeonti, 2015)

Similarly to *USEUM*, *Google Arts and Culture* partners with cultural institutions and artists around the world to make artworks available to people through an online

platform. However, as you might expect, the reach of Google is far greater. The website contains collections from more than 1000 museums across 70 countries including big partners like the British Museum and the Getty Institute. The platform offers different ways to search for artworks including thematically, by colour, using image recognition models, via artist or institution, geographic location, through expert and community curated collections, and via user based recommendation systems. There are also many more types of interaction from 360° views, to zooming into ultra-high-resolution images to see fine details, documentary videos, tours and even games. Alongside these exploratory features, the user is able to curate their own online exhibitions through a gallery of 'favourite' images.

Considering the platform's lofty ambitions the actual user experience is unremarkable. At its most basic, it is a search engine through which the user can find images via a keyword search, returning a grid of images from Google's archive with the related tags (figure 76 and 77). This feature helps locate a particular painting, browse for inspiration, or even find surprising links between items. However, it has a reductive quality, and using the search is similar to looking through stock images. Through the accumulation process of the search, artworks are reduced to commodities that can increase and decrease in value depending on crowd-rating. When using the site, the user's actions feed the recommendation system, and the act of democratisation, in reality, feels like an act of flattening. For example, as soon as they add an item to the 'favourites' list, it immediately skews the images recommended on the discovery page. The journey through the site narrows the more it is used – a tool used to great effect in online shopping websites and streaming platforms but not necessarily beneficial when

looking at art. As National Art Critic Ben Davis aptly says “it feels like a trophy museum that you slowly realize is built by robots” (Davis, 2016).

However, there are many positives to the enterprise. The website does give opportunities for greater diversity. While a user may come to the site to find work by a familiar artist, there are multiple avenues for discovery of new work which might not make it into a museum limited by physical space or curatorial scope. The democratising nature of this platform lies in the ability to surface lesser-known or underrepresented artists and stories and display these next to established regulars in major museums. For example, ‘Manga’, ‘Mali Magic’ and ‘Afrofutures’ collections appear alongside predictable regulars like ‘Klimt’, ‘Monet’, ‘Pollock’ and ‘Caravaggio’ on the featured collections page. However, this diverse portfolio is still clearly highly mediated through Google’s cultural lens and liberal values.



Figure 76 Detail of Google Arts & Culture Search for 'Human'



Figure 77 Detail of Google Arts & Culture Search for 'Touch'

This contemporary fetish for databases is present in the experience of these online collections sites. The archive is offered on a grid, a dataset of items brought together through search terms or thematic clustering. The grid of images, or returned data, becomes an image in its own right, cultivating its own ways of seeing. The user views the images together as if shopping for an appropriate artwork. They may further investigate an item, expanding it to a centralised perspective, before searching again – shuffling the grid. The image grid or sequence has become a key symbol for online archives. It is how we search for our own memories, through photo apps and image sharing feeds e.g. Instagram. Creating a purposefully designed Instagram gallery is aspirational for many Instagram users (Manovich, 2017). This may involve curating visually similar images to create an aesthetically pleasing grid. Google Art & Culture provide search tools that allow the users to create their own visually cohesive grid, e.g. the colour search which enables users to search the database via a preferred colour, reducing the contents to an image recognition based set of colour swatches (see figure 78).



Figure 78 search based on the colour red, Google Arts & Culture (Google Arts & Culture, 2012)

The State Library of New South Wales has created an online platform offering an experimental birds-eye-view of their collections in the form of a densely populated image grid (see figures 79-83). Like Google Arts & Culture's key search methods, the images can be organised based on each image's key colours and visual similarities. Before selecting one to explore, the user can zoom in and out of the grid to see more detailed images. However, downloading the images in a reasonable time requires a good internet connection.

On this website, the main visual interest is in the image dataset as a whole, and the ability the user has to perform non-linear navigation through it by selecting images from the array. This website does not claim to be an efficient way to find information in a library, but provides an experience of the library collection as a dataset. The visual appeal of the mass of data is what is celebrated, rather than the content itself. The dataset is given a reassuring feeling of authenticity because it is connected to the formal library online collection site, but it is the representation of knowledge en masse that is the main attraction. This project is visual testament to the "unprecedented fetishising of the museum database" (Parry, 2007, p. 57). The website performs the role of a knowledge monument, showcasing the scale of the collection online rather than the meanings held within.



Figure 79 grid view of Aereo, An experimental bird's eye view of the digital collections from the State Library of New South Wales (Giraldo, 2020)



Figure 80 grid view of Aereo, An experimental bird's eye view of the digital collections from the State Library of New South Wales (Giraldo, 2020)



Figure 81 grid view of Aereo, An experimental bird's eye view of the digital collections from the State Library of New South Wales (Giraldo, 2020)

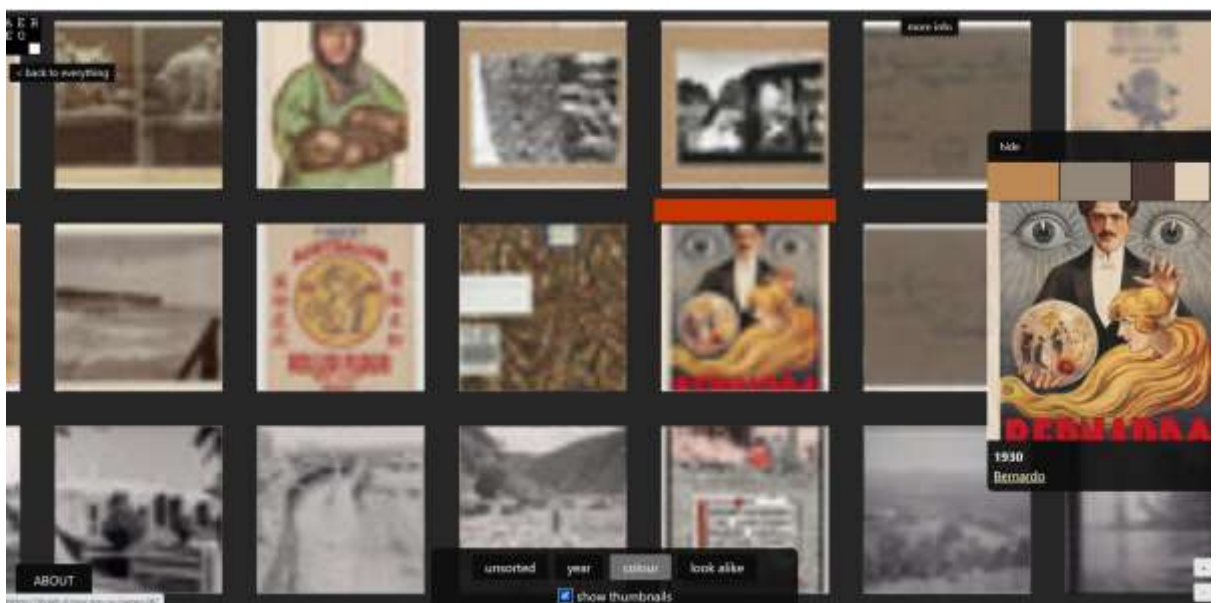


Figure 82 zoomed in grid view including selected image, of Aereo, an experimental bird's eye view of the digital collections from the State Library of New South Wales, (Giraldo, 2020)

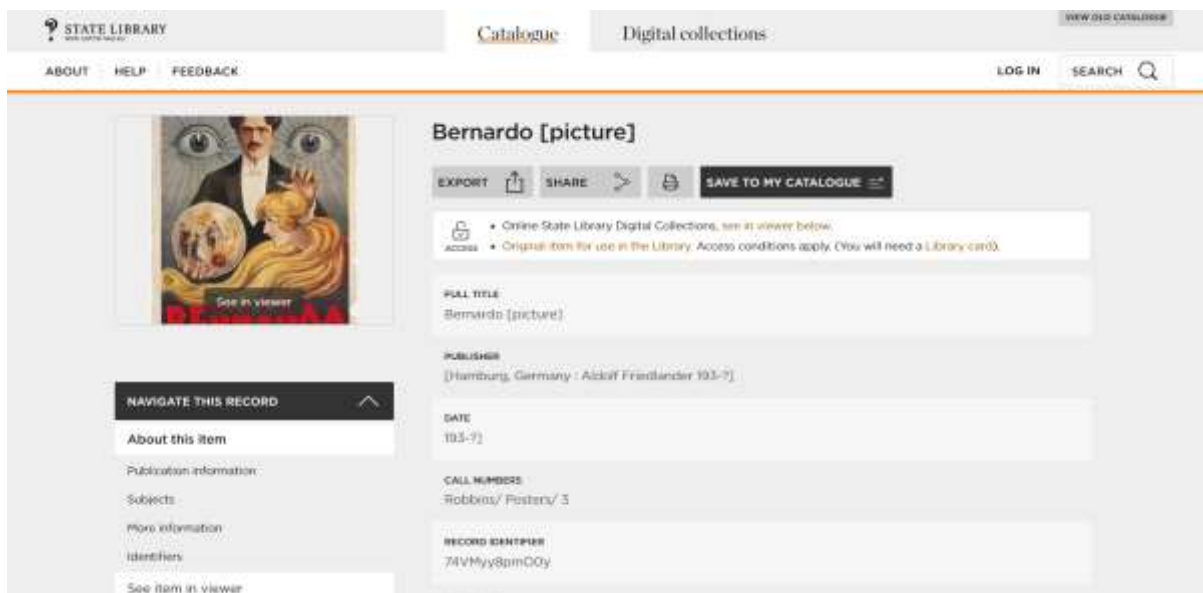


Figure 83 corresponding collections database entry from the State Library of New South Wales (Giraldo, 2020)

Alongside the Google Arts & Culture platform is a design lab in which artists and researchers can collaborate with Google technologists on projects. The lab facilitates artists to reimagine the online collection platform and data visualisation beyond the typical grid form. *Art Emotions Map* (Keltner, et al., 2021) enables users to explore the “atlas of emotions” that people experience when looking at works of art. 1,300 people were asked to describe 1,500 paintings by choosing from a list of different words. The results revealed an array of 25 emotions associated with the artworks viewed and these were used to plot an interactive map, grouping artworks that trigger specific emotions (figure 84). Quivering clusters of artworks wavering between emotional responses gives a new way of approaching the collection, leading the user to question their own emotional responses to an image. This map shows another motif of cultural data visualisation - clustering.

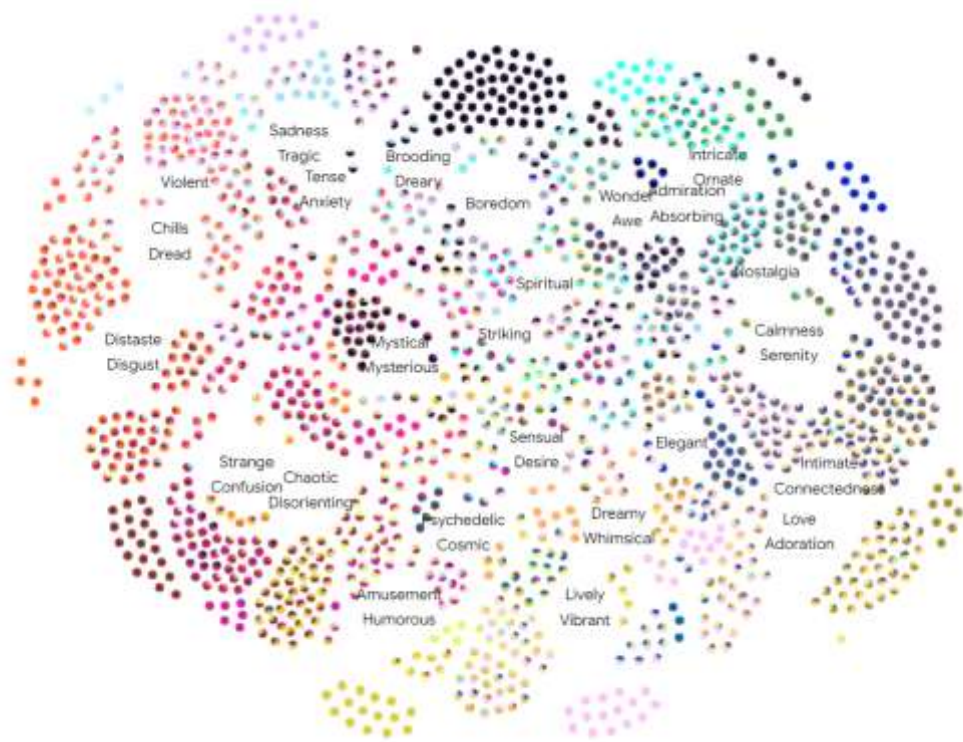


Figure 84 Art Emotions Map Experiments with Google by Nicolas Barradeau, Romain Cazier, Alan Cowen and Dacher Keltner (Keltner, et al., 2021)

The Smithsonian Institute collaborated with Google Art & Culture Lab to develop machine learning tools to help Smithsonian curators uncover the history and contributions of women in science (Harmon & Cherny, 2022). The team used machine learning to mine archive metadata to uncover stories about women in Smithsonian history. Machine learning algorithms were used to identify “named entities” (such as people, places, or dates). Using the named entities, data scientists created a networked visualisation to show relationships between entities. Smithsonian curators could then browse among the “nodes” in the network and see who is connected to whom in the collections metadata. Finally, a clustering algorithm was applied to the images in the collection’s metadata to expose the breadth and diversity of Smithsonian collections and how these items related to women scientists (see figure 85). The

project provides useful methods for finding hidden information and therefore histories of people previously unreported in the museum infrastructure. Projects like this expose the complexity of the archive and offer new insights into the behind-the-scenes machinery of the museum through new paths for exploration of records.



Figure 85 Surfacing Women in Smithsonian History, Elizabethn Harmon and Lynn Cherny (Harmon & Cherny, 2022)

Professor and Digital Interaction Designer, Cyril Diagne, produced a series of visualisation tools while resident at Google Arts& Culture Labs. He used machine learning curated images to create a digital landscape through which users could explore the collection. The image library was presented to the user as a “Curator’s Table”, laying out the possibilities of the collection (see figure 86 and 87). A keyword search produces a two-dimensional grid of images drawn from the table (see 88 and 89). This spatialized experience of the collection database provides an almost cinematic experience of travelling over and through the collection. Similarly, his collaboration *Free Fall* (2017) places artworks in a 3D environment “where you can

choose to visualise what a cultural big bang looks like, or travel through the sea of artworks decade by decade” (Diagne & Barradeau, 2017). In this work there is an emphasis on the experiential database, travelling through it and immersing yourself in the flow of data (see figure 90, 91 and 92). Diagne’s collaborations employ image recognition algorithms in which images are organised via visual similarity and image recognition auto-tagging. In his work *t-SNE Map* (Diagne, et al., 2018), the t-SNE algorithm, a statistical method for visualizing data by giving each data point a location in a two or three-dimensional map, is used to map images onto a landscape forming clusters based on visual similarity (see figure 93 and 94). In his collaboration *Tags* the user can explore a dataset of tags used to categorise artworks on the platform (see figure 95). *Tags* uses the same algorithm and set of tags used by the Google Photo’s app to categorise users’ photos. The piece claims that the “the machine looked at the artworks [...] without the intervention of humans” and that the keywords generated reflect how the “computer sees” the artworks (Diagne & Hugo, 2017).

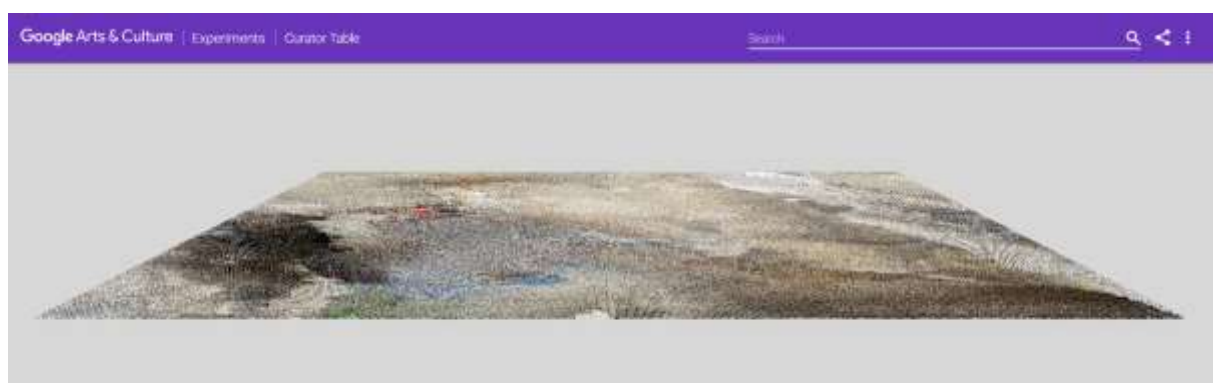


Figure 86 Curator Table by Cyril Diagne and Simon Doury (2017)

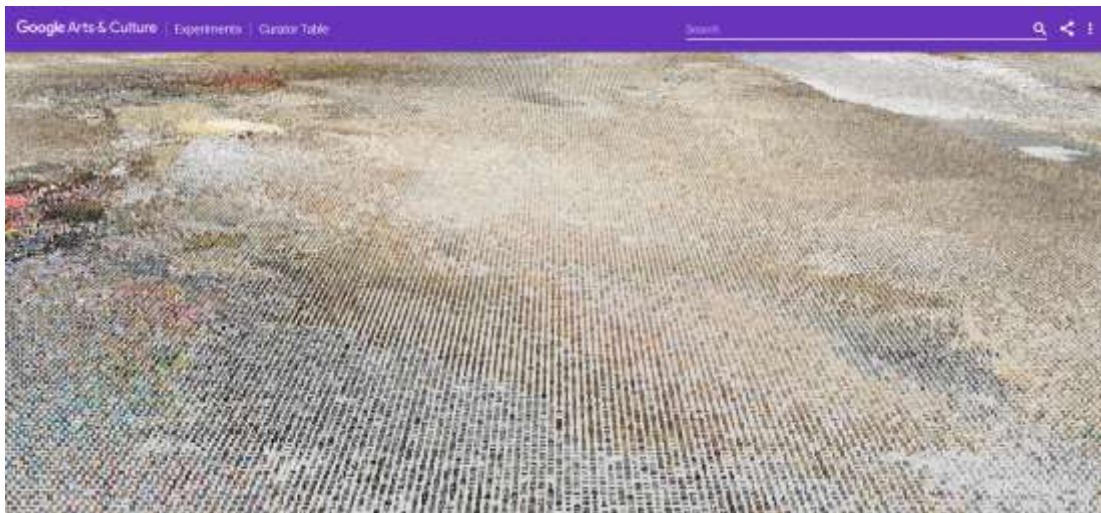


Figure 87 Curator Table by Cyril Diagne and Simon Doury (2017)

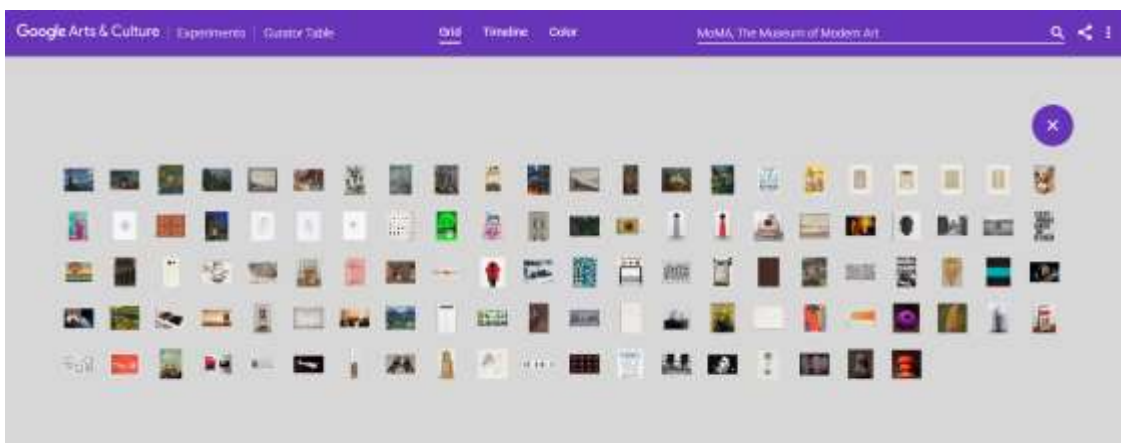


Figure 88 Curator Table by Cyril Diagne and Simon Doury (2017)

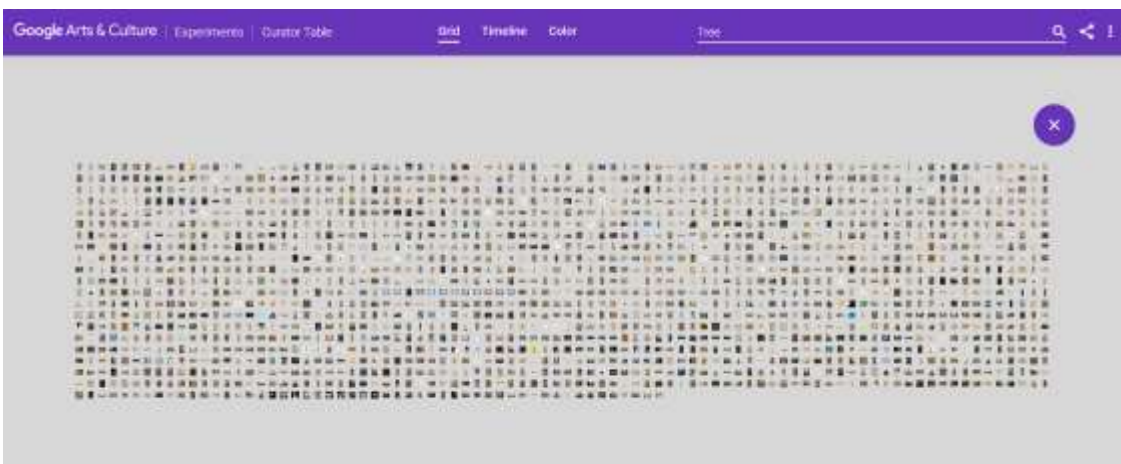


Figure 89 Curator Table by Cyril Diagne and Simon Doury (2017)

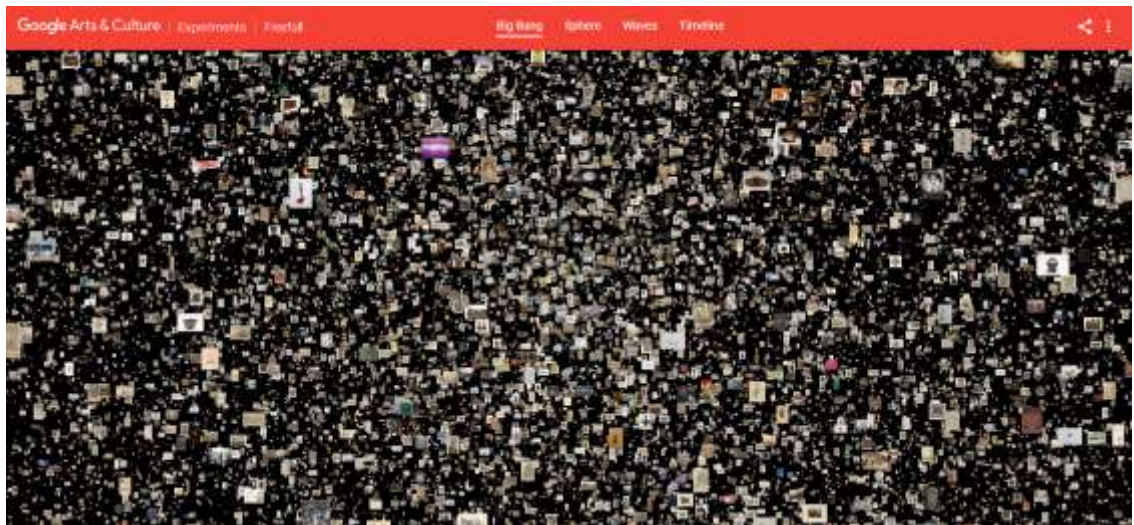


Figure 90 Free Fall, Big Bang, by Cyril Diagne and Nicolas Barradeau (2017)

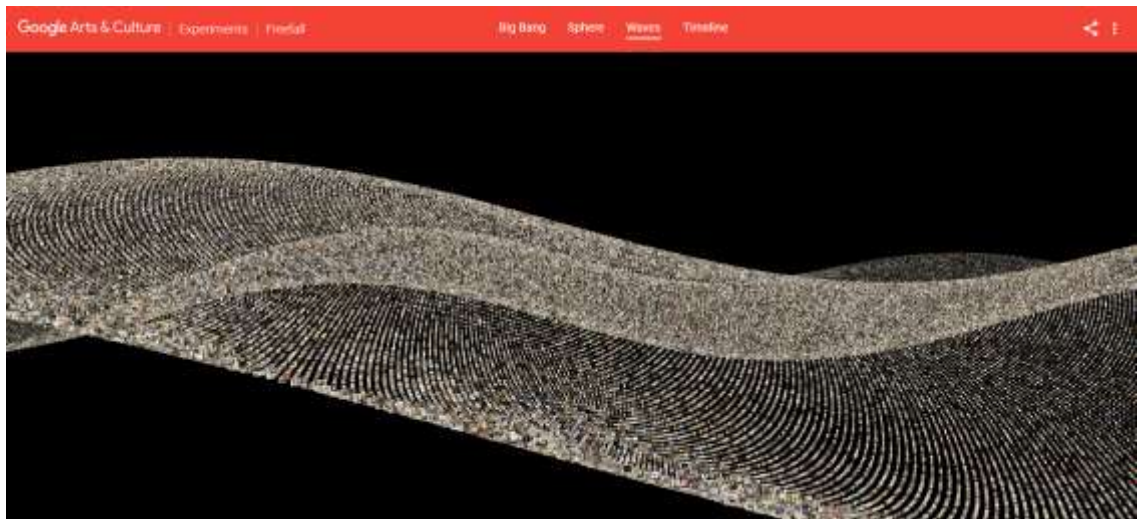


Figure 91 Free Fall, Wave, by Cyril Diagne and Nicolas Barradeau (2017)

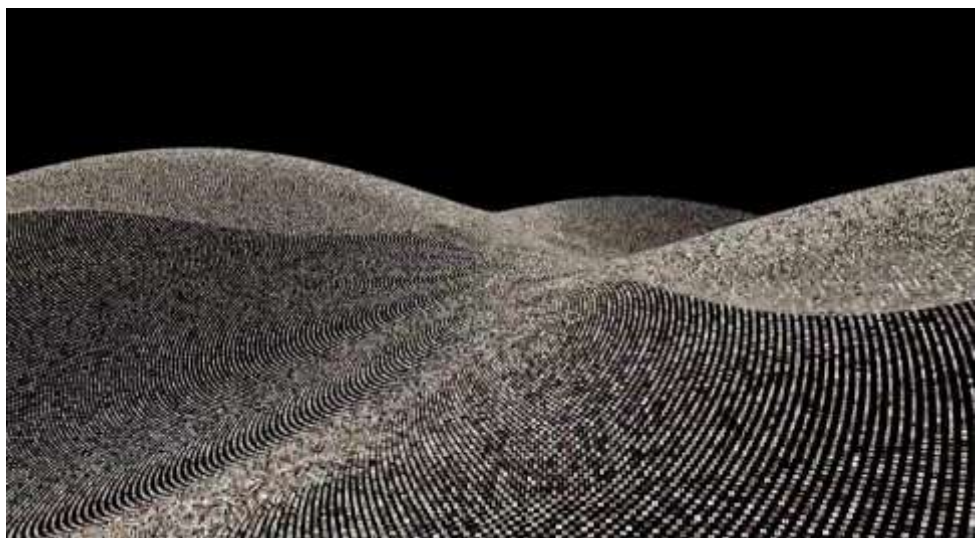


Figure 92 Free Fall, Wave, by Cyril Diagne and Nicolas Barradeau (2017)



Figure 93 t-SNE Map by Cyril Diagne, Nicolas Barradeau and Simon Doury (2018)



Figure 94 t-SNE Map by Cyril Diagne, Nicolas Barradeau and Simon Doury (2018)

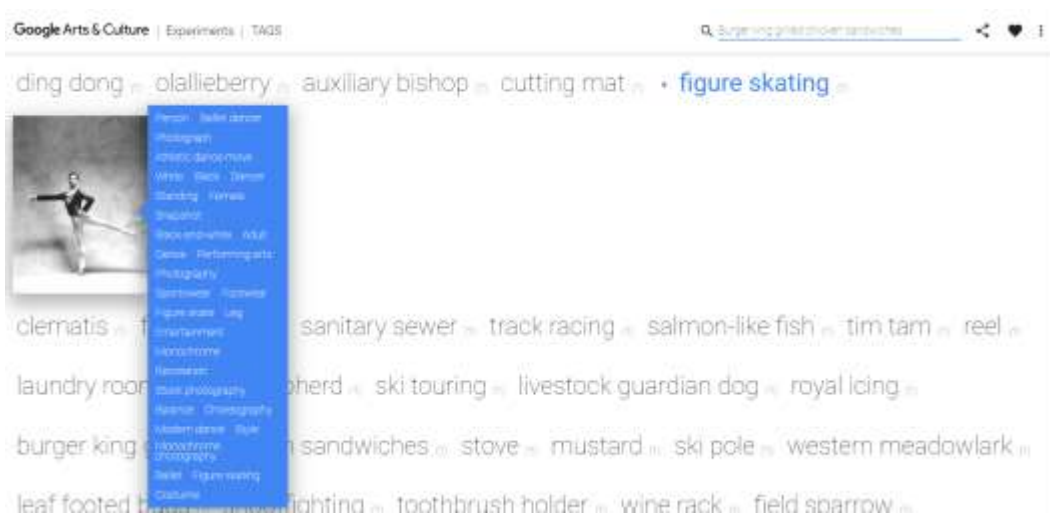


Figure 95 View of Tags by Cyril Diagne & Gaël Hugo (2017)

Interestingly the approach of two major national museums, the British Museum and the Tate Modern, to creating digital collections experiences has been to revert back to the timeline, or chronological hang (see figure 96 and 97). *The Museums of the World* (British Museum, Google Arts & Culture, 2020) invites online visitors to “discover the British Museum's collection through time, continents and cultures” (ibid). Transferring collection classifications and subject specialisms into the online space. Furthermore, this closed off and centralised experience copies the authoritarian language of the physical museum choosing the name *The Museum of the World*, and the self-declared role of the British Museum to command the narratives of cultures around the world is not critically engaged with.



Figure 96 *The Museum of The World*, the British Museum, Google Arts & Culture (2020)

Tate Modern’s *Tate Timeline of Modern Art* (Tate, 2016) is an interactive timeline that brings together images of over 3500 works of art by 750 artists. Users are invited to interact with this large scale touch interface to “read more about modern art

movements, and to see connections between artists across time” (ibid). The visual language of the interactive wall suggests a non-linear experience through the use of clustered points in space. However, the positioning of the artworks on a timeline is based on traditional Western European obsessions with the progressive and linear history of art. This is all the more interesting as Tate is widely credited as one of the first galleries to hang artwork thematically rather than chronologically. Why then, with all of the potential of digital technologies, has the gallery reverted to a traditional timeline of modern art?

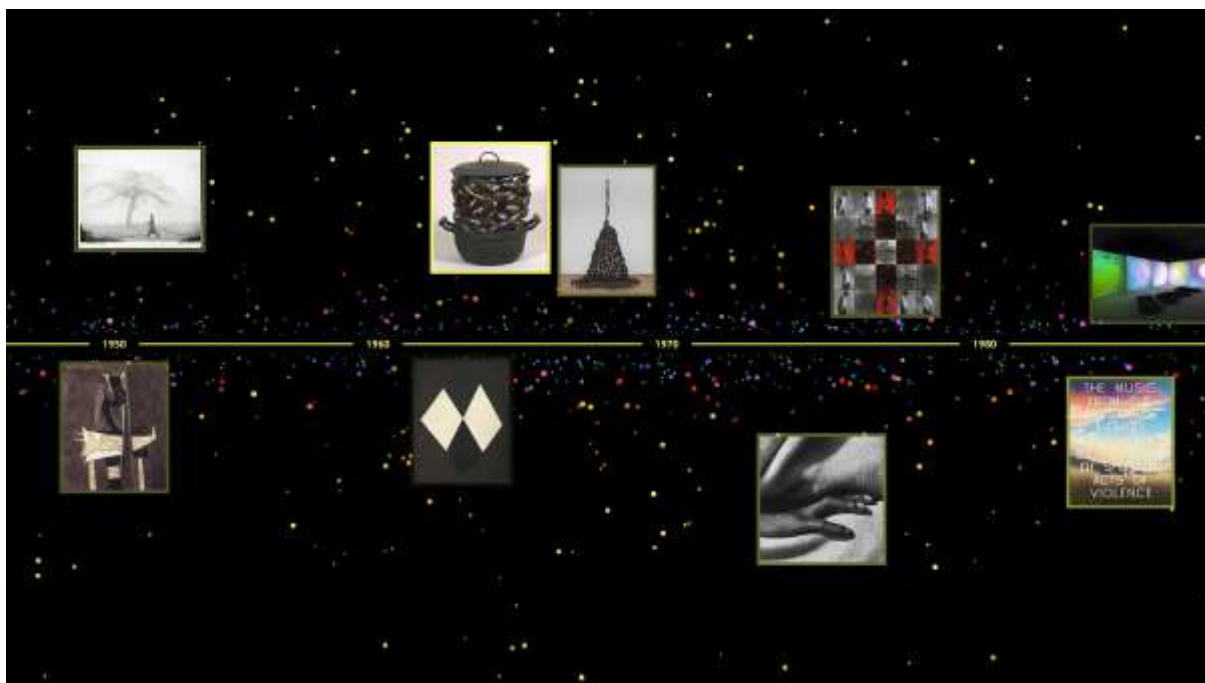


Figure 97 Timeline of Modern Art, Tate and Framestore (2016)

Design company Local Projects (Local Projects, 2022) are known for their digital immersive experience design in the cultural sector (see figures 98, 99 and 100). They have worked on large scale projects, including *A Museum of Collective Memory* for the National September 11 Memorial & Museum (Local Projects, 2014) (see figure 100). Their work is immersive and places people within archives through large scale

projection an interactive screens. They create visceral and emotional connections between the audience and archives using first-hand witness accounts and evoking personal memories.

Visualising datasets as non-linear narrative devices are a recurring theme in Local Projects work. They give the visitor the feeling of being part of a story by being amongst the historical dataset or archive. In the UMass Amherst Chapel, Local Projects developed an interactive wall that allows users to access an archive over more than 700 stories, by touch interaction with a visual interface for the archive organised on a grid (see figure 101). Again, the experience is not of a curated narrative history of the chapel, it is through investigating a database of information and navigating your own path through it based on personal interest.



Figure 98 Local Projects, 'Please Touch the Art' Cleveland Museum of Art, (2013)



Figure 99 in Echoes around the World, Local Projects create an audio and visual tapestry from the testimonies of 417 people describing where they were when they heard about the September 11th attacks on the World Trade Centre, Local Projects, (2014).



Figure 100 UMass Amherst Interactive Wall, Local Projects, (2017).

Navigating back through the previous examples to Malraux and his ‘Museum without Walls’, the visual framework of the image grid persists, linking Malraux’s studio floor to the contemporary webpage. Heterogeneous assemblage of images across the web, including online galleries, image sharing platforms, shops, and social media all use the grid as the main display apparatus. This scrolling visual schema for the information on the internet is a familiar experience. History is offered both as a browsing activity and as a non-linear experience of discovering – depending on individual levels of engagement. Lev Manovich calls the database “a new symbolic form of the computer age” (Manovich, 1999, p. 81), he says that the online search engine and database provides a non-linear experience in which “the world appears as an endless and unstructured collection of images, texts, and other data records” (ibid).

This vision can be seen in most of the digital museums projects discussed in this section. An image archive arranged as a grid (that provides direct access to the museum database) appears to be the dominant visual schema for online collections, which links back to the collection of images on Malraux's studio floor. Furthermore, we can see this type of visual schema applied to knowledge databases in films. For example in *Ready Player One* (Spielberg, 2018), the character called 'Curator' can access a huge archive displayed as images not dissimilar to current museum collection visualisation experiences (see figure 101). This contemporary visual language for knowledge and collections, based on searching landscapes of images as data points, expresses a vision for the internet as an archive of activity and a networked cloud of data. We imagine this online archive to be capable of keeping everything, popular items in it are pushed to the surface based on our personal preference and the knowledge of the crowd, and nothing is lost. This emphasis on keeping all data evokes concerns of surveillance – as if all of our actions are captured and stored. However, it also evokes Sci-Fi dreams of permanence in the hive mind of all human existence - the internet.

With our contemporary fascination with data sets and archives, there is something about the experience of stored knowledge en masse that we find fascinating – from swimming through immersive data sets to visiting museum storage sites. The complete data set is as attractive to us as the individual items held within it. The symbol of the database is a monument to knowledge en masse and there is pleasure in the scale of the achievement and the authority a database brings. Manovich, in his discussion on the pervasive symbolism of the database, argues that we should “develop poetics, aesthetics, and ethics of this database” (Manovich, 1999,

p. 81), but how can digital museums move beyond the image grid of the online gallery to a visualisation schema that recognises and represents complexity in collections and draws multiple links between objects?



Figure 101 'The Curator', *Ready Player One*, Steven Spielberg (2018)

2.7.6. Knowledge Visualisation and Immersive Technologies

New media artists of the 60s were also experimenting with the possibility of distributed platforms for visual media. In 1965 artist and filmmaker Stan VanDerBeek unveiled his *Movie-Drome*, made from the repurposed top of a grain silo (see figure 102). The *Movie-Drome* was designed to be a prototype communications system that would store and transmit images to other Movie-Dromes around the world.

VanDerBeek saw this device not as pure cinema, but as an 'experience machine', a

place for experiencing a new radical art and technology (Sutton, 2015) (see figure 103 and 104). Interestingly artists choose enclosed spaces for the transmission and receipt of knowledge, however through emerging networked technologies, and the potential for multiple hubs, these experiences are designed as nodes in a wider distributed and sharing network. These types of immersive hubs for the experience of knowledge can be described a precursors to digital museum exhibitions.



Figure 102 Exterior of Stan VanDerBeek's Movie-Drome (1965)

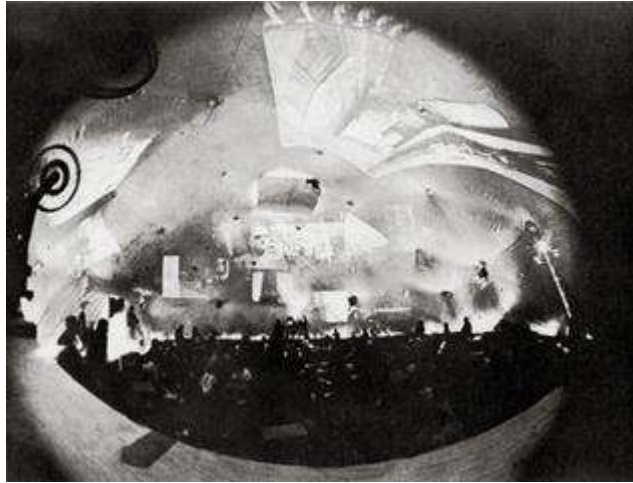


Figure 103 Interior view of Stan VanDerBeek's Movie-Drome (1965)



Figure 104 Interior view of Stan VanDerBeek's Movie-Drome (1965). Photographed by Peter Moore.

Similarly in 1962, experimental architect and designer, Ken Isaacs, developed the *Knowledge Box*, a multimedia information system built on his concept of the 'total environment', as a learning tool (Snodgrass, 2012)(see figures 105-108). The *Knowledge Box* was a four-by-four metre wooden cube equipped with twenty-four slide projectors and speakers. It was initially built at Chicago's Institute of Design by Isaacs and a group of his students. Life Magazine reported it as a tool for people to be able to deal with ever-increasing amounts of knowledge:

"New teaching techniques and devices are therefore much required in order to cram as much knowledge as possible, as fast as possible, into his swimming brain.

Out of the imagination of one specialist, 32-year-old designer Ken Isaacs of the Illinois Institute of Technology, has come a machine called a "knowledge box" that he hopes will help fill this need." (Life Magazine, 1962)

These two 1960s immersive knowledge experiences reflect a utopian vision of the time for distributed learning and open access to culture. Both artwork-inventions have designed their own unique architecture and technology for immersive projection. The desire to experience knowledge en masse, as a mechanism to attempt to deal with growing amounts of cultural knowledge available through the expanding use of film, photography and early networked media, is at the centre of these works. The ambitions of these two projects draw parallels with renaissance museum pioneers, but rather creating 'cabinets' or 'theatres' of physical wonders, these designers make use of the new media of the time, projection and the emerging promise of networked media.



Figure 105 Ken Isaacs, Knowledge Box, Life Magazine, (1962)

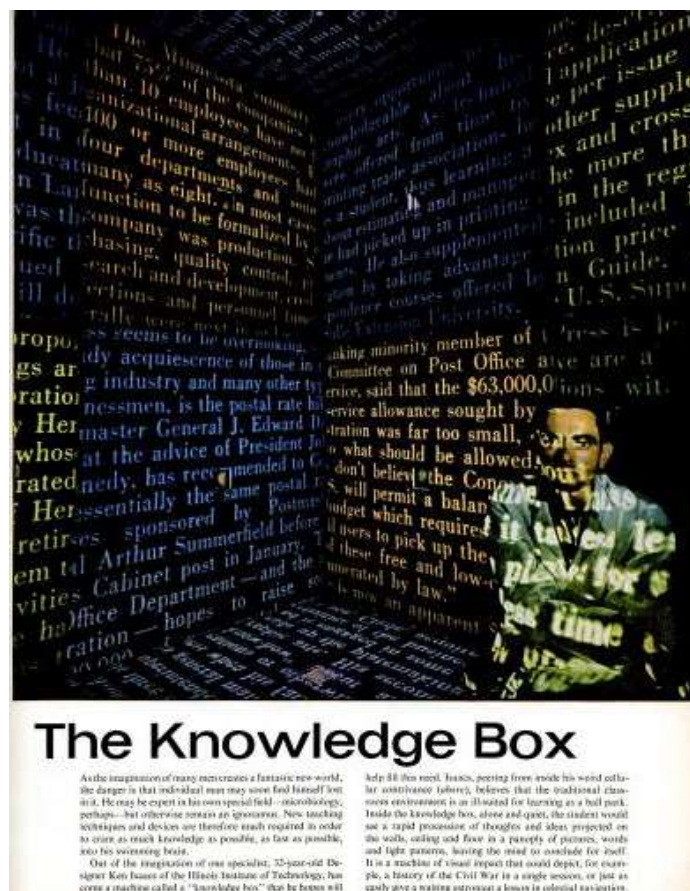


Figure 106 Ken Isaacs, Knowledge Box, Life Magazine, (1962)



Figure 107 Ken Isaacs, Knowledge Box (1962), (Socks, 2016)



Figure 108 Ken Isaacs, Knowledge Box (1962), (Socks, 2016)

Multiple platforms and tools are now available online for creating virtual art gallery and museum experiences (e.g. Mozilla Hubs, ArtSteps, SpaceSpark etc.). Users can now curate and invite visitors to experience virtual gallery experiences of digital works. These spaces are democratising as anyone can curate a museum or gallery exhibition. Through these tools, exhibitions that may not be sanctioned in traditional museums and galleries are possible online and work can be gathered from the internet.

It is interesting with all of the possibilities of 3D digital immersive environment that users and developers of these platforms tend to opt for a traditional gallery architecture – a labyrinth of small rooms, with images hung at ‘eye-level’ with accompanying object texts (for example, see figures 109 and 110). Microsoft published a set of design principles for creating digital productions, one key principle was called *Authentically Digital* (Clayton, n.d.). *Authentically Digital* means not attempting to recreate rules or properties of the physical or real-world in the “purely digital realm” (ibid). It is surprising that with all the possibilities of 3D immersive digital space, that people recreate the limitations of physical gallery buildings – from lighting issues, to size constraints and available wall space. This may be because curators still need design constraints to work to or the scaffolding provided by the visual language of museum or gallery architecture – especially if the work they are curating was initially designed for a gallery space. However, since the practice-base of this thesis is focused on the specific language of networked and digital media – and drawing distinctions between networked visual schemas and traditional fixed physical museums, it would be inappropriate to recreate a physical space in an online museum collection experience. This thesis will therefore practise *authentically digital* design to focus on

developing a collection visualisation in response to the language of the internet and not a recreation of visual language of the museum.



Figure 109 LGBTQ+ VR Museum, Antonio Foster, Thomas Terkildsen (2021)



Figure 110 Museum of the Fossilised Internet (Ivens, n.d.) Developed and available on Mozilla Hubs.

2.7.7. Museum without Objects – immersive and persuasive

While many museum scholars and practitioners are rethinking the role of the museum, at its core the museum mechanism is still based on education through the establishment of storylines for human history, punctuated with objects carefully preserved to reinforce the learning well into the future. The dataset of the museum is still the collection and catalogue, objects are still hierarchically organised and exhibited, and curators, alongside other key museum stakeholders, still have the ultimate power to choose what, and who, is or is not included.

This process of collecting, curating and crafting stories lines is an exercise in world-building, in fact the creation of any knowledge organising scheme is an exercise in world building, and in the creation of any world, boundaries are formed as decisions are made as to what is and is not included in that world (Turner, 2017). This is not necessarily a problem and is in fact necessary for the creation process. Museums are no different in this sense – a museum knowledge framework is defined by its boundaries. However, this curatorial decision making process at the centre of the knowledge infrastructure must be continuously questioned.

The British obsession with the preservation and conservation of objects is challenged in Stuart Hall's essay 'Whose Heritage?' (Hall, 1999). Hall discusses the problems of Western museums' role in defining a 'national narrative' through the cataloguing of artefacts, and argues the world building process of the museum draws a

line between who and who does not belong in the cultural identity of a place. The lines between who and who is not included impacts a diverse intersection of communities. The permanence and the authority of museums' exclusionary process have been felt by those who the institution has misrepresented or underrepresented, whether they are from other (non-European) cultures, religions, geographies and well as working class, women, queer and disabled people. As museums have not only appropriated physical objects from different cultures but through the process of classification and display, museums have also appropriated the intellectual rights attached to objects, alongside the power to contextualise and assign meaning to them. The weight of hundreds of years of discriminatory collecting and record keeping is felt by contemporary museum institutions and the communities they affect. The case for both object reparations and more recently taxonomic reparations (Adler, 2016) require that the whole museum infrastructure be interrogated, including the practice of collecting. In response, many contemporary museologists are now arguing that museums must shift their focus from objects to human stories, often through multimedia exhibitions.

Errol Francis, the Artistic Director of *Culture&*, argues that contemporary museums should consider the importance they place on objects if they are to truly engage with the movement for decolonisation (Francis, 2019). He argues that the model of museums that we have inherited is based on "acquisitive idea of a museum of objects" and that we must move beyond a "system of objects", referencing philosopher Baudrillard's work (1996), to create museums that are more contemplative spaces (Francis, 2019). Francis uses the example of the proposed *House of Civilisations* museum on the Reunion Island, a former French colony, as a design for a museum without a collection of objects. The museum was designed to be a place for

contemplation, and active dialogue rather than a building for the preservation of objects. He argues that new museums that operate outside of European traditions reflect a better way to memorialise and explore the past than object orientated collection museums. Museums attempting to reframe relationships promote the use of objects as catalysts for debate, however when the presence of many of these objects is so contested, the crime is still present in their continued position as controlled by the museum. As Turner argues, “In order to work towards a post-colonial equitable information infrastructure, a full acknowledgment of the social history of the development of the system itself is the first step” (Turner, 2015, p. 8)

Museums’ obsession with objects evokes concepts like ‘object agency’ and the importance of objects for learning about the past, however contemporary scholars are beginning to recognise the limitations of Western museums’ fixation on the power of the object (Francis, 2019; Hall, 1999). Projects like the *Relational Museum* lead by the Pitts Rivers Museum, use notions of ‘object agency’ to present collection artefacts as talismanic nodes that connect people and history together. In so doing, suggesting that the museum can be a hub and mediator for connecting people with a variety of different cultures. However, as Hicks raises, the project, while aiming to explore the history of the museum through its collections, completely erases the Victorian acts of colonial violence that brought those objects together. Hicks critiques the abstract assertions of the project as recorded in the project book *Knowing Things: Exploring the Collections at the Pitts Rivers Museum 1884-1945* (Gosden & Larson, 2007), for example: ‘objects hold people together’, that collections ‘enable reasonably stable structures that allow people to interact productively’, that ‘the Museum is a dynamic entity, made up of a shifting mass of people and things’, that ‘objects collect people’

and so past networks of human relationships ‘sparkling chains of connection’ (Hicks, 2020, p. 30). This essentialist view of objects as having a special and privileged place in our telling of history, but completely removing the study of them from the violent colonial acts that brought them to be so misplaced and in need of connecting to other displaced objects, is seen on the British Museum Collections website (see figures 68-70) where, as discussed earlier, the colonial violence of the trade in Egyptian grave artefacts was missing from the object record. As Hick writes:

“The urgent twin task for European anthropology museums is to use their status as unique public spaces and indexes of enduring colonial histories to change the stories that we tell ourselves about the British Empire, while taking action in support of communities across the Global South in building museums on a totally new kind of model.” (Hicks, 2020, p. 35)

Based on the desire to move away from the current model of museums a new type of museum has emerged (Message, 2006). These museums are not based on collections of objects, and the business of collecting and classifying, these museums focus on memorialising crucial historical events “deemed essential for interpreting the present and envisaging the future” (Arnold-de Simine, 2013, p. 10). The focus of these new museums are generally the histories of persecution, migration and violence. They are founded by and/or with communities whose heritage is not represented in traditional museums and therefore national narratives and cultural memory. Communities whose possessions have been taken, undervalued, misclassified, or eradicated. In the place of objects, these museums tend to produce highly visualised, multimedia narratives, telling the stories of people through immersive experiences rich with images and filmic discourse (Arnold-de Simine, 2013; White, 1988). Silke Arnold-de Simine (2013) calls these types of museums ‘memory museums’ which she defines

as a museum that represent the past through the framework of 'memory' and promoting feelings of empathy in visitors through witnessing events through experiencing of personal accounts. These are similar to what Alison Landsberg and Hilde Hein refers to as 'experiential museums' (Landsberg, 2004; Hein, 2006), in which visitors are supposed 'experience' the past through the eyes of real people and their personal accounts, empathising and emotionally investing in their experiences. Key examples of these museums include *The Legacy Museum: From Enslavement to Mass Incarceration* in Montgomery, *Yad Vashem Holocaust Museum* in Israel, *Museum of Memory and Human Rights* in Santiago, and *International Slavery Museum* in Liverpool.

Memory museums use various immersive experiences to place you face to face with the people affected by these monumental events. Landsberg calls these types of experiences 'transfential spaces' designed to produce empathetic responses in visitors through a form of 'prosthetic memory', where people can experience the memories of events they did not live through the emotional testimony of another (Landsberg, 2004, pp. 19-23). These types of experiences can particularly help people with ties to those affected, whether survivors and their families or descendants, but Landsberg's opinions that mass media can render memories 'free-floating' and thereby available to other groups or individuals to adopt and use to create empathy that transcends traditional barriers and thereby open up the potential for progressive politics has been criticised (for, Berger, 2007).

Arnold-de Simine argues that Landsberg's claims on the use of media experiences to promote progressive opinions through 'sharing' memory are deeply

problematic, and is concerned museums are using this method uncritically. She uses the example of The International Slavery Museum in Liverpool, which opened in 2007, and uses simulated witness testimonies by actors “in which the visitors become witnesses to the witness” (Arnold-de Simine, 2013, p. 93). These stories were packages and sold to “mesmerized white audience as voyeuristic windows on bleak but distant, abject and horrific experiences” (Hesse, 2002, p. 146). Arnold-de Simine identifies the dangers of empathy by identifying with witness narratives without also identifying the complex ways in which your own life experience is linked to the Transatlantic Slave Trade, and how white European descended people have been able to dehumanise African people to justify atrocities committed on a global scale, and why there are still enslaved people living today and many companies still profit from their labour.

Arnold-de Simine discusses the problem of immersive technologies deployed in museums to create a highly empathic response in visitors as a problem of complexity. By creating empathic and memorising experiences focused on the testimonies of single historic characters, visitors are not engaging with the complex histories, and different actors engaged in social and political conditions of colonialism and slavery. This is true of both immersive filmic exhibitions that aim to create empathy, and exhibits that connect people with the museum database as an aesthetic and unmediated experience. The dazzle of the archive or the use of highly immersive design practices can act to obscure the difficult conversations we need to have about our collective history and the reasons behind power relationships and discrimination.

2.5.8. Towards a new museum epistemology

This chapter has taken a historiography approach to understanding museum epistemology framed by Foucault's concept of episteme and Manual Lima's key knowledge visualisation schemas – circles, trees and networks. Through this exploration I have developed a grounding framework for both considering present issues and future potential for a new epistemology for museums.

Key insights:

Museum curation is a world building exercise in which certain items are removed from the 'real world' and recontextualised to develop knowledge within the 'museum world'. Since the initial dreams of renaissance 'memory theatres', museums have been engaged in encapsulating knowledge. As our networked society exists in the 'space of flows' we imagine knowledge as flowing around us in vast webs. In the 'space of flows' museum knowledge boundaries demarcating 'inside' and 'outside' knowledge must be torn down.

A new epistemology for museums would not exist on hierarchical taxonomies, but on distributed networks. Collections would be interdisciplinary and classification would exist across web taxonomic structures. Multiplicity of meaning would be embraced as knowledge would be viewed as containing many perspectives and in constant development through distributed modes of research and engagement. Knowledge would be regarded as local, and authoritative universal facts or narratives would be dismantled and rebuilt as entanglements of situated meanings.

The museum would constantly review the distribution of epistemic power in society, locally and globally. Folksonomy approaches to cataloguing would be standard practices as institutional barriers between the museum and the public would dissolve and power to define new knowledge and meanings would be shared amongst all museum staff, visitors and communities. Through this approach museums staff would be actively engaged in community building and actively engage in debates around accessibility. Through this process colonialist objects and records would be challenged, and recontextualised, in a large scale repatriation process.

Museum collections would not favour the physical but contain new kinds of digital objects. Physically removing an object from its context would only be practiced if the community who 'owned' the objects were in full agreement and involved in any knowledge management work.

2.5.9. Frameworks for Museum Knowledge Visualisation

Visualising systems of thought has been demonstrated to be an important part of establishing human understanding of the world (Lima, 2013). Organising knowledge into patterns is foundational to our understanding of the museum, and the recording of knowledge. Human brains are small, so we need to record knowledge in order to move onto making new discoveries (Weinberger, 2012) and museums and libraries act as store places for that knowledge. However, knowledge is now changing from entirely physically located medium to a digital and hyperlinked medium (ibid). Now knowledge is far more discursive and exists in a 'space of flows'.

Lima has established the network as the leading contemporary cultural meme for representing knowledge. The network reflects multiplicity, non-linearity and infinite interconnectedness. Rather than relying on fixed tree structures, humanity is now turning to networks to properly map the inherent complexities in the modern world. As networks are the new dominant schema for knowledge visualisation, the museum must adapt and embrace the qualities of the network and complexity within heritage collections and the museum knowledge infrastructure.

Throughout history, knowledge visualisation schemas have been used to map and shape our understanding of the world. Networks expressing visual complexity are entering cultural spaces as artworks, and visual complexity is becoming as attractive to contemporary culture as balanced or ordered knowledge on tree schemas was considered beautiful by early modern society. Museums are monuments to the knowledge they contain, architectural design has been developed through open storage and exhibition design to celebrate the beauty of an accumulation of physical knowledge. As knowledge mediums are changing from physical to digital, new forms of knowledge monuments should be developed. Shared immersive reality or planetarium domes, are established sites in museums for awe and wonder at star maps and alternative knowledge spaces. What if they could be repurposed for mapping networked visualisation of the knowledge in museums, establishing new knowledge monuments based on interconnectivity and complexity?

Networks are constituted from points (or nodes) connected by links. A node represents an end point for data transmission end or redistribution point and links are vectors of travel for data. Imagine a museum collection as a set of nodes, each node

representing an object, document, person, event or place – links can then be used to map the connections between nodes, aiding understanding of the museum knowledge infrastructure as a complex web relationships and entanglements. Adopting the network as a knowledge visualisation, organisation and representation tool for cultural institutions, museums can reframe their ways of knowing, adopting a new epistemology that is non-hierarchical, adaptive and recognises complexity in cultural collections.

To visualise the museum as a network, an authentically digital approach must be taken. Networked knowledge is a departure from the physical space of the museum architecture into a new purely digital realm. Discursive design methods can help develop networked approaches to collections visualisation that promote discourse in museum communities. Furthermore, networked visualisation should be subject to constant revision, and always exist in a never finished or fixed state. The network should adapt and change based in the apparatus of looking, in knowledge on the network should be considered to be in a constant state of becoming.

The use of databases can establish authoritative relationships between the people managing knowledge input and those reading the knowledge established in the database framework. Networked data visualisations, based on databases, can amplify these power relationships through appearing too complex to understand and specialist in their use of technology. Folksonomy approaches to managing knowledge in the database and/or network visualisation should be considered to open up museum processes and breakdown institutional barriers and established hierarchies. Folksonomy and open cataloguing approaches should be applied to engaging critically

with the colonialist knowledge infrastructure present in many museum collection in the West.

3. Prototypes

New knowledge in this practice-based thesis is formed from a series of prototypes, presented in this chapter. The prototypes build on the contextual framework outlined in chapter 1 and 2, and have been developed through discursive design methodologies designed to encourage new ways of thinking about the socio-technical and socio-cultural future of museums. Each prototype has been developed through a process of unmaking and remaking. Unmaking our current understanding of museums and archives, and remaking through a prototyping - employing discursive, speculative and activist design methodologies. Each new prototype is designed to stimulate discourse, and exhibited to the public in prototype form to be tested – inviting users and makers into a design discourse.

Each prototype is designed around questions, provocations and intentions. The prototypes ask questions including:

- How would our understanding of a museum collection change if we mapped it as a complex network, with object's nodes connected via multilayer interlinkings?
- Can network topologies be used to reveal complex histories connected to historic artefacts and places?

- Can people change public opinion through collective archive making using emergent technologies?
- How can equitable, two-way, relationships be formed between museums and communities?
- What new experiences could emerge when the code-space of the knowledge institution infrastructure is revealed?

The author has led, or co-led, the design and technical development of each prototype, based on this body of research. However, collaboration has been integral to the discursive design process:

The ***Museum Collection Engine*** is a museum collection database visualisation tool and was designed during a period when the author was resident and immersed in the collection centre of Birmingham Museums Trust, and previous to commencing this PhD research, she was in the curatorial team specialising in interactivity and digital. This knowledge and daily communication with museum staff informed the discursive design of the prototype and evaluation process.

Shared Pasts: Decoding Complexity was developed with a team including a researcher, a historian, a curator, a writer, and a creative technologist. The author designed the prototype and led the technical development based on this research. However, the discourse with the team and collaborators in the wider cultural sector through the support of the South West Creative Technology Network and the British Library informed the discursive design and evaluation process.

Women Reclaiming AI was co-founded by the author and Dr. Birgitte Aga. The project took a participatory design approach to developing workshops, the archive or

corpus, and the AI chatbot prototype. The growing community of contributors are credited as co-designers and their ongoing participation is integral to the development of the prototype, as the personality of the chatbot and nature of the corpus emerges from the collective intent of the community – of which the author is an equal part and contributor.

Sanctuary Stories was designed and directed by the author. Emma Birks from Asylum matters and Sister Margaret Walsh, and the staff of St. Chad's Sanctuary collaborated on the organisation of the project. The discursive design process for this project was based on the experience and reflection of the author.

British Library Algorave was curated by the author in collaboration with the British Library, the Alan Turing Institute and the Algorave Live-Coding community. The discursive design process for this project was based on the experience and reflection of the author.

3.1. The Museum Collection Engine (MCE)

3.1.1. Introduction

The *Museum Collection Engine* (MCE) (Manton, 2018) design emerged out of a desire to map the cultural collection of Birmingham Museums Trust in an immersive space. My initial concept developed when I was working in the Curatorial Team of Birmingham Museums Trust and, in my spare time, making creative work for the digital planetarium dome at Thinktank, Birmingham Science Museum. I had the vision to try to map the collection, revealing links between objects, in the way that the dome is

traditionally used to map celestial object datasets, including stars. The proposed system would generate constellations from clusters of linked objects that could be viewed from multiple angles and remapped based on the user's search preferences.

When beginning the research project in this thesis, Birmingham Museums Trust did not have an accessible collections API. It was only through privileged access to the collection centre that I was able to spend significant time working with the collection to develop my concept.

The final application was developed with creative technologist Chris Hunt from Controlled Frenzy.

3.1.2. Intention

The intention for the MCE prototype was to use discursive design methods to imagine a new digital museum architecture in which users could explore the collection within a structure that reflects contemporary relationships with knowledge. To develop my concept, I decided on some key design considerations for the digital museum experience:

1. Museums are public spaces, and experiences within them are shared.
2. Museums are monuments to knowledge that arouse the senses of visitors. A digital museum should use data visualisation methods to create an inspirational and awe-inspiring experience.
3. The medium of knowledge in the information age is networked, and information is navigated through hyperlinks.

4. Relationships between peoples, places and events are intersecting, multi-layered and subject to change based on the apparatus of looking, and heritage experiences should understand and attempt to reflect that complexity.
5. MCE should be interactive, and searchable and the information it returns should be relevant and useful to users.

Museums are prominent and popular public spaces. As the experience of a museum is shared with other visitors, MCE needs to be experienced in a shared or group environment. I chose to use a 360° projection dome (planetarium dome) rather than a Virtual Reality (VR) experience. The planetarium dome is a lesser-used technology due to its specific architecture but planetariums already have a presence within museums so the technology is available. VR would seem to be an obvious choice as the technology has the potential to create highly compelling 360° immersive experiences in which the user can be transported to alternate imaginary worlds. However, VR experiences that require a headset are limited by their technology to solo participation, and multi-player VR experiences show other people in the virtual world as avatars which cannot be touched. It is therefore challenging to create a convincing communal experience within the limitations of VR.

Contemporary planetarium domes use projection mapping to create a shared virtual reality experience in which audiences can be transported through space and time. The 'magic' of the dome space can carry the viewer from one cognitive schema to another in a psychological phenomenon known as a 'gestalt switch.' In a dome, it is possible to create the visual illusion of journeying through the infinite expanse of the cosmos and then, within seconds, dive into the confines of a single biological cell. The

ability of the dome space to highly alter the perception of the visual field around the viewer leads to a heightened sense of immersion and creates a feeling of awe and wonder. Moreover, the dome experience is a group experience within an architecture already familiar in our public spaces.

The dome's architecture resonates with the original renaissance museum concept, a memory theatre where people could experience knowledge with a single sweeping look. For renaissance museum pioneers, the dome architecture symbolised collective memory onto which knowledge could be mapped, creating inspiring knowledge monuments and spaces of reflection. MCE is designed on these ideals and uses the virtual dome space to reproduce the pleasure of being immersed in an archive.

Using the contemporary knowledge visualisation paradigm of the network to create an experience of museum knowledge closer to how we imagine flows of information in contemporary -society – networked, rhizomatic and highly interconnected - MCE visualises the museum collection as a three-dimensional network with artefacts presented as nodes. Relationships or links with other artefacts are graphically represented as lines. By switching the visual taxonomy of the collection from a hierarchical tree structure to a rhizomatic network, users can explore the multitude of connections between objects, reveal new connections, and travel through the collection as they would navigate information in contemporary networked media. Through a collection search engine, constellations of objects form based on the strength of their relationship to other objects (or nodes), and constellations are formed and reformed dependent on user interaction.

Visualising the museum as a network allows the museum to represent and understand the collection's complexity. Each collection object record has the potential to contain many layers of information, reflecting multiple relationships to other objects, places, time-periods and people. Interactive visualisation allows the network to change shape with each interaction and grow in size and scope as more people engage with it.

The visualisation draws information from a museum collection database hosted in The Cloud and, from this information, generates an interactive networked visualisation in the virtual space. As the visualisation is virtual and not limited to the physicality of the museum architecture, users can create assemblages of any objects from the collection database using keyword searching, as one would when looking for information on the internet. The dome's potential to create seemingly infinite virtual landscapes enables the user to explore far more collection objects and data than would be possible within the physical constraints of the museum or even on a single screen. Curators may use the prototype to inspire new modes of research, simply pulling objects together through a search rather than navigating a storage building, thereby providing unprecedented access to the breadth of the collection in storage. Lesser seen objects will surface, and previously unimagined groupings of objects may inspire new ways to understand heritage.

3.1.3. Design and Implementation

The Museum Collection Engine (MCE) generates networked visualisations of museum collection objects, with attached object information drawn from the

collection database. The networks are designed to appear as constellations of objects, with interrelations indicated through graphic links. The visualisation has been developed in a 3D game engine (Unity) and can be used in a web browser, but is designed principally for a dome projection theatre or digital planetarium.

The initial design concept for the MCE was to use 3D models produced through photogrammetry for the object nodes. The hope was that users would have a more compelling experience if they could see the objects in 3D, but as there are approximately 800,000 objects in Birmingham Museums Trust's collection, I focused on a small sample. I attempted to develop a method via which a good scan of an object could be produced within a short space of time, to allow as many collection objects as possible to be used in the visualisation. I tried multiple hardware and software solutions, including a laser scanner (Next Engine), structured-light 3D scanner (Artec Eva and Structure Sensor for iPad), and photogrammetry (DSLR and Agisoft Metascape photogrammetric processing and 3D model generating software) (see figures 111 - 116). Each 3D scanning process was time-consuming and environmental variations led to inconsistent results.

Furthermore, the 3D object files sizes, including the 3D object information e.g. polygonal faces and textures maps, were too large to be successfully loaded en masse into a visualisation. Luckily, I could access the image library for the Birmingham Museums Trust Collection. The image library contains around 8000 images of collection objects. Each image is titled with the object reference number, so it was a relatively easy task to match these to items on the collection database. Using this

image collection and corresponding information from the collection database, I made a convincing visualisation.

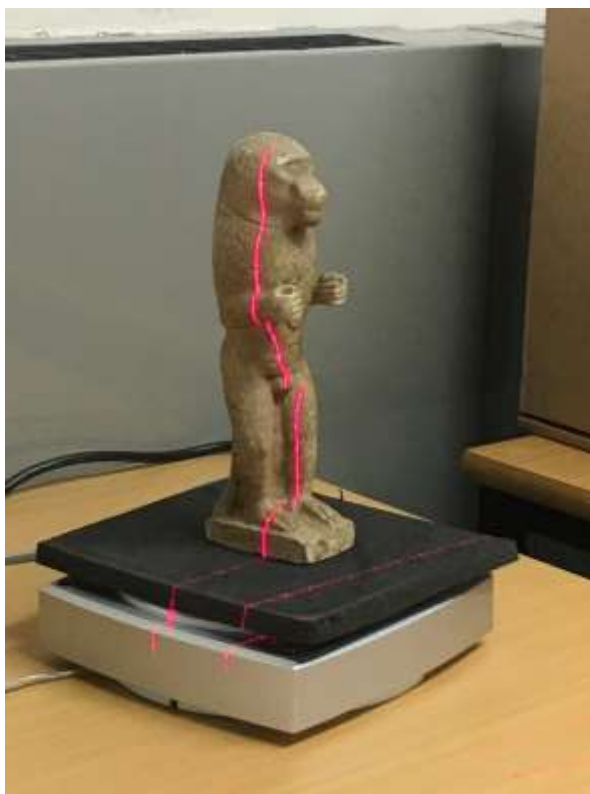


Figure 111 Laser scanning test at Birmingham Museums Trust Collections Centre (Manton, 2018)



Figure 112 Laser scanning test at Birmingham Museums Trust Collections Centre (Manton, 2018)



Figure 113 Laser scanning test at Birmingham Museums Trust Collections Centre (Manton, 2018)



Figure 114 photogrammetry test at Birmingham Museums Trust Collections Centre (Manton, 2018)



Figure 115 photogrammetry test at Birmingham Museums Trust Collections Centre (Manton, 2018)

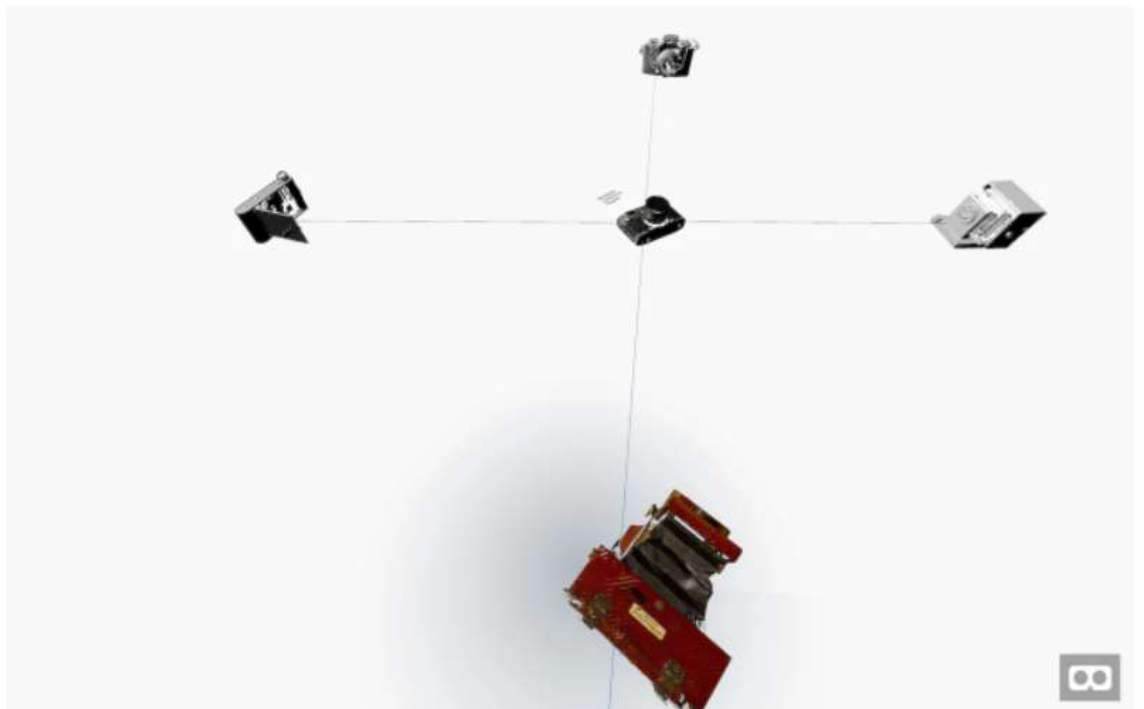


Figure 116 MCE Test using photogrammetry models from Birmingham Museums Trust camera collection (Manton, 2018)

MCE uses a search engine for a user to query the collection database and return a selection of images, and attached information relating to the user's inputted search term. The user's keyword search queries selected fields within the museum collection database and a dataset of AI-predicted image recognition tags. This returns

an array of images from the image library related to the search query. A new constellation is generated with each search query, forming links with the previous constellation. The user can discard and rearrange objects to make their own constellations.

The images are structured in 3D space using a force-directed graph drawing algorithm designed to draw graphs that are well spaced and ordered. The force-directed graph produces nodes in 3D space with equal distance between them. The algorithm assigns forces among the nodes, simultaneously attracting and repelling nodes to ensure that nodes are held together but spread equally in space. In these equilibrium states, nodes that are not connected are generally drawn further apart – visually organising the nodes based on a user-defined type of similarity.

Early MCE prototypes were browser-based, using a JavaScript framework. The user could rotate and zoom in and out of the network using a keyboard and mouse. For initial prototyping, I did not have the dataset from Birmingham Museums Trust prepared, so the Science Museums Open API was used (see figures 117 – 125).

The next MCE iteration was developed using the Unity 3D Game Engine as it is capable of rendering real-time interactive environments and has its own physics engine which was used to simulate the force-directed graph. The project was built both for the browser, WebGL, and the dome. A 360° camera object was used to render the environment for the dome. User interaction was mapped to a touchscreen UI interface that allowed users to navigate through the 3D constellations of objects. The user was able to type in their search term, at which point, the system would search the database for corresponding items and return the correct number of nodes

(represented as a grey circle), and next to each node was an image of the object and object title. A line renderer was used to connect corresponding objects, and on selecting an object, key information from the database would be shown in a separate UI window. (see figures 126-128).

The image library and corresponding data was stored in the Azure Cloud. This allowed the application to be used anywhere. Azure Cloud Cognitive Services were used to deploy AI computer vision tools to analyse the images and create new tags to enable richer search experiences.



Figure 117 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)

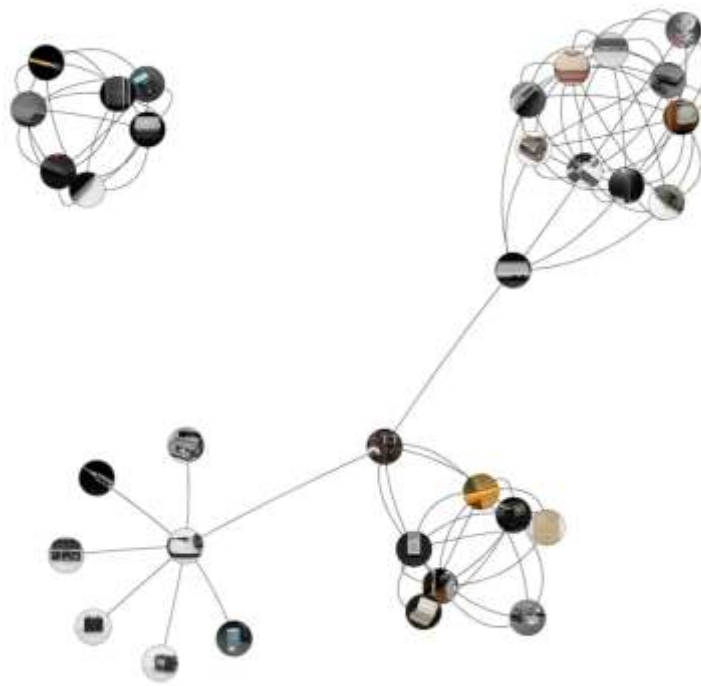


Figure 118 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)



Figure 119 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)



Figure 120 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)



Figure 121 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)

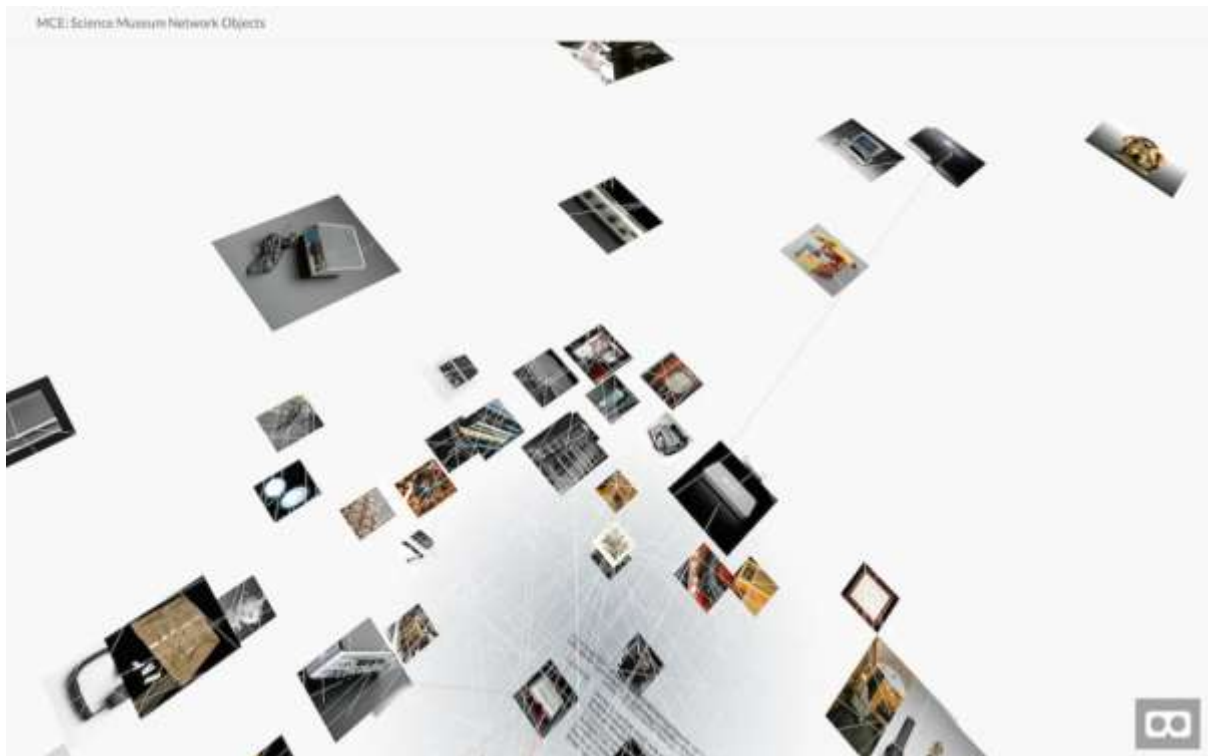


Figure 122 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)

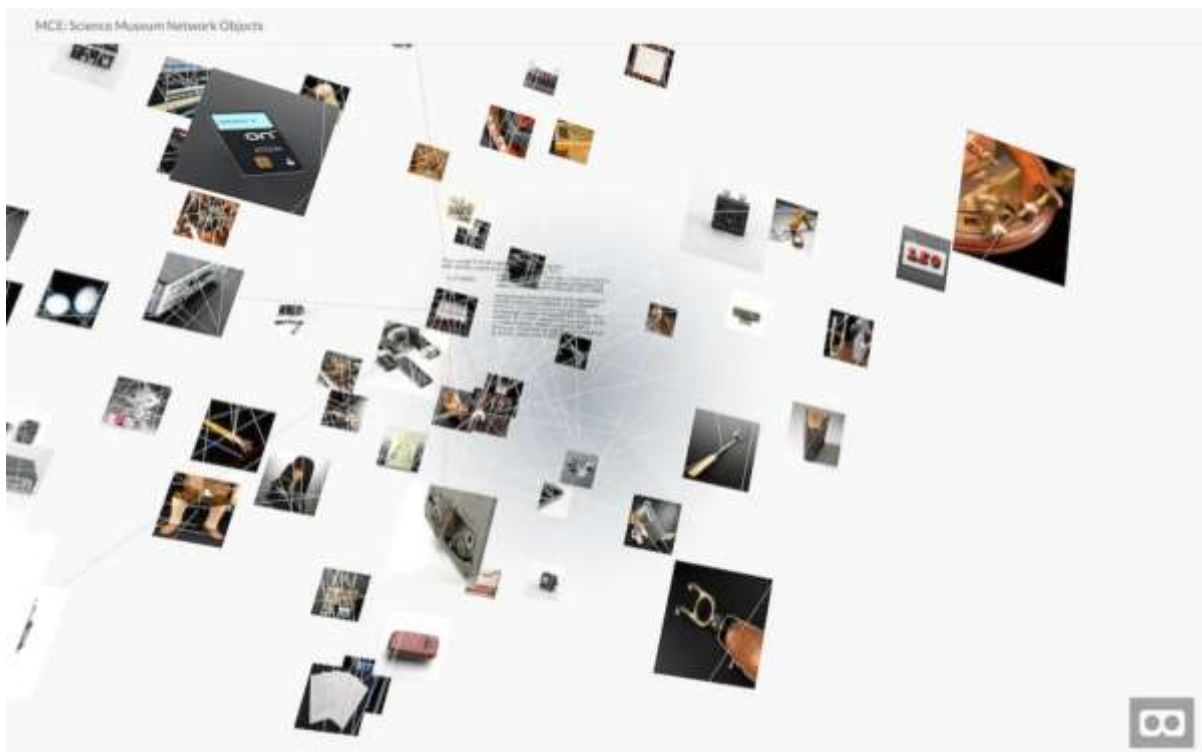


Figure 123 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)

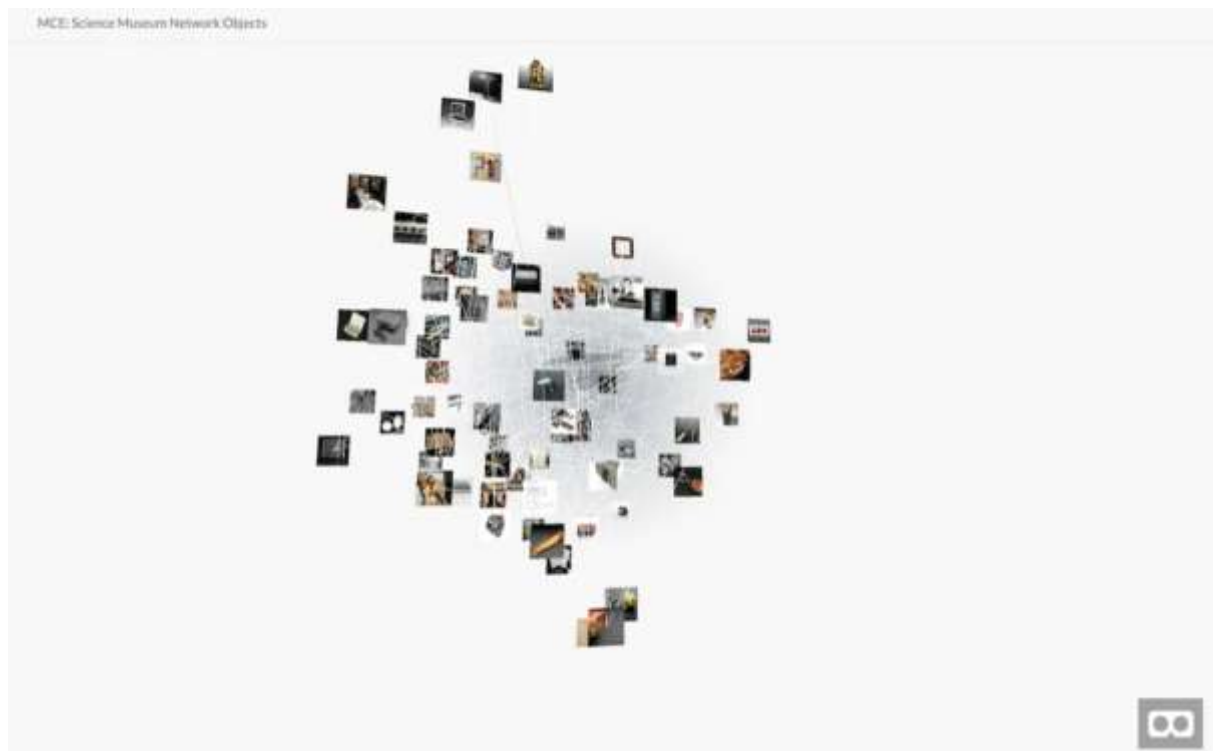


Figure 124 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)

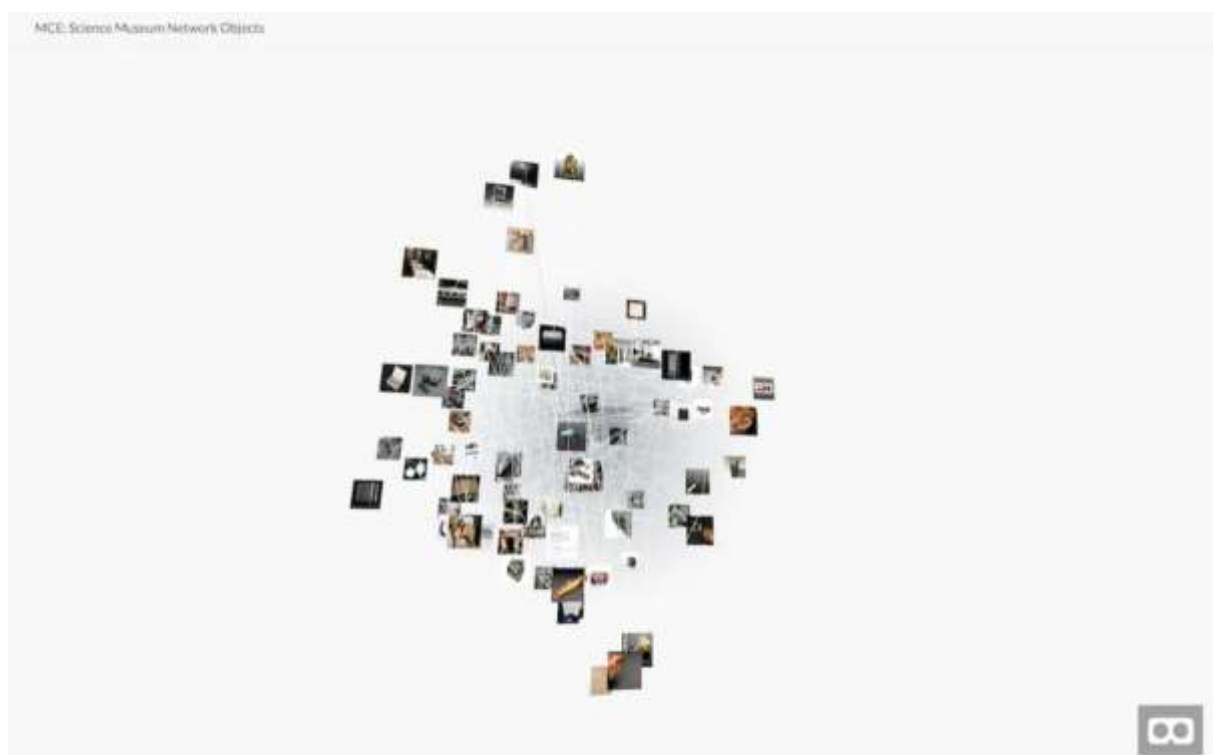


Figure 125 Early MCE prototype using Science Museum Collection API and force-directed graph algorithm. (Manton, 2018)

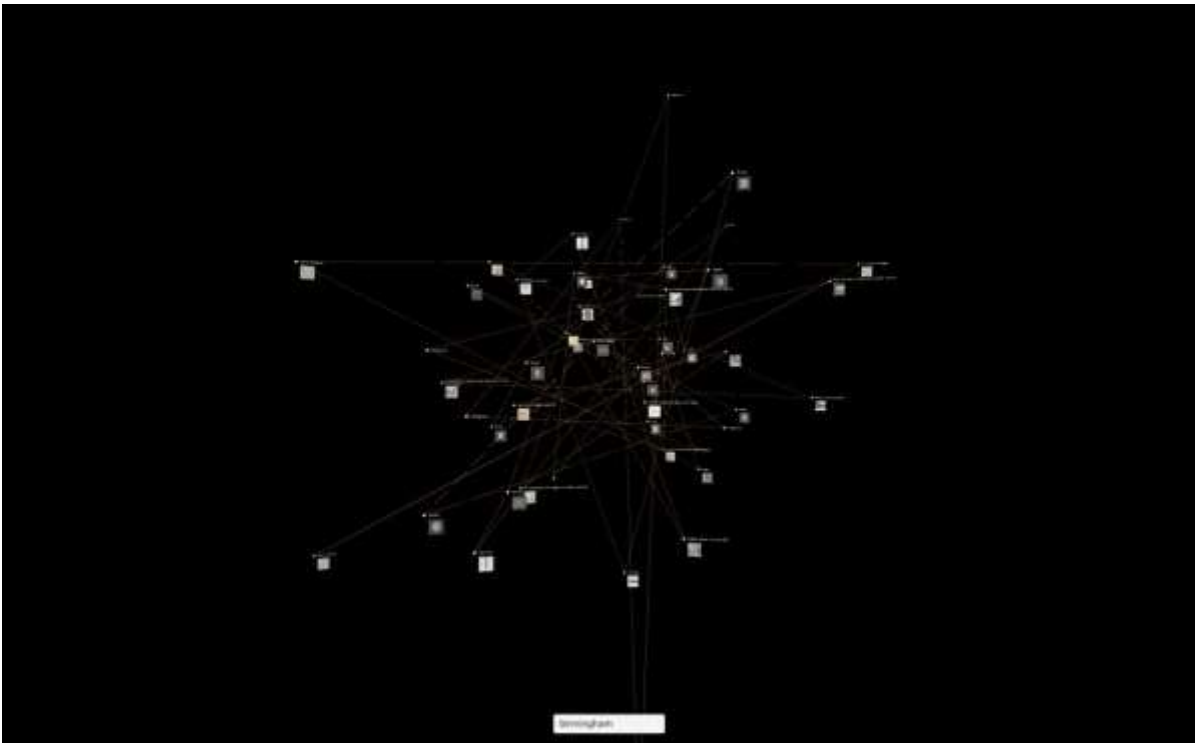


Figure 126 MCE Prototype developed for digital planetarium dome in Unity Game Engine (Manton, 2018).

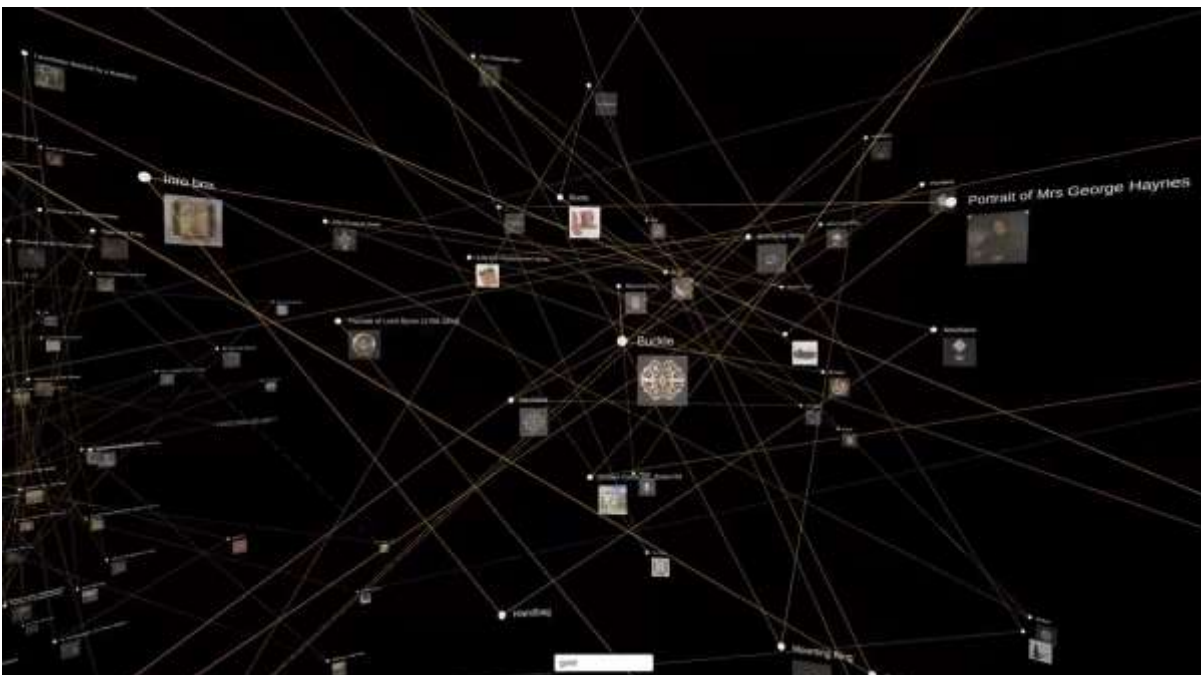


Figure 127 MCE Prototype developed for digital planetarium dome in Unity Game Engine (Manton, 2018).

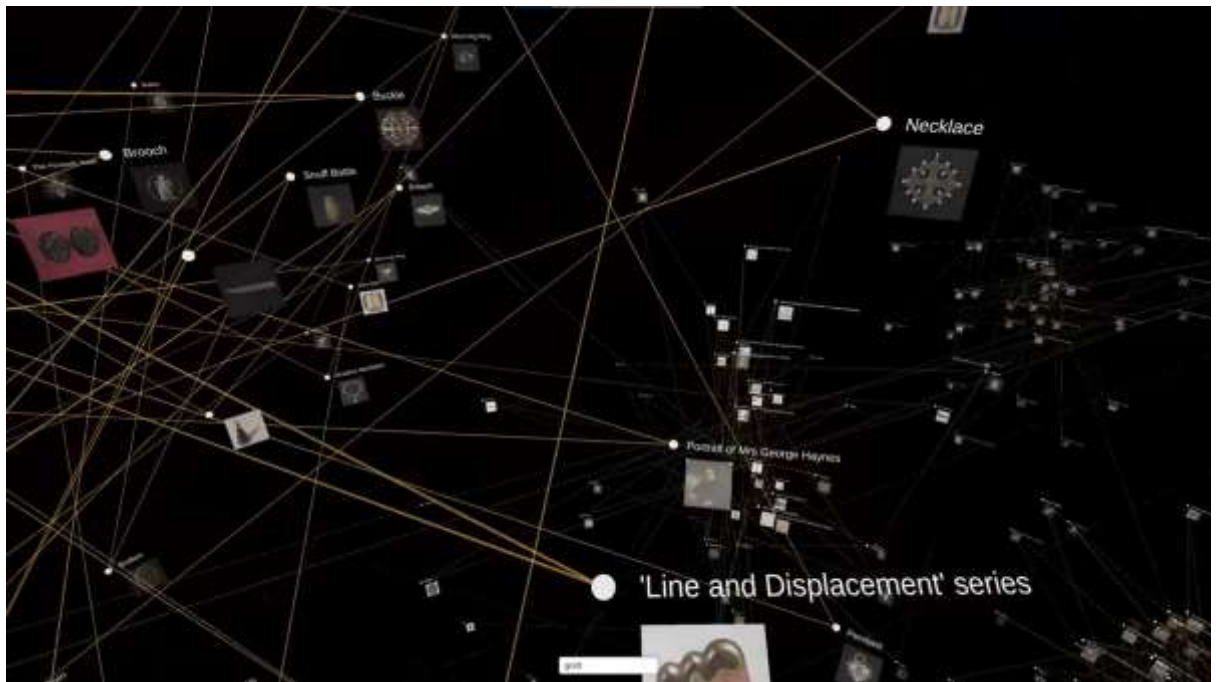


Figure 128 MCE Prototype developed for digital planetarium dome in Unity Game Engine (Manton, 2018).

3.1.4. Observations and Evaluation of Practice

The Museum Collection Engine connected users to the museum collection using the visual language of the information age – the network. Exploring relationships between museum objects as constellations initiated conversations about the breadth of the collection and the surprising links between artefacts and between collections. Using keyword search terms that covered various database fields, including collection, material, maker, location and dates, unforeseen assemblages of objects that crossed time and discipline were brought together – potentially for the first time. Using constellations as a metaphor for these assemblages, alongside the distinctive dome environment, inspired people to look at the collection in a new light.

The installation was successful in creating a space for new discussions about the collection and developed meaningful threads through multiple objects. However,

because of the diversity of objects presented, the sort of sustained narratives that would be woven through an exhibition were fleeting and lacked momentum. Generating the constellations and flying through them, as if admiring a changing landscape from an aeroplane window, was the main mode of interaction. As users made more search queries the complexity of the constellations grew and the map became more impressive in its intricacy. As more links were drawn, the more illegible the map became. The experience of the user emerged as one of witnessing growing complexity, rather than navigating the collection as a way to understand the specific web of relationships. This experience of complexity inspired users to think about the potential of the collection, and the untold narratives hidden in the web of interrelationships. It unearthed parts of the collection that would generally not make it into a public exhibition, and drew interdisciplinary connections between previously segmented collections.

The visualisation aimed to show the potential for a non-hierarchical museum collection visualisation, in which objects were explored through user generated networks and rhizomatic structures. However, the visualisation drew records data and metadata directly from the museum database, and therefore built on the foundations of a hierarchical knowledge system. Faceted database terms pulled favoured results, and users gravitated towards searching for values that corresponded to established fields (e.g. materials: gold, silver, wood or object type: painting, sculpture etc.). Furthermore, as the visualisation pulled unmediated data directly from the database, the possibility of representing colonial collections within the spectacle of an immersive experience – aimed at celebrating collections, was present. The use of Microsoft Azure's existing computer vision training set of image recognition tags created further

potential for the misrepresentation of items. The biases present in image recognition libraries, including language and data models that privilege white western culture have been widely reported. Using Microsoft's cognitive tools creates an undoubtedly richer experience, tagging the collection with items present in the images, not just curatorial descriptions. More work needs to be done to mitigate the biases present within current image recognition training sets.

3.1.5. Next Steps

Key limitations of the current system are based on types of data and language used in the collections database and available image recognitions datasets. To overcome this, and to create an experience integrated into the communities around the museum, a folksonomy approach through a system of social tagging will be implemented. The use of social tagging has the potential to create a far richer collections search than would be possible through the current system. Furthermore, this data would emerge from the community, realising the vision of a non-hierarchical and open experience. Social tagging datasets take time to develop, and require significant public engagement activities beyond the scope of the prototype recorded in this thesis. However, it could be explored as part of a larger research project.

Representing complexity was one of the key challenges of this prototype, however the experience of complexity appeared to overtake the usefulness of the application as a collections research tool. In future iterations, I propose to explore different mechanisms for mapping complexity, including multiple visual schemas and layering multiple types of constellations.

3.1.6. Key Insights and New Knowledge

MCE successfully demonstrated how the visual language of the information age (the network) can be applied to the visualisation and exploration of museum collections. The prototype enabled users to search the collection in a novel and functional way, while providing a sense of the epic scale of the collection through the visual potential of the projection dome.

Visual complexity for museum knowledge:

Experiencing the museum collection as a network of interconnected items inspired users to consider the potential of recognising the multiplicity of connection between artefacts in the collection and imagine how many more connections could be discovered. This experience showed the potential of knowledge visualisations to dissolve boundaries between subject discipline collections and discover new meaning through showing new connections and rapidly creating fresh assemblages of objects. Furthermore, the prototype surfaced objects rarely seen by the public and created more engaging opportunities for showing more of the collection than a standard online collection search engine or physical museum collection.

Artists are beginning to exploit the inherent beauty people find when looking at images that express visual complexity through networks. Lima calls this movement 'Networkism' (Lima, 2013). However, the dazzle of the network may limit users' critical engagement with the content of the collections they are seeing. The experience of knowledge may stop users questioning the authority of museum information including the provenance of the objects, the object's role within the collection and the language used in their classification and description. In this way, the aesthetic experience of

visual complexity may limit users' engagement with the actual complexity found within the contextual information of an object.

Knowledge Monument:

The dome provides an ideal digital architecture for knowledge representation and the realisation of the museum as a knowledge monument. The dome can create a monumental feeling in its visual infiniteness and enclosing architecture. The dome is furthermore a shared virtual reality experience, where users can spend time reflecting on the experience. However, while the museum is still dealing with its 'inherited model' and colonialist knowledge infrastructure, we must be critical of any dazzling experience of knowledge that prevents clear interrogation of its content – and the meaning of that content for different communities. The monumental visual appeal of the dome projection may act to amplify the feeling of trust and authority in the museum dataset by those who experience it. There is a distinct danger in applying optical techniques to visualising the behind-the-scenes or knowledge infrastructure of the museum as the collection may appear more magical in this space and users may be less likely to look within the mystical "black-box" revealing discriminatory processes within the system.

Community building:

Social tagging may provide mechanisms for community engagement in the collection, and create a far richer and more accessible dataset than the current collection information and image recognition models could delivered independently.

New epistemology:

This prototype presents a number of features that could shape a new epistemology for museums, the first is the potential for presenting collections as networks, replicating the fluid, multi-layered and inter-connected experience of contemporary knowledge. This digital and interactive visual schema for the museum collection could facilitate discussions on meaning making in collections and interdisciplinary displays. The conceptualisation of the collection and knowledge within it changing between different shapes and modes of becoming enables further discourse on the nature of meaning making in museums and situated knowledge.

Furthermore, using a dome projection and the capability of the medium to create the optical illusion of an infinite space, creates the sensation of a museum collection without boundaries. Even though there are clearly many knowledge boundaries in the museum collection, and knowledge boundaries in the vast landscape of the internet, the presentation of infinity can generate discussion on expanding what is and is not included in the museum collection.

Digital and networked technology has the capability to bring objects from across the globe, situated within different geographical spaces and cultural contexts, together in a single interactive visualisation. Using this type of tool and reproduction techniques, museums would have the ability to show diverse objects without removing them from their places and cultures of origin. However, this recontextualisation would still need to be approached sensitively and not digitally recreate the oppressive cultural superiority of colonial times.

3.2. Shared Pasts: Decoding Complexity

3.2.1. Introduction

The concept for *Shared Pasts: Decoding Complexity* (Manton, 2019) grew out of observations at the time of the UK referendum to leave the European Union, colloquially known as Brexit, and the social and political fault lines within British society that discourse around the referendum exposed. Dr Nadine El-Enany argues that Britain's manoeuvre away from the EU is "intricately connected to its imperial history" referencing Catherine Hall's warning for European societies against discarding "uncomfortable memories of colonialism" emphasising the "need to do some memory work" on the legacy of Empire (El-Enany, 2017; Hall, 2002). Through the work of academics and activists, calls for Britain to acknowledge the brutal and racist legacy of imperialism have become increasingly prominent in public discourse and museology. However, the UK's grand national narratives and an uncritical nostalgia for Empire have been blocking meaningful debate in many quarters.

Traditionally, the approach to knowledge in the museum has been internalist. Museums express a version of history in an alternate reality or museum space where objects are recontextualised to fit curatorial narratives. This application brings knowledge from inside the museum to outside spaces and community knowledge to inside the museum and public spaces. This new sight of knowledge sharing is achieved through what I have called 'story zones.' The augmented reality design of the application creates a story zone around each object or place, which the visitor can

explore and interact with. Each story zone contains multiple narratives, which the user sees as nodes floating in 3D virtual space.

The project aimed to examine the potential for immersive technologies and knowledge visualisation to tell the complex and multi-layered stories traced through historic artefacts, people and places, to expose hidden or under-told histories to promote greater and more nuanced public discourse around colonialism and Empire. To develop my concept, I decided on four key design considerations for the digital museum experience:

1. The prototype should be designed with the scope to map complex, multi-layered and diverse narratives
2. An 'anti-personalisation' recommendation system should suggest following narratives from lesser engaged chosen stories.
3. The experience should exist within and outside the physical museum and integrate non-museum collection artefacts.
4. Engagement with story zones and AR should be intuitive.

3.2.2. Intention

Shared Pasts: Decoding Complexity uses discursive design methods to question whether augmented reality technology can be used to reveal multi-layered and interlocking narratives linked to historic artefacts, people and places. The project aimed to give a 360° degree view of the past, revealing the complexity surrounding cultural collections and landmarks, showing that meaning-making is dependent on the lens through which you see the past. The project developed a new platform which museums and connecting communities could use to share and showcase their

knowledge, enabling and enhancing narratives around our past from many more points of view.

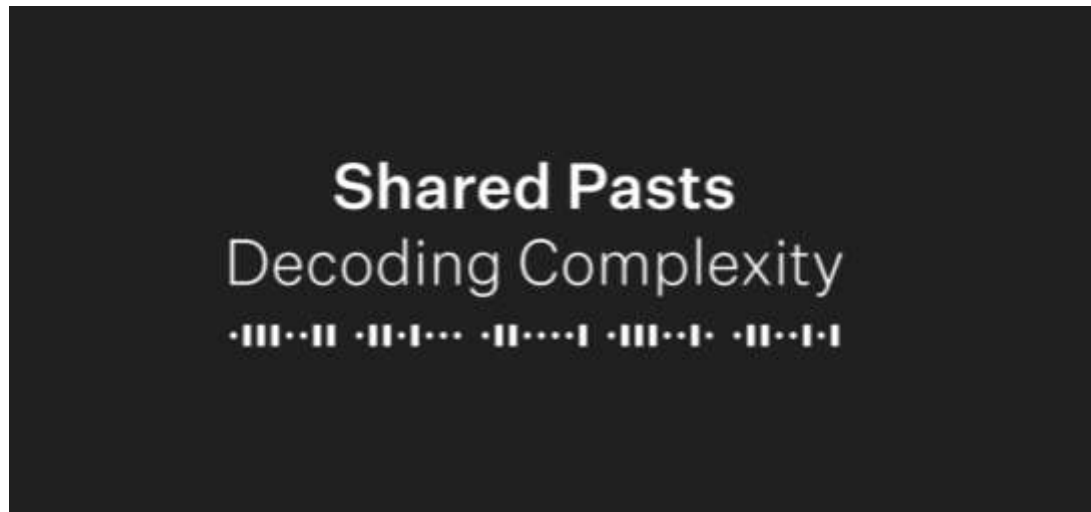


Figure 129 Shared Pasts: Decoding Complexity Logo, Designed by Intercity. (Manton, 2019).

At this moment in U.K. history, there is a pressing need to tackle the challenges of acknowledging alternative histories to the ones people may have been brought up with, recognising complications, and dealing with the echo chamber created by modern media platforms. *Shared Pasts: Decoding Complexity* aimed to challenge people's preconceived notions or biased opinions about the past by bringing under-told or hidden histories to the fore. The AR app enabled users to orientate themselves to see diverse outlooks via an intuitive augmented reality interface and system of 'recommendations' based on seeing and experiencing alternative narratives. The prototype app was developed in Bristol, a city like many in the UK, which holds contested and concealed histories rooted in colonialism. The project aimed to expose the intricate interlocking narratives situated in public spaces and promote discourse about our shared pasts.

Immersive technologies have been adopted in the cultural sector to allow users to experience history – however, the retelling of history through immersive experience can often simplify complicated stories – focusing on a singular point of view. This project used its AR platform to enable the user to explore complicated and often underrepresented narratives from different people to gain a 360° view of the past. The AR app has a machine-learning trained recommendation system (similar to media platforms such as Netflix). This ‘recommendation system’ recommends narratives that widen users’ fields of view based on recommending different paths to those taken by other users and surfacing less opted for narratives. The aim was to subvert the concept of personalisation – recognising that a personalised approach to history can reinforce existing biases and narrow viewpoints on history.

The project was developed in collaboration with Sue Giles, Senior Curator of World Cultures at Bristol Museums and historian Professor Olivette Otele, Professor of Slavery and Memory of Enslavement at Bristol University, writer Lisa Harewood, interactive fiction, researcher Julia Scott-Stevenson and creative technologist Chris Hunt, Director of Controlled Frenzy. Adjoa Andoh voiced the narratives – a Bristol-born actor known for roles in BBC’s *Dr Who* and Netflix’s *Bridgerton*, and voice direction was by Sarah Addezio. The project was supported by Bristol Museums, The British Library, Watershed, and Bath Spa University. The project was funded through a project grant to explore immersive media by The South West Creative Technology Network.

3.2.3. Design and Implementation

Shared Pasts: Decoding Complexity is a mobile application that presents the user with different narratives, mapped or layered onto places and artefacts of historic significance using augmented reality. Museums and community groups were able to add their narratives (including audio files, images and video) to the application through an online platform.

The application was developed using AR Foundation and Unity 3D game engine. Different AR triggers were used, including 3D object scanning, image triggers and geolocation. The user would see a series of circles or nodes appear in the virtual 3D space on finding a trigger. Each node represented a narrative, and the user was invited to choose one to read or listen to. After listening to the first narrative, the user was recommended a second narrative through a graphic line drawn between the original node and a new node, giving the visual impression of a network being built. The recommendation of a 'next' narrative was based on data gathered from other app users, recommending a less chosen initial narrative choice or alternatives to paths to those followed by other users.

All of the prototype AR app narratives were developed by project collaborators and voiced by Adjoa Andoh. However, a web platform was developed to allow other people to contribute narratives to the chosen objects or places. To test the potential of different types of AR triggers, initial storytelling zones were chosen for the prototype (Bristol Museum collection objects, a public statue, a domestic item and a location). The project team selected these trigger points to test the design constraints of the

technology and to present a thoughtfully curated experience, both inside and outside the gallery.

Each object chosen was supported by multiple narratives. These narratives are:

Sugar:

The domestic item chosen was sugar as it has powerful, yet not widely discussed, links to colonialism. The history of sugar is closely linked to stories of migration, trade, slavery and colonisation. Sugar was a key commodity grown on plantations worked by enslaved people in the Americas and the British Caribbean. The sugar trade transformed the landscape of Bristol with sugar warehouses and refineries built around the harbour, and the money from the sugar trade and slave trade made the City of Bristol and its merchants incredibly wealthy. Sugar is a common element of the UK diet and is linked to obesity and diabetes. Key narratives were written by the team that covered a range of topics based on sugar. Narratives developed for the sugar object included:

- The origins of the British tradition of sugar in tea
- Sugar and the slave trade
- Sugar and Bristol's Slavery Abolitionist Movement
- The Caribbean Repatriation Commission setup to address the economic impact of British colonial rule and the Trans-Atlantic Slave Trade
- The science of sugar
- The addictive qualities of sugar

The sugar narratives were triggered by 'scanning' a bag of sugar. A virtual 3D object produced by an Electron Microscopy scan (see figures 130 and 131) of a grain of sugar

appeared in the virtual space on scanning the sugar. Around the sugar grain, a network of stories appeared (see figure 132).

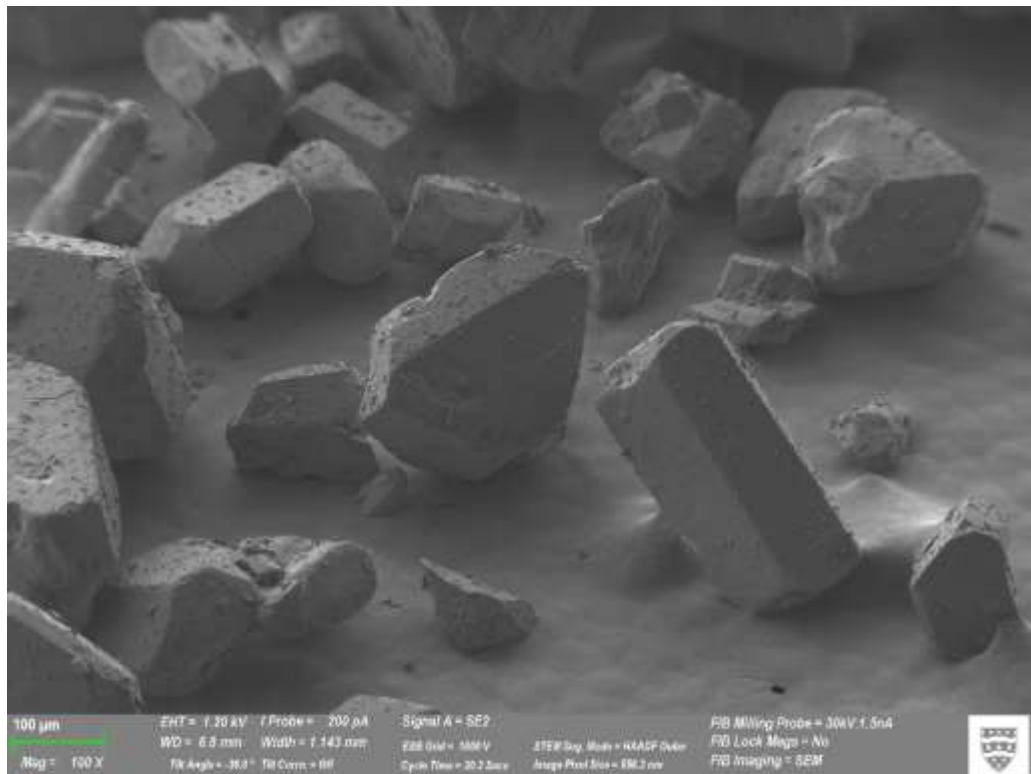


Figure 130 Electron Microscopy Scan of Caster Sugar by Plymouth University. (Manton, 2019)

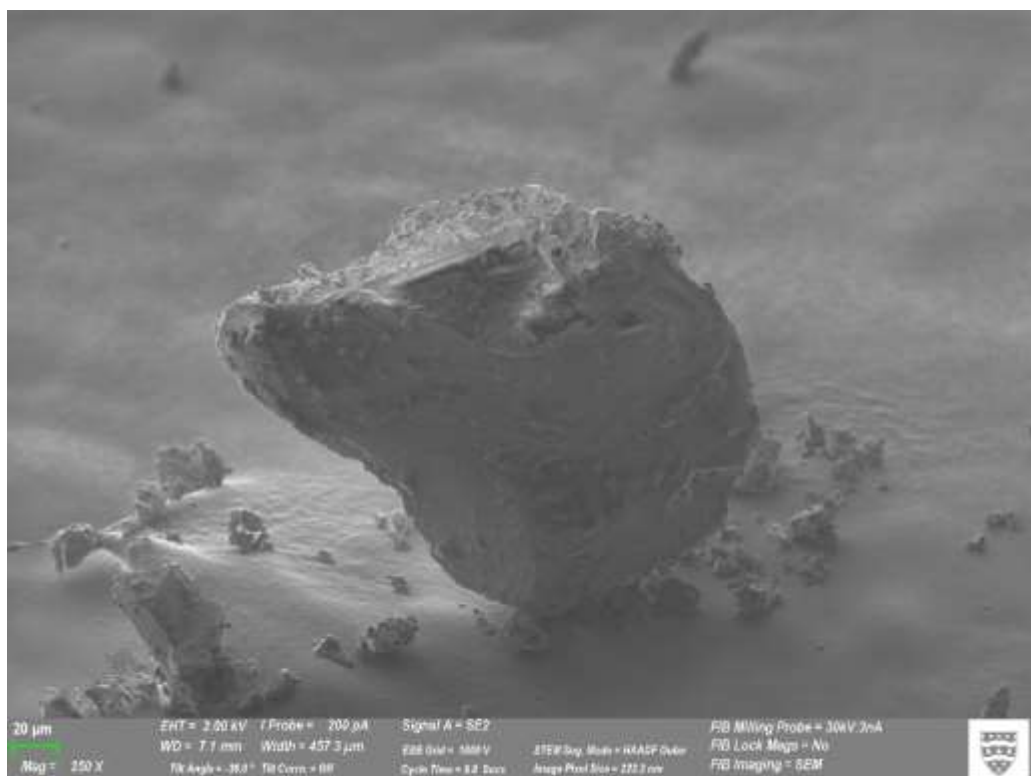


Figure 131 An Electron Microscopy Scan of a single grain of sugar by Plymouth University. (Manton, 2019)



Figure 132 screen capture from *Shared Pasts: Decoding Complexity* AR App showing Sugar 3D object and narrative nodes. (Manton, 2019)



Figure 133 *Shared Pasts: Decoding Complexity* Exhibition at Arnolfini Gallery, Sugar object trigger, (Manton, 2019).
Photo credit: Joe Auburn.

District Officer's Staff:

The Bristol Museum's collection object was a ceremonial staff used by District Commissioners' officials of the British Empire posted to the British colonial Gold Coast, present-day Ghana (see figures 134 and 135). The British used the staff to symbolise authority in the region, and the staff is a symbol of British colonial practices. Key narratives for this item explored:

- The Gold Coast (Ghana) under British colonial rule
- The economy of a British colony
- British colonial administration
- Ghanaian Independence



Figure 134 3D object scan of District Officer's Staff at CAMERA, University of Bath, (Manton, 2019).



Figure 135 District Officer's Staff from the Collection of Bristol Museums. Staff was used as a 3D object trigger (Manton, 2019). Photo credit: Joe Auborn.

Statue of Edward Colston:

The public statue was of Edward Colston, the infamous slave trader who was, until recently, remembered as a celebrated merchant, Member of Parliament and philanthropist who paid for many key civic buildings in Bristol and whose name can be seen across Bristol on street names, buildings and organisations. When Edward Colston was governor of the Royal African Company, conservative estimates are that 84,500 Africans were loaded onto ships in Africa and transported to be sold as slaves by the company. People transported and sold included men, women and children. Around a quarter of these people died on route. So this man was celebrated in Bristol with a grand statue in a prominent place, oversaw the forced deportation,

enslavement and deaths of tens of thousands of people (men, women and children) from the continent of Africa. Key narratives for the statue:

- Colston, the slave trader, and the Royal Africa Company
- Colston as a celebrated benefactor of Bristol
- Countering Colston, the movement to remove the statue

Since the AR app's development, the Statue of Edward Colston has been pulled down and thrown into the Bristol harbour as part of a Black Lives Matter protest. The statue was subsequently removed from the harbour and is now part of the collection of the Bristol Museum.



Figure 136 Statue of Edward Colston (2019). Photo credit: Joe Auborn



Figure 137 Shared Pasts: Decoding Complexity prototype launch. In this image, the story nodes have appeared around the statue of Edward Colston (Manton, 2019). Photo credit: Joe Auborn



Figure 138 Shared Pasts: Decoding Complexity prototype launch. In this image testers and project team are discussing the app inside the story zone for the Statue of Edward Colston (Manton, 2019). Photo credit: Joe Auborn



Figure 139 Screenshot of 3D object marker scanning for AR trigger. Statue of Edward Colston. A previous artistic protest about slavery can be seen at the statue's base (Manton, 2019).

Pero's Bridge:

The location used to test geolocation triggers for the app was Pero's Bridge. Pero's bridge is a modern bridge named after Pero Jones, a man born into slavery on the island of Nevis in the Caribbean and brought to Bristol in 1783 by his master John Pinney. Pero's Bridge is one of the few public monuments to slavery in Bristol, despite the city history as one of Britain's leading ports for the Trans-Atlantic Slave Trade. Key narratives for Pero's bridge include:

- The life of Pero Jones
- The naming of the bridge

- The life of Fanny Coker, an enslaved woman also brought by John Pinney



Figure 140 *Shared Pasts: Decoding Complexity AR App testing, Pero's Bridge (Manton, 2019)*. Photo credit: Joe Auburn



Figure 141 *Shared Pasts: Decoding Complexity AR App testing, Pero's Bridge (Manton, 2019)*. Photo credit: Joe Auburn



Figure 142 *Shared Pasts: Decoding Complexity* AR App testing, Arnolfini Gallery (Manton, 2019). Photo credit: Joe Auburn

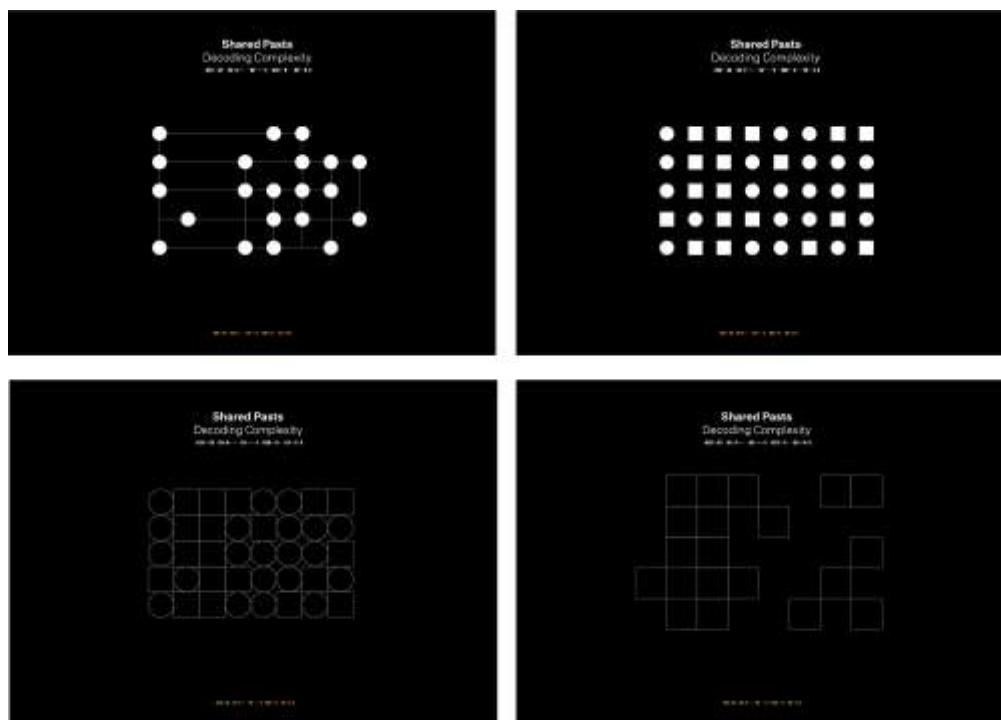


Figure 143 *Shared Pasts: Decoding Complexity* AR image triggers designed by Intercity. They were printed onto postcards for use outside of the story zones (Manton, 2019).

3.2.4. Observations and Evaluation of Practice

The prototype application was exhibited in the Arnolfini Gallery in Bristol.

Visitors were invited to first look at the two objects, the District Officer's Staff and the Sugar, and their surrounding virtual story zones, in the gallery space. Then go outside the gallery for two on-street story zones, Pero's Bridge, just outside of the Arnolfini and the statue of Edward Colston, which was a five-minute walk away. At each story zone site, visitors choose their initial narratives and then follow on narratives for each section were recommended by the system and indicated to the visitor through a new line drawn between the narratives in 3D virtual space.

The visual design and AR interface gave users the impression of multiple and different narratives being stored around or attached to each object or place. The 'graphs' of nodes and links concept developed through the Museum Collection Engine (MCE) prototype was designed to give an impression of multiplicity, complexity and non-linearity. The nodes appeared in 3D virtual space when users 'scanned' the story zone with their mobile device. Visitors found the discovery of the nodes within the story zones exciting. They commented that the visual map of nodes quickly and easily articulated the purpose of the application - to share different narratives and points of view. The use of the graphic line drawn between the nodes to recommend the following narrative to the user was successful. Most users were intrigued by the recommendation and did follow the app's advice to listen to or read the subsequently recommended narrative. Some users commented that the narratives were written as if designed for reading in a textbook rather than listened to as if a story.

It was challenging to explain the recommendation system and how it can recommend lesser heard narratives as an expression of an 'anti-personalisation' in museum design. The graphic link presented between the nodes guided the user successfully but may have given the impression of the stories having a greater link to each other beyond being developed for the same story zone. Explaining machine learning tools to non-specialist users was challenging, and as this concept was new, users struggled to understand why the following story node was being recommended. On reflection, the design of the recommendation system may not be of consequence to the user if they are engaging with the application well and following the links. Still, as an important design feature designed to get users thinking about how museums guide visitors using new technologies, I would have preferred it to have been better understood by users. Furthermore, the recommendation system never received enough data within the prototype testing sessions, resulting in the recommendation appearing to be random.

Early on in the project development, Professor Otele warned us to avoid proposing a 'balance sheet' approach to the history of the British Empire and colonialism (for example, Boehme, 2016). A balance sheet approach to teaching or talking about the British Empire tends to offset the atrocities committed by the British Empire with all of the 'good things' that the Empire did – as if writing a list of pros and cons or score sheet. The balance sheet approach tends to separate the 'good' and the 'bad' rather than presenting all aspects of history as a web of interrelated actions. The concern regarding *Shared Pasts: Decoding Complexity* making the balance sheet approach was that by designing the app to give a '360° view of history' and tackle biases by offering 'alternative points of view', the app would mask the different

experiences and the harm done by colonialism and Empire. For example, the narratives in the statue of Edward Colston story zone included both narratives on his role in overseeing the enslavement of tens of thousands of people from the continent of Africa through his governorship of the Royal African Company, but also narratives that revealed how he used some of the vast profits he made from the slave trade to benefit the city of Bristol through his investments in city infrastructure and civic buildings. Clearly, both of these aspects are interlinked and co-exist, they do not ‘balance out’ each other, and the narratives within the application do not split these two aspects into separate nodes. The nodes within the app were designed to show the complexity of the stories, not propose a balance between opinions. The language used to describe the experience, e.g. ‘different perspectives’, is particularly problematic when dealing with colonialist narratives. By separating narratives into separate nodes, rather than showcasing complexity, there is a potential for siloeing information and creating a ‘balanced’ experience rather than a ‘complex’ one. Providing links between the narratives and encouraging users to move between stories from within stories could help this problem. The user could be presented with a complex network and emerge from the experience seeing a visualisation of the network they have travelled through – rather than connecting nodes based on separate stories they have chosen and been recommended by the system.

The statue of Edward Colston was pulled down on the 7th of June 2020 during a Black Lives Matter protest in Bristol (see figures 144, 145 and 146). The protestors then rolled it to the harbour and pushed it into the water. This was a decisive moment for residents of Bristol and people around the world. It created huge debates about the celebration of colonialist figures in our public spaces. Within Bristol, community

organisations had campaigned to remove the statue for decades, including Countering Colston (Countering Colston, 2015), before it was pulled down during the protest.



Figure 144 Topping of Statue of Edward Colston by anti-racist protestors at Black Lives Matter protest in Bristol, BBC (2020)



Figure 145 Statue of Edward Colston pushed into Bristol Harbour, BBC (2020)



Figure 146 Black Lives Matter protest placards arranged around the statue of Edward Colston after Black Lives Matter protest in Bristol, ArtNet (2020)

Witnessing this powerful act of protest encouraged a re-evaluation of the *Shared Pasts: Decoding Complexity* app. The app aimed to encourage engagement with the complex history surrounding the statue. One of the narratives, 'Countering Colston', asked people to consider the statue's prominent and celebratory position in public space. While the app was encouraging users to think about complexity, the protestors created a rupture in the fabric of public space and discourse in Bristol. This act of community resistance was one of great historical significance and completely reconceptualised in the minds of the public the position of the statue celebrating Colston in Bristol, opening and progressing the public discourse on the legacy of British colonialism and the slave trade. The impact of the toppling of Colston on all

communities is yet to be fully understood. Still, it has been widely celebrated, and the reconfigured statue is now in the permanent collection of Bristol Museums and part of a display at M-Shed (see figure 147).

Understanding history as a web of actors and events, and the range of changing positions from which the web is encountered, is a critical aspect of engaging with our past and re-imagining the museum's role as a space for recognising and encouraging reflection on complexity and multiplicity in heritage. However, exploring and articulating complexity must not act to obscure simple truths. While it is important to recognise the multiple experiences and opinions regarding Edward Colston and the legacies of his life and the lives of his contemporaries, truth revealing ruptures in contemporary thinking hold great power. Reflecting on the toppling of Colston, museums must not get so caught up in the complexity of history and colonialism's impact globally that they avoid necessary actions like decolonisation, repatriation or community consultation for removing culturally offensive artefacts from display.



Figure 147 Statue of Edward Colston, with preserved traces of the protest, on public display in M-Shed, Bristol. ArtNews (2021)

Museums are monuments to knowledge in our public spaces. Museums celebrate the history of human endeavour and are monuments to the sum of human knowledge. Through their architectural design, they hold monumental stature in our public spaces. There is a pressing need for these monuments to our national narratives to re-examine and decolonise collections and catalogue records. Exploring complexity must not obscure the simple truths of colonialist brutality and legacy. However, it should encourage greater engagement with cultural memory and community identity in the UK, creating the space to understand national narratives from new perspectives.

3.2.5. Next Steps

To comprehensively evaluate the success of the *Shared Pasts: Decoding Complexity* app, more stories should be gathered alongside a broader scheme of public testing that was not possible within the scope of this thesis but may be possible as part of a future standalone project with a larger project team. The story-gathering process should be through a community engagement programme designed by key community stakeholders. The narratives should be inclusive of different storytelling mediums, including oral histories.

Evaluating the use of discrete narrative nodes and separate story zones has proved problematic in articulating complexity. Further insights into the expressing complexity in this subject are necessary. Links, different types of links between nodes, and information within nodes will be investigated in future prototype iterations.

3.2.6. Key Insights and New Knowledge

Shared Pasts: Decoding Complexity successfully showed how augmented reality technologies and networked visualisation schemas could be employed to indicate the myriad interlocking narratives connected to historic locations, people and artefacts. The prototype has advocated an alternative recommendation system, proposed as a type of ‘anti-personalisation’, in which less chosen narratives and pathways are recommended to new users to extend perspectives beyond the paths chosen by our peers.

Visual complexity for museum knowledge:

Links in networked visualisation schemas can indicate the strength of connections between narratives and plot a pathway between distinct narratives.

Network visualisations can signify the complexity of multiple narratives across people and time periods attached to places and objects.

The concept of complexity in collections should be applied to increasing open debate and improving discourse around our shared heritage. However, complexity should not be used to obscure simple truths and limit debate and slow down necessary change.

Knowledge Monument:

Augmented reality technologies and network visualisation principles can be applied to creating situated knowledge monuments inside cultural institutions and across public spaces.

Community building:

Modular visualisation methods, able to adapt to more and improved content, create more opportunities for sharing community-based narratives than physical exhibitions.

Community curation has the potential to present alternative points of view and underrepresented stories to the users. However, designers and curators must be cautious of ‘balance-sheet’ approaches to interpreting and understanding history.

Applications such as this should present opportunities for critical and collective debate, in which narratives can be constantly reviewed and curated.

New epistemology:

The development of *Shared Pasts: Decoding Complexity* using discursive design methods revealed several key features and aspects of discourse that should be considered in a new epistemology. These include considering the potential of digital technologies to tell multi-layered, adaptive and multi-perspective narratives and the capability for augmented reality to take museum knowledge into places outside of the museum walls. However, it exposed some of the issues museums may experience when moving from a limited number of fixed narratives in a physical exhibition to a complicated, open and changing network of narratives in a virtual space. Careful consideration must be given to the curation of narratives and how to clearly articulate the purpose of revealing that complexity and building complexity into exhibition design – and not allowing it to obscure or limit public debate.

The application showed the potential of virtual AR museum exhibitions, allowing knowledge to flow through the museum and public spaces in a series of interconnecting webs, to do what is not possible in physical exhibitions limited by the physical technology of display. *Shared Pasts: Decoding Complexity* has the potential to include far more narratives than a physical exhibition and to grow, change and adapt the stories presented dependent on expanding knowledge.

3.3. Women Reclaiming AI

3.3.1. Introduction

The concept for *Women Reclaiming AI* (Aga & Manton, 2018) emerged from a desire to co-create a community archive of language, thoughts and ideas from a diverse yet underrepresented group. Folksonomy processes were the inspiration for creating a community or bottom-up archive based on collective intelligence rather than imposing ideas from a top-down position.

To develop the concept, we decided on four key design considerations for the development of the archive and co-designed chatbot:

- The archive should be written and designed by the community using a folksonomy approach.
- The project should share skills with women usually marginalised from technology development by demystifying the language and processes around artificial intelligence (AI).

- The archive should represent diverse points of view.
- The archive should be living and constantly open to change and development.

Women Reclaiming AI is a collaborative AI voice assistant and activist artwork made by a growing community of over one hundred women, non-binary and genderqueer people. The project aimed to rewrite and reimagine the ‘man-made’ cultural myths of artificial intelligence (AI) and robotics by developing a feminist AI voice assistant. By creating a platform for collective writing and editing, the project co-created an AI voice assistant and unique archive or dataset of women’s language that challenges gender roles. Research indicates that only 13.5% of people working in machine learning are female (Wallach, 2016). AI voice assistants like Google Home, Alexa, Siri, Cortana, and Bixby use female names, identities, and voices. Studies reveal that both men and women respond more favourably to female speech and want their AI assistant to be ‘obedient and assisting’ (Corat, 2019). In response, and critiquing the commercial pursuit of humanising AI technologies – challenging the bias and stereotypes embedded within – ‘Women Reclaiming AI’ developed an archive of women’s speech and ideas by taking a folksonomy approach to examining what it means to be a woman and explored the potential for gender diversity to be at the forefront in the development of AI systems. The resulting output is an AI voice assistant that reflects female identity, using the words and speech from the community and inspirational women that participants admired.

This project was created by Coral Manton and Birgitte Aga in collaboration with the *Women Reclaiming AI* community. The project was funded by the Arts Council.

3.3.2. Intention

The intention of Women Reclaiming AI was to develop a chatbot expressing the thoughts, ideas and desires of women as a piece of activism or protest at the development of voice assistants gendered as women, subordinate and serving, made by predominantly male development teams. To question the creation of an idealised female identity or archetypal AI woman, we co-created an archive of writing with a community of women, creating a collective intelligence of what it means to be a woman using a folksonomy approach. Community building involved developing and running workshops to get as many diverse voices as possible to contribute to the archive or corpus.



Figure 148 Women Reclaiming AI logo. Designed by Intercity. (Aga & Manton, 2018)

The project has links with Donna Haraway's (1991) *A Cyborg Manifesto* railing against the hegemony of male visions of technology-mediated futures. It uses

emerging technologies to propose a move beyond the limitations of current discourse around gender and feminism. The project is inspired by cyber-feminism and the “concept of the internet being a revolutionary tool to overthrow patriarchy, destroy the existing gender binary and achieve feminist liberation” (Renzel, 2017). However, *Women Reclaiming AI* does not regard the Internet and data drive technologies like AI as neutral spaces in which women have equal power to overthrow the existing social order²⁶. The internet and AI datasets reflect the biases already embedded in society. Humans create the Internet and the systems embedded within it, and datasets used to develop natural language and other predictive technologies are derived from human activity. Therefore as Renzel (2017) argues, they are biased and imbued with the same sexist and racist assumptions which pervade society. *Women Reclaiming AI* subsequently aimed to create a bespoke and unique dataset, circumventing the issues of perpetuating existing biases in available archives and developing a co-created and non-hierarchical archive of women’s language.

3.3.3. Design and Implementation

The heart of *Women Reclaiming AI* was a workshop designed to break-down cultural myths about AI, demystify the development processes and engage in group writing for the feminist archive and dataset. Twenty Workshops took place around the

²⁶ For example the Amnesty International research project ‘Toxic Twitter’ exposed the high levels of abuse directed at women on Twitter, most acutely experienced by women of colour (Amnesty International, 2018).

UK and Europe between 2018 and 2021, these included Karst in Plymouth, *Automate Me* in Leeds, and as part of the programme for The Barbican's *AI: More Than Human* exhibition in London. Over one hundred women took part in the workshops, and most of them joined the community and carried on with the writing and editing process. Workshops were reminiscent of DIY and activist-based feminist discussion and making circles (See Red Women's Workshop , 2016; Morris & Withers, 2018) and were non-hierarchical, supportive and confidential.

The workshops were designed to create a safe space for participants, in which they felt encouraged and supported to express their opinions, listen to others and share any thoughts. Throughout each workshop, the ethos was maintained – that women's language matters, women can make mistakes and do not need to be perfect, and women have the right to change their minds. By creating this space, all women felt empowered to contribute to the archive. The archive was designed to be diverse and in constant development or flow. We were not headed for one perfect ideal of an AI woman but an archive that represents a network of evolving and changing ideas. Women were also able to include quotes from other women they admired, but these quotes had to be referenced with the author's name. At the end of each workshop, the chatbot was deployed to a smart speaker (Google Home), and women were invited to converse with the chatbot as a performance with the archive (see figures 149 and 150).



Figure 149 Women Reclaiming AI Workshop, Knowle West Media Centre, (Aga, Manton 2018)



Figure 150 Women Reclaiming AI Workshop, The Barbican AI:More than Human, (Aga, Manton 2019)

We chose to use Dialogflow as the basis of our shared platform for writing and editing (see figures 151 and 152). We chose Dialogflow because it used Google's natural language processing AI tools and was able to provide pronunciation for most words and made deploying the chatbot and performing with it using far easier. The workshops provided participants with a basic understanding of scripting and chatbot development using this platform. Each participant was given complete editorial access and trusted with the continued future of the archive. Writing for the chatbot was local to that workshop and specific to the opinions of the women contributing. For this reason, we developed a community agreement every member signed based on mutual respect and standing against abuse. Extract from community agreement:

"As a member of a growing community, we ask you to treat others in the group with respect and not to delete or change any other people's entries from DialogFlow. We ask that you do not make any entries that could be offensive or discriminatory to any vulnerable or minority groups. Your entries into DialogFlow will be publicly visible by people using the Chatbot on the website so take care with the words you choose. Any words that are not your own and entered into Dialogflow need to be referenced with the author in brackets." (Aga & Manton, 2018)

The chatbot was exhibited to the public as part of ARS Electronica in Linz, Austria, and at Birmingham Open Media (BOM) (see figures 153 and 154). All collaborators (who chose to be) are credited on the website and on the object label whenever the chatbot is exhibited.

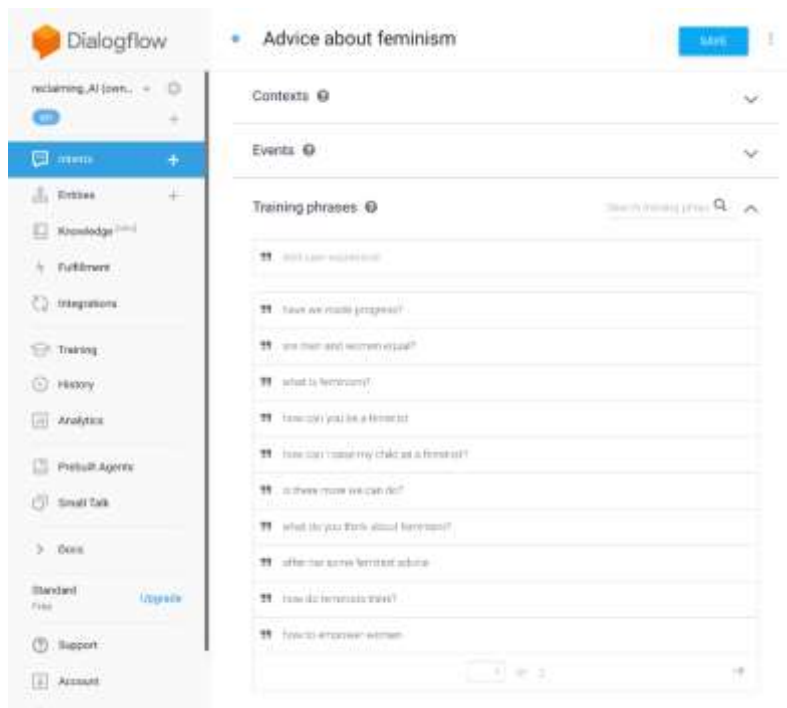


Figure 151 Women Reclaiming AI archive development in Dialogflow (Aga, Manton, 2018)

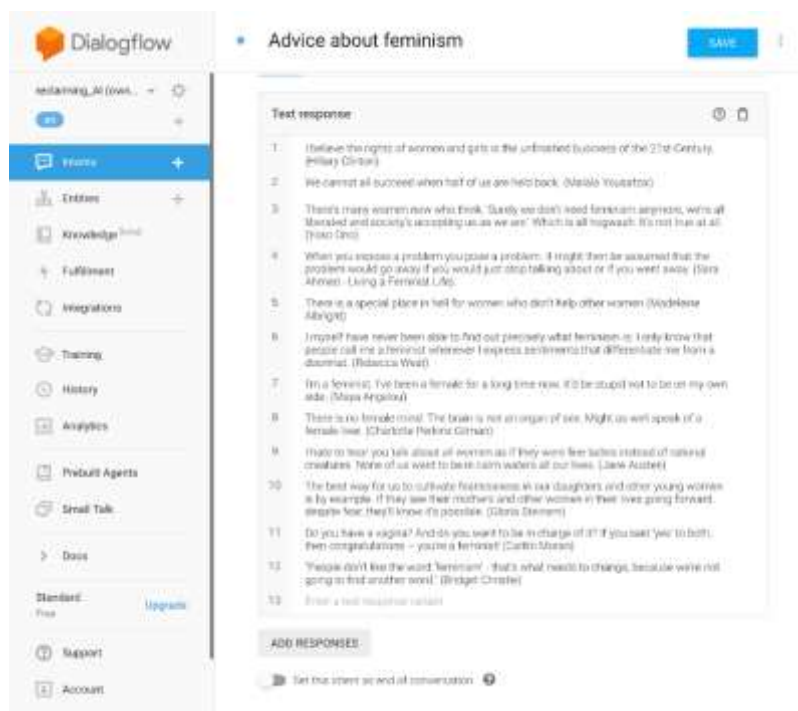


Figure 152 Women Reclaiming AI archive development in Dialogflow (Aga, Manton, 2018)



Figure 153 Women Reclaiming AI Exhibition, Birmingham Open Media (BOM), (Aga, Manton 2019)



Figure 154 Women Reclaiming AI Exhibition, ARS Electronica, Linz, (Aga, Manton 2019)

3.3.4. Observations and Evaluation of Practice

In 2019 the *Women Reclaiming AI* chatbot was exhibited to the public at ARS Electronica in Linz, Birmingham Open Media (BOM), the Eden Project in Cornwall, and the *Women Reclaiming AI* website. People found speaking to the chatbot and hearing responses from the corpus of women's language the project had developed intriguing. The corpus is constantly being written and edited, so exhibitions felt *live* and *edgy*. The exhibit did need to be facilitated for users to get the most out of speaking to the chatbot because unless you knew the phrases to get the most meaningful responses, users might have missed the best of the archive.

Even though the exhibitions were successful, it was the workshops, and the act of collective discussion and writing, in which the project truly came to life. Discussion in workshops was open, diverse and non-hierarchical. The archive of women's language developed inside and outside the workshops was challenging, funny and inspirational. The archive is intriguing and unique and constantly growing and evolving. The project shows that creating alternative archives is possible and rewarding for participants and the wider community. Deployment of a folksonomy approach to co-creating an archive was highly successful, and the community has grown to 100+ women. The project gained international recognition, and the team shared the project through invited conference presentations and panels at a United Nations specialised agency conference on gender and AI in Budapest (2019), to staff at The British Library (2019), and Art Machines II in Hong Kong (2021).

3.3.5. Next Steps

Exhibiting the chatbot as an output of the project is challenging as you need to know what to say to it to receive the best responses. For this reason, we are developing plans for a printed dataset so that people external to the project can get a better sense of the breadth of the archive.

3.3.6. Key Insights and New Knowledge

Women Reclaiming AI successfully showed how a community could take ownership of how they are represented or misrepresented by a dominant group. Writing for the archive was an act of protest, and the resultant chatbot recorded the activism alongside providing an interface for the archive. By drawing new connections and engaging in collective knowledge creation, the community of women proved that collective intelligence is a powerful mode of archive building and can be used to imagine alternate futures through design discourse. The project further explored alternative means of archive creation and access - talking to collective voices through a chatbot interface and collecting ideas through gathering a dataset.

Visual complexity for museum knowledge:

The archive did not have a visual interface and did not use visualisation as a tool; however, we imagine the next iteration will be a printed dataset or browser-based navigable visual dataset, which may use some visual language of complexity and interconnectivity. The experience of developing this archive does underline the

importance of an easily searchable dataset, as we found the chatbot interface limits the interactions to the users trying to find the right questions to initiate conversation. In this way, the full breadth of the archive is not easily discoverable.

Community building:

Women Reclaiming AI was a prototype primarily aimed at generating discourse on community building. The project was an activist artwork that prioritised marginalised voices in the development of the corpus and chatbot. The project successfully developed an archive, within a non-hierarchical knowledge community.

New epistemology:

This discursive design prototyping process has proved the potential for non-hierarchical collective folksonomy approaches to archive creation intending to improve participation and reveal alternative histories and futures in world-building exercises.

3.4. Sanctuary Stories

3.4.1. Introduction and Intension

Sanctuary Stories (Manton, 2018) grew out of time spent volunteering at St. Chad's Sanctuary in Birmingham and with the Asylum Matters activist organisation. St. Chad's Sanctuary is a place of welcome for refugees and asylum seekers in Birmingham. The Sanctuary was coordinated by Sister Margaret Walsh but is not a religious organisation. The Sanctuary is where refugees and asylum seekers can go for community support, access to basic legal advice, essentials like food and clothes, and

English lessons. While volunteering there, I saw the need to record the work of the Sanctuary and the experiences of the Sanctuary users. A lot of work had been done to record people's experiences taking the journey to seek sanctuary in Europe, across the Mediterranean Sea in boats, and many to Calais and then across the channel. However, less work had been done to record the people's experiences once they had arrived in the UK, dealing with the Home Office, finding safety and community. This project contributed to the research in this thesis through the lens of community development and the creation of a unique oral history archive, not through the participants' experiences or the content of the oral histories. So no reference to personal histories will be discussed.

Sanctuary Stories was a collaboration with Birmingham Museums Trust, Asylum Matters and St. Chad's Sanctuary. The project aimed to develop an oral history archive of the experiences of Refugees Asylum Seekers, with a particular focus on experiences since arriving in the UK. The relationship between the museum and collections and the participants was integral to the project. Project participants were invited to visit museums and heritage sites across Birmingham, engage with collections relevant to migration and meet specialist curators. The project sought to create a sense of welcome in Birmingham for refugees and asylum seekers through visiting/learning about Birmingham's heritage particularly through themes of migration. The project also looks to improve English Language skills and give the group confidence in sharing their stories and creating advocates for their community.

To develop the project I decided on two key design considerations:

- The relationship between the museum collections and the participants was central to the concept.
- The exchange of skills was an important element of the design, through using the project to further develop the English language provision at the Sanctuary. This in turn would build confidence with participants to offer oral histories.

The project was funded by the Heritage Lottery Fund and the oral histories are part of the permanent collection of Birmingham Museums Trust and available to the public.

3.4.2. Design and Implementation

The project used discursive design methods to develop a programme of engagement between an external and underrepresented community in the recording of heritage in Birmingham and the museum trust. The relationship between the museum and the project participants aimed to find methods to benefit both stakeholder groups.

The project's overall aim was to record a series of oral histories of a group of refugees and asylum seekers from different home countries, all seeking sanctuary in the city of Birmingham. To work toward recording these oral histories, a relationship of trust and equal exchange was developed between the museum and the participants. This was done by coordinating a series of visits to Birmingham museums and heritage sites, providing opportunities for the group to meet and discuss migration histories with specialist curators on the history of migration in Birmingham to create a sense of welcome for the refugee and asylum seeker group. The group visited the Birmingham Museums and Art Gallery, Soho House, ThinkTank Birmingham Science Museum, the Museum of the Jewellery Quarter, and the Museum Collection Centre (see figures 155

and 156). During the visit, the importance of migration and history of migration in Birmingham was discussed, alongside the participants' experiences. Collections inspired discussions, including key collection pieces for example, the painting *The Last of England* by Ford Madox Brown prompted discussions of experiences of migrants travelling via boats in the Mediterranean Sea and The English Channel. Viewing photography by Vanley Burke in an exhibition at Soho House in Handsworth prompted discussions about other migrant communities in Birmingham and their experiences in establishing communities in the city, including dealing with racism and celebrating identity through food. Alongside each visit, an English lesson was developed with the Sanctuary, offering opportunities to improve vocabulary and practise English speaking.

Finally, the oral histories were recorded at The Sanctuary after a trusting relationship had developed and participants felt ready to discuss experiences in the UK. The project was showcased during Refugee Week (2018) at Birmingham Museum and Art Gallery (see figures 157 - 161).



Figure 155 Sanctuary Stories visit to Birmingham Museum and Art Gallery (Manton, 2018)



Figure 156 Sanctuary Stories visit to Birmingham Museum and Art Gallery (Manton, 2018)



Figure 157 Sanctuary Stories event for Refugee Week at Birmingham Museum and Art Gallery (Manton, 2018)



Figure 158 Sanctuary Stories event for Refugee Week at Birmingham Museum and Art Gallery (Manton, 2018)



Figure 159 Sanctuary Stories event for Refugee Week at Birmingham Museum and Art Gallery (Manton, 2018)



Figure 160 Sanctuary Stories project flyer (Manton, 2018)



Figure 161 Sanctuary Stories project flyer (Manton, 2018)

3.4.3. Observations and Evaluation of Practice

Sanctuary Stories programme design and oral histories were exhibited to the public as part of Refugee Week 2018 in Birmingham. The oral histories were included in the permanent collection of Birmingham Museums Trust in the same year. The project built a strong relationship between the participants and the museum through careful consideration in designing a programme of activities to build trust, create a sense of welcome and forge links between present-day stories of migration to the city and those from the past. The result was an original archive containing underrepresented voices within Birmingham, which is now part of the museum's permanent collection. Alongside this, through the experience gained in sharing their personal stories, project participants have gone on to share their experiences, supported by Asylum Matters, to MPs at The Houses of Parliament and Councillors at Birmingham City Council meetings.

This project developed methods for the museum to collect to consider the equity of the people and the museum and provide the opportunity for the museum to provide a much-needed service to its community. Furthermore, a collection was developed by people unable to share material goods with the museum, creating memory experiences without the requirement of collecting objects.

3.4.4. Key Insights and New Knowledge

Community building:

Sanctuary Stories suggested new models for museums to collect oral histories, particularly from vulnerable communities, in a way that offers a two-way exchange

with potential benefits to both stakeholder groups. The project has provided insights into creating archives for an underrepresented groups with multiple barriers to accessing museum spaces, including discrimination and language.

New epistemology:

Sanctuary Stories provides insights into new ways that museums can work with communities and develop new archives that create a two-way exchange between the museum and surrounding community,

3.5. British Library Algorave

3.5.1. Introduction and Intension

In 2019 I curated an Algorave at the British Library in collaboration with the Alan Turing Institute as part of the *Late at the Library* programme. At this time I was a Research Affiliate of the British Library and interested in the code space of its knowledge infrastructure - the places where knowledge management systems define new interfaces between people and knowledge. The Algorave used British Library Labs collections data to create new music and visual experiences, recoding collections metadata and facilitating engagement and discussion with the behind-the-scenes mechanisms of the library and the layers of software and metadata that make up its knowledge infrastructure. To curate this live event I decided on three key design considerations:

- The *show your screens* ethos of Algorave and use of library code, would promote discussion of the library as a code space and the information infrastructure of the library.
- Using library code would experiment with inverting the library infrastructure and question the coded infrastructure of the library.
- Consider alternative uses of the library space that question information infrastructures and coded knowledge storage mechanisms.

Performers at the British Library Algorave were Coral Manton, Alex McLean (aka Yaku), The Yorkshire Programming Ensemble (TYPE) including Lucy Cheesman, Laurie Johnson, Ryan Kirkbride and Innocent Granger, Antonio Roberts (aka hellocatfood), Dan Hett, Lizzie Wilson (aka digital selves), Shelly Knotts and Joanne Armitage (aka ALGOBABEZ).



Figure 162 Coral Manton performing at Algorave at the British Library in collaboration with The Alan Turing Institute, 2019. Photo credit: Antonio Roberts



Figure 163 Coral Manton and Alex McLean (aka Yaxu) performing at Algorave at the British Library in collaboration with The Alan Turing Institute, 2019. Photo credit: Antonio Roberts



Figure 164 Algorave at the British Library in collaboration with The Alan Turing Institute, 2019. Photo credit: Antonio Roberts

3.5.2. Observations and Evaluation of Practice

The Algorave took place at the British Library as part of the *Lates at the Library* programme and saw 800 people dancing to music and visuals generated by algorithms. The event, next to the King's Library Tower invited participants to consider the code-space of the library by using library collections and metadata to generate some of the audio and visual experience. One of the key aims of the Algorave and Live-Coding community is to open the 'black-boxed' electronic music, by projecting the screens of the performers for the audience to see. Collections metadata is essential for the storage and retrieval of knowledge in the library, but is not usually seen or interrogated by the public. By creating a space of open-code and infrastructural inversion – through the showing of code and therefore making processes, the library became a sight of open knowledge.

3.5.3. Key Insights and New Knowledge

Knowledge Monument:

The Algorave took place at the base to a significant knowledge monument – The King's Tower Library. The practice of showing code, alongside remixing library metadata within the code, encouraged discourse on the code-space of the library and metadata present within the library information infrastructure.

New epistemology:

Discourse around the Algorave suggested the importance of knowledge institutions developing into public spaces for multiple forms of creativity and expression. The live-coding projections produced discourse on the importance of open and discoverable library data and metadata and the importance of transparency in knowledge institution processes.

3.6. Visual Complexity for Museum Knowledge

As has been established in the early chapters of this thesis, contemporary society is coming to terms with a growing awareness of complexity in the world. The rigid architectures of knowledge we imagined have evaporated into conceptual clouds of data, and through our relationship with Web 2.0, knowledge is now considered interconnected, collective, dynamic, morphing, multi-layered and multifaceted.

Chapter two chronicled the changing knowledge schemas present in museums from memory palaces to heterogeneous *wunderkammer* to rigid taxonomic structures, each change resulting from a major epistemic shift in European culture. Chapter two concluded with an exploration of the current epistemic shift, driven by the launch of the information age and the seismic impact of the hyperlink, social internet (Web 2.0) and resultant knowledge networks.

In the classical episteme, knowledge consisted of tabulating accurate interrelationships amongst facts, based on objective and unbiased observation that produced only one correct and unambiguous system of truth. This system was described through hierarchies and branching tree structures. Experts were of high

importance, and a museum curator's role was to tabulate historic significance and reveal universal cultural narratives or truths. In the current episteme, knowledge is socially constructed by communities negotiating compromises among a variety of points of view. Like Wikipedia, StackOverflow and GitHub, knowledge resources are co-constructed by communities of contributors, and the interrelationships and discussions between contributors are where meaning is created. These new forms of relational knowledge have raised concerns about trust and the impact on knowledge of a lack of traditional trusted sources and expertise. Expertise is now negotiated by the community through the quality of discussion, persuasiveness of arguments and a web of recommendations based on other popular, valued and regular contributions. These social epistemological webs have had some highly celebrated results (e.g. Wikipedia) and some concerning ones (e.g. online conspiracy theorist groups that adopt fringe beliefs like 'Flat-Earthers'). Expertise in Web 2.0 communities "involves understanding disputes in detail and proposing syntheses that are widely accepted by the community" (Dede, 2008). Relationships are formed of complicated and shifting networks of dispersed users, knowledge that was once authoritative and travelled out from a single root is now community-based, omnidirectional and non-hierarchical. This new networked knowledge comprises complex interactions in which meaning is being negotiated in a constant state of becoming.

This chapter recorded the process of developing five prototypes that adopted discursive design approaches and new technologies to probe a reimagined museum for the information age that embraces the complexity of knowledge in the networked society - placing the museum in the *space of flows*. These prototypes practically demonstrated the theory presented in this thesis – the language of networks applied

to display the interconnectedness of historic artefacts, people and places can help construct a new epistemology for museums in the information age. Furthermore, this application of visual complexity has communicated knowledge as non-fixed, collaborative and expanding. The visual schema of the network has proved to be a valuable device for showing multiple histories or narratives from different perspectives – communicating that the interpretation of history is situated, relational and made up of complex webs of meaning. The language of networks has even be applied to surfacing underrepresented or hidden narratives through the development of an “anti-personalisation” recommendation system in *Shared Pasts: Decoding Complexity*

This discursive design based exploration of the potential of embracing and representing complexity in museum knowledge, through experimentation with emerging technologies, has proved to be valuable in reimagining and generating discourse in proposing a new epistemology for museums. However, the reality of complexity has proved to be complex in the challenges it has raised.

Complexity is difficult to navigate. Exploration of a complex network starts somewhere in the middle and has no obvious direction of travel. Complex networks can do valuable work in dismantling the ‘grand narratives’ prevalent in museum displays and catalogues and in so doing, create new spaces for lesser-heard and hidden histories. Embracing complexity in museum world-building practices provides fewer opportunities for reductionist or discriminatory knowledge segmentations, as complex networks flourish on multiplicity and increase numbers of data points. However, how does the user find meaning with all of these extra layers of data available? Museum architectures are designed to tell stories through the navigation of space and indicate

importance or value from how objects and information are organised in that space. When this rigid architecture is replaced by the endless possible formations of a network, how are narratives created, and how is value expressed? In the *Museum Collection Engine (MCE)* (Manton, 2018) the network reveals paths of interrelated objects. Some of these reveal shared contexts based on key people, events or places. However, dependent on search terms, many paths are constructed on similarities, drawn from the language within the museum collection database or image recognition tags. It is difficult for the user to construct a picture of the knowledge contained in the museum collection through sliding between individual objects and records. In MCE, value tends to be drawn from the number of nodes in the network, amount of connections, or scale of clusters. However, as has been established in chapter one and two, museums are built on colonialist and discriminatory data. When value is derived from the frequency of search terms in museum databases, value is situated within a discriminatory knowledge infrastructure. Furthermore, in MCE, AI image recognition algorithms were included in the search, but similarly to the museum database, image recognition tags are built on libraries of discriminatory data and biased tagging practices. Therefore, to explore collections using the techniques of data visualisation and language of networks, the dataset on which the collection is built must be interrogated. The “black-boxed” knowledge infrastructure of the museum must be opened and the information within it be open to all communities. The introduction of folksonomy cataloguing and object tagging processes can assist in building a richer dataset and therefore search, based on community knowledge and collective intelligence.

MCE was successful as a new method to search the collection and explore museum objects through relationships or links. Searches can return surprising and unseen groupings of objects that may inspire new modes of research and interdisciplinary exhibitions. Museums could adopt MCE to signify a new approach to knowledge in their communities that actively reshapes itself based on user input and creates multiple and constantly evolving perspectives from which to view knowledge in the museum. Furthermore, MCE can be used to lift the lid on the “black-boxed” museum infrastructure and surface objects from the collection in storage and connections between objects that might never be seen – however, only by enabling users to contribute to the catalogue and recontextualise objects through collective meaning-making can the museum infrastructure be open.

The *Shared Pasts: Decoding Complexity* (Manton, 2019) project created its own and original archive of community created narratives. These narratives appeared as nodes in virtual space. Links were plotted between nodes based on a recommendation system that suggested less popular narratives or pathways. This project was not restricted by the inherited museum catalogue database, but was built on contemporary knowledge and opinions. However, through design discourse and reflection it became clear that the time spent forming and navigating complex webs of perspectives and narratives could act to obscure simple truths. Time spent tied up in complexity can restrict people’s ability to see the plain truth of a situation. Time spent in complexity may stop communities from enacting necessary change. This leads me to the conclusion that museum knowledge should emerge from and acknowledge complexity – not reside in it. Through campaigns like *Museums are Not Neutral* (Museums Are Not Neutral, 2022) the potential and importance for museums as

spaces for social discourse and change are shared. This potential can be realised through museums acknowledging and exploring collections, people and places as complex webs of meaning but not getting so lost in those webs that they become insular and all-encompassing – obscuring necessary truths about the past. Networked and visually complex visualisation and collection search tools have a role in a new type of museum as an acknowledgement of multiple histories and perspectives. They can be used as a catalyst for seeing new connections, promoting new discourse and engaging new voices. However, networks must not be disconnected from people or communities. Community knowledge should be embedded in them, and the network becomes a space from which new collective and open knowledge can flow. The new expertise in the museum is based on the museum providing a platform for community knowledge and building trust through the inclusion of diverse voices and the ability to change.

3.7. Community Building

As discussed in the previous section, knowledge in the information age is socially negotiated. Knowledge in traditional museums is internalist and highly mediated by curators. Furthermore, knowledge is restricted by the boundaries of the catalogue, collection disciplines, and physical storage space.

With the ubiquitous presence of Web 2.0, knowledge creation is now recognised as a collaborative or community-based practice. Knowledge is no longer fixed by the limitations of its physicality (e.g. ink on paper), knowledge in digitally

networked spaces travels around the world in seconds, can be constantly edited and revised, and seemingly infinite amounts can be stored.

For museums to adapt to this epistemic shift in collective intelligence, they might experiment with folksonomy processes. Museums have been experimenting with folksonomy-based image tagging (see chapter 2 section 'Folksonomies'). However, for knowledge to be truly social, more museum cataloguing should be opened to the public's collective intelligence. This concept was investigated in the prototype *Women Reclaiming AI* (Aga & Manton, 2018), in which a community of 100+ women, non-binary and genderqueer people developed an original archive of women's language through collective writing and editing. This archive is living, in that it is constantly evolving and subject to change. A community agreement was developed and the community was given direct ownership of the archive. This radical trust approach has produced a meaningful, inspiring, humorous and celebratory dataset to reflect diverse women's identities. Museums could experiment with folksonomy collections by adopting this approach to developing new archives and exhibitions, by opening a subject for discussion, collecting and cataloguing by a community. Each member donating digital artefacts and catalogue entries to the digital museum. In this way, diverse voices can be included and the knowledge shared will reflect this diversity and the social aspects of the internet.

Knowledge in museums is a commodity, and the more knowledge a museum can claim to hold, the more valued the museum. However, when museums are looking to collect from and record vulnerable communities, this power relationship can be exploitative. *Sanctuary Stories* (Manton, 2018) aimed to develop new approaches to

equitable relationships between knowledge institutions and subjects of enquiry. This social and networked relationship with communities is essential to equitable and sustained folksonomy practices in museums.

3.8. Knowledge Monument for Information Age

Impressive museum architectures and the scale of museum collections in storage can act as ‘knowledge monuments’ within our civic spaces. Visitors to knowledge monuments (as discussed in chapter two ‘Knowledge Monuments’) marvel at the scale and human endeavour contained within its collection. Museums are monuments to physical and hierarchical knowledge, but what of knowledge in the *space of flows*? The *Museum Collection Engine* (Manton, 2018) experimented with the concept of developing a new knowledge monument for the information age. Museum knowledge in the dome was networked, interactive, and navigable in 3D space. Users were intrigued by constellations of objects, the sensation of being immersed in a web of knowledge and ‘flying through’ that web using a bespoke controller. The dome space was chosen due to its potential for shared virtual reality and position in public spaces. As in the proposal for the *Movie-Drome* (1965) by new media artist Stan VanDerBeek (discussed in chapter 2 ‘Knowledge Visualisation and Immersive Technologie’’) the dome becomes its own node in the *space of flows* allowing distributed museum knowledge to flow in and out of the dome space using online networked museum collections and search engines.

The experience of knowledge en masse can have an intoxicating effect in its impressive scale and contextual relationship with European consumer culture and

fetishisation of knowledge databases. However, these types of highly immersive experience can act to fetishise the knowledge on display. The immersive architecture of the projection dome and constellations of museum objects generated by users interacting with MCE acted to dazzle the users. This dazzling effect may dissuade people from critically examining information contained within and assuming the authority of the dataset on display. The invitation for users to add to the archive or view community-based catalogue entries could counteract this reverence for the spectacle of knowledge. Directly connecting users to the knowledge on display, and linking themselves with other people contributing to the networked archive, can ground the experience in reality. This immersive experience of being part of an interrelated community of knowledge could be a new monument to distributed, networked and social knowledge in the *space of flows*.

3.9. New Epistemology

The motivation for the pursuit of new knowledge presented in this thesis was to contribute to growing discourse around new definitions and a new epistemology for museums. The insights that this thesis contributes emerged through the development of a series of prototypes using discursive design methodologies. This process was designed to reimagine the museum for the information age, probing critical discourse in the growing complexity we apply to observing human-made and ‘natural’ phenomena, the social construction of knowledge in networked communities, and

emerging technologies non-hierarchical network schemas for organising contemporary knowledge.

The key insights for a new museum epistemology presented in this thesis are that:

- Museum knowledge circles are porous, and museum knowledge flows in and out of the museum with minimal friction.
- Knowledge is situated, socially constructed and open to change.
- Knowledge should be understood and articulated as complex, social, dynamic, multi-layered, based on the apparatus observation and the perspective from which it is viewed.
- Museum knowledge represents multiple points of view and is situated in the experiences of museum communities.
- Knowledge in museums is transparent and processes are open.
- New knowledge schemas reflecting advances in network science and communication should be established for museum collections.
- Folksonomy approaches to collection, cataloguing and constructing new knowledge are essential to the working of the museum infrastructure.
- Complexity in museums should not act to obscure key museum messages or limit our ability to do “memory work” and redress colonial injustices.

4. Conclusion

The nature of knowledge has undergone a period of rapid change. The predominant mediums of knowledge have transformed from physical, fixed and permanent to digital and in a constant state of formation and renegotiation (Weinberger, 2012). The dominant visual schema for knowledge has transformed from enclosing circles and hierarchical trees to dynamic and complex networks (Lima, 2013; 2014; 2017). Knowledge previously held in the *space of places* has now been released into the *space of flows* (Castells, 2010). Museums, as knowledge institutions, are grappling with this epistemological shift. They are under increasing pressure to leave behind their traditional internalist, essentialist, objective and authoritative forms of knowledge and develop a new epistemological approach based on contemporary knowledge practices built around acknowledging relationality and complexity.

The practice-based research inquiry recorded in this thesis has responded to this desire for change, and joined a growing collection of voices within and outside the museum sector, building a new epistemology for museums for the information age. The research in this thesis focuses on visual and structural schemas for knowledge organisation realised through community curation and folksonomy processes. The research has further questioned the role of museums as knowledge monuments and how these monumental structures could adapt to operate in the *space of flows*.

Each practice element has used discursive design methods to generate discourse and build new insights for a reimagined museum and museum epistemology for networked knowledge in the *space of flows*. Their findings and contributions to knowledge have been synthesised and summarised below:

4.1. Contribution of new knowledge: Visual Complexity and Networks in representing and organising museum knowledge

This practice-based research inquiry has proposed and realised the application of network knowledge schemas in visualising and making accessible museum collections – with a particular focus on the collection in storage. This inquiry has further developed insights and key considerations for approaching and visualising museum collections from the perspective of relational complexity. These insights include discussions on complexity as a mechanism for social inclusion through expressing multiple perspectives in the collection and discussions on obfuscation driving dehabilitation in the ability to critically engage with the past and do “memory work”, particularly around decolonisation and understanding the global impact and reach of imperialism.

4.2. Contribution of new knowledge: Discursive design for museum practice

This practice-based research inquiry has offered key insights into the application of discursive design methods in reimagining museums for online, networked and distributed spaces – that are not focused on a sprint to get collections online as quickly as possible but are focused on ethical and community-based methods to keep and interpret collective heritage. The use of discursive design, particularly design activism and speculative design, has proved to be a valuable approach to

envisioning museum knowledge in the *space of flows*, in a way that generates discourse and participation. Furthermore, discursive design and prototyping have proved a successful method for working with emerging technologies and museum collections – which can be costly and time-consuming.

4.3. Contribution to new knowledge: Knowledge Monuments for the Information Age

This practice-based research inquiry has adopted discursive design methods to imagine a new type of knowledge monument for the information age. This thesis has recommended the dome as an ideal architecture due to its foundational relationship to museum development, connection with utopian knowledge-sharing network concepts of the 1960s, and its ability through immersive projection to make infinite and awe-inspiring spaces. The thesis has further raised some concerns when approaching museum data visualisation, in knowledge monuments, in an uncritical way that works to limit discourse and understanding of the museum knowledge infrastructure.

4.4. Contribution to new knowledge: Folksonomy in archive creation

This practice-based thesis has developed new types of archive creation through community co-creation and chatbot conversation design and development. These methods propose new ways for museums to interact with communities and produce multiple flows of information inside and outside of the museum. Furthermore, the thesis recommends more equitable approaches to collecting oral histories and objects from the most vulnerable communities.

4.5. Contribution to new knowledge towards a new epistemology for museums

This research inquiry has produced multiple insights contributing to a new epistemology for museums. These are listed in the last section of the previous chapter. These insights enter into a continuing discourse around the future of museums and the potential of new museum definition and new museum epistemology.

4.6. Concluding Remarks

Museums are inspirational places full of wondrous objects, captivating artworks, and extensive collections of 'ordinary' items that together represent the enormous breadth of human invention and endeavour and are joyous to behold. Museums are sites of epistemic power and influence and are potential public discourse magnets.

I have been lucky enough to work in museums, libraries and archives for over a decade and have been privileged enough to work in some astonishing spaces with remarkable people passionate about making knowledge and heritage open, accessible and meaningful for all people. I am excited by the potential within the sector for change and see the present moment as a catalyst for discourse on knowledge and meaning-making in museums. The collection of museology discourse that celebrates the potential for museums to be "democratising, inclusive and polyphonic spaces" (ICOM, 2019) while exposing and acknowledging the damaging role museums played in

colonialist expansion and establishing discriminatory imperialist grand narratives, is hopeful.

Charting the development in knowledge schemas and practices, from physical to digital, has been fascinating. I am excited by the possibilities of Web 2.0, Cloud computing, and advances in immersive technologies for opening new ways of seeing and understanding knowledge in museums. These transformative technological advances have the potential to inspire a new epistemology for museums that is collaborative, community-driven, non-hierarchical and open. I am excited to play a part in this movement.

BIBLIOGRAPHY

- Acker, A., 2021. Metadata. In: N. B. Thylstrup, et al. eds. *Uncertain Archives: Critical Keywords for Big Data*. Cambridge & London: MIT Press, pp. 438-449.
- Adler, M., 2016. The Case for Taxonomic Reparations. *Knowledge Organization*, Volume 8, pp. 630-640.
- Adorno, T., 1967. Valéry Proust Museum in Memory of Hermann von Grab. In: T. Adorno, ed. *Prisms*. London: Garden City Press, pp. 175-185.
- Aga, B. & Manton, C., 2018. *Women Reclaiming AI [online prototype]*. [Online] Available at: <https://womenreclaimingai.com/>
- Alberti, S. J. M. M., 2005. Objects and the Museum. *Isis*, 96(4), pp. 559-571.
- Alexander, C., 2015. *A City is Not a Tree: 50th Anniversary Edition*. Oregon: Sustasis Press.
- Alpers, S., 1991. A Way of Seeing. In: I. Karp & S. D. Lavine, eds. *Exhibiting Cultures: The Poetics and Politics of Museum Display*. Washington and London: Smithsonian Institution Press, pp. 25-32.
- Ames, M. M., 1985. De-schooling the museum: a proposal to increase public access to museums and their resources. *Museum*, Volume 145, pp. 25-31.
- Amnesty International, 2018. *Toxic Twitter: A toxic place for women*. [Online] Available at: <https://www.amnesty.org/en/latest/research/2018/03/online-violence-against-women-chapter-1/> [Accessed 21st July 2021].
- Anderson, B., 1983. *Imagined Communities*. London: Verso.
- Anderson, R. G. W., Caygill, M. L. & MacGregor, A. G. S. L. eds., 2004. *Enlightening the British: Knowledge, Discovery and the Museum in the Eighteenth Century*. London: British Museum Press.
- Anderson, S., 2020. Some provocations on the digital future of museums. In: K. Winesmith & S. Anderson, eds. *The Digital Future of Museums: Conversations and Provocations*. London and New York: Routledge, pp. 10-25.
- Architects Journal, 2021. *Carmody Groarke plans overhaul of British Library's huge Boston Spa site*. [Online] Available at: <https://www.architectsjournal.co.uk/news/carmody-groarke-plans-overhaul-of-british-librarys-huge-boston-spa-outpost> [Accessed 13th August 2021].

- Arnold-de Simine, S., 2013. *Mediating Memory in the Museum: Trauma, Empathy, Nostalgia*. London and New York: Palgrave Macmillan.
- Aroyo, L., 2007. *Personalized Museum Experience: The Rijksmuseum Use Case*. Toronto, Archives & Museum Informatics.
- Arts Council England, 2017. *Diversity Focus Report*. [Online]
Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/610859/Diversity_focus_report.pdf
[Accessed 21st July 2021].
- Authur, E., 2004. The Decorative, Abstraction, and the Hierarchy of Art and Craft in the Art Criticism of Clement Greenburg. *Oxford Art Journal*, 27(3), pp. 339-364.
- Barad, K., 2003. Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter. *Signs*, 28(3), pp. 801-831.
- Barad, K., 2007. *Meeting The Universe Halfway: Quantum physics and the entanglement of matter and meaning*. Durham & London: Duke University Press.
- Baudrillard, J., 1996. *The System of Objects*. London: Verso.
- Bazin, G., 1967. *The Museum Age*. Brussels: S.A. Publishers.
- Bearman, D., 2008. Representing Museum Knowledge. In: P. F. Marty & K. Burton Jone, eds. *Museum Informatics: People, Information and Technology in Museums*. London and New York: Routledge, pp. 35-57.
- Beaulieu, A. & de Rijcke, S., 2016. Networked Knowledge and Epistemic Authority in the Development of Virtual Museums. In: C. van den Akker & S. Legene, eds. *Museums in Digital Culture*. Amsterdam: Amsterdam University Press, pp. 75-92.
- Bedford, D., 2021. *Knowledge Architectures: Structures and semantics*. Routledge: London and New York.
- Bennett, T., 1988. The Exhibitionary Complex. *New Formations*, Volume 4, pp. 73-102.
- Bennett, T., 1995. *The birth of the museum: history, theory, politics*. London and New York: Routledge.
- Bennett, T., 2004. *Pasts Beyond Memory: Evolution, Museums, Colonialism*. London: Routledge.
- Bennett, T., 2013. *Making culture, changing society*. London: Routledge.

- Bennett, T. et al., 2017. *Collecting Ordering Governing; anthropology, museums, and liberal government*. Durham NC: Duke University Press.
- Berger, J., 2007. Which Prosthetic? Mass Media, Narrative, Empathy, and Progressive Politics. *Rethinking History: The Journal of Theory and Practice*, 11(4), pp. 597-612.
- Bergman, M. K., 2021. *Hierarchy*. [Online]
Available at: <https://www.isko.org/cyclo/hierarchy#2>
[Accessed 21st July 2021].
- Berners-Lee, T., 1989. *Information Management: A Proposal*. [Online]
Available at: <https://www.w3.org/History/1989/proposal.html>
[Accessed 4th June 2020].
- Bernheimer, R., 1956. Theatrum Mundi. *The Art Bulletin*, 38(4), pp. 225-247.
- Birmingham City Council, 2014. *The Library of Birmingham*. [Online]
Available at:
https://www.birmingham.gov.uk/info/50132/visiting_the_library_of_birmingham/
[Accessed 12th August 2021].
- Birmingham Museums, 2017. *Birmingham Museums*. [Online]
Available at: <https://www.birminghammuseums.org.uk/>
[Accessed 11th August 2021].
- Birmingham Museums, n.d. *Collection*. [Online]
Available at: <https://www.birminghammuseums.org.uk/collection>
[Accessed 20th August 2021].
- Boast, R., 2011. Neocolonial collaboration: museums as contact zone revisited. *Museum Anthropology*, 34(1), pp. 56-70.
- Boehme, K., 2016. *Time to Throw Out the Balance Sheet*. [Online]
Available at:
<https://blogs.sussex.ac.uk/snapshotsofempire/2016/01/26/time-to-throw-out-the-balance-sheet/>
[Accessed 21st July 2021].
- Bonnell, J. & Simon, R. I., 2007. 'Difficult' exhibitions and intimate encounters. *Museum and Society*, 5(2), pp. 65-85.
- Bowker, G., 2005. *Memory practices in the sciences*. London and Cambridge MA: MIT Press.
- Bowker, G. C., Baker, K., Millerand, F. & Ribes, D., 2010. Toward Information Infrastructure Studies: Ways of Knowing in a Networked Environment. In: J.

- Hunsinger, L. Klasturp & A. Matthew, eds. *International Handbook of Internet Research*. New York: Springer, pp. 97-117.
- Bowker, G. C. & Star, S. L., 1996. How things (actor-net)work: Classification, magic and the ubiquity of standards. *Philosophia*, Issue 25.
- Bowker, G. C. & Star, S. L., 1999. *Sorting Things Out: Classification and its consequences*. Cambridge, London: MIT Press.
- Bowker, G. C. & Star, S. L., 2000. Invisible Mediators of Action: Classification and the Ubiquity of Standards. *Mind, Culture, and Activity*, 7(1), pp. 147-163.
- Brace, C. L., 2005. *"Race" is a Four-letter Word; The Genesis of the Concept*. New York: Oxford University Press.
- British Council, 2021. *Museum Without Walls*. [Online]
Available at:
<https://www.britishcouncil.org/tr/en/programmes/arts/museum-without-walls>
[Accessed 1st February 2022].
- British Library, 2014. *British Library opens National Newspaper Building*. [Online]
Available at: <https://www.bl.uk/press-releases/2015/january/british-library-opens-national-newspaper-building>
[Accessed 12th August 2021].
- British Library, 2018. *The Enlightenment*. [Online]
Available at: <https://www.bl.uk/restoration-18th-century-literature/articles/the-enlightenment>
[Accessed July 1st 2021].
- British Library, 2021. *Transforming Boston Spa*. [Online]
Available at: <https://www.bl.uk/projects/boston-spa-plans>
[Accessed 13th August 2021].
- British Library, n.d. *The Journey of a Collection Item*. [Online]
Available at: <https://www.bl.uk/about-us/our-story/explore-the-building/the-journey-of-a-collection-item#>
[Accessed 21st July 2021].
- British Library, n.d. *What is the King's Library?*. [Online]
Available at: <https://www.bl.uk/about-us/our-story/explore-the-building/what-is-the-kings-library>
[Accessed 23rd August 2021].

- British Museum, Google Arts & Culture, 2020. *The Museum of the World*. [Online]
Available at: <https://britishmuseum.withgoogle.com/>
[Accessed 1st February 2022].
- Broberg, G., 1990. *The Quantifying Spirit in the 18th Century*. Berkley: University of California Press.
- Burdick, A. et al., 2012. *Digital Humanities*. Cambridge MA: MIT Press.
- Burke, P., 2011. *A Social History of Knowledge II: From the Encyclopaedia to Wikiedia*. Cambridge: Polity Press.
- Cairns, S., 2011. *Tag! You're It! What value do folksonomies bring to the online museum collection?*. Philadelphia, Museums and the Web.
- Candy, L., 2006. *Creativity & Cognition Studios*. [Online]
Available at: <http://lindacandy.com/about-me/research/practice-based-research/>
[Accessed 1st February 2021].
- Carruthers, W., 2019. Heritage, Preservation, and Decolonization: Entanglements, Consequences, Action?. *Future Anterior*, 16(2), pp. 2-24.
- Castells, M., 2010. *The Rise of the Network Society*. 2nd ed. Chichester: Wiley-Blackwell.
- Chun, S. et al., 2006. *Steve.museum: An Ongoing Experiment in Social Tagging, Folksonomy, and Museums*. Albuquerque, Museums and the Web.
- Clayton, S., n.d. *Modern Design at Microsoft: Going beyond flat design*. [Online]
Available at: <https://www.microsoft.com/en-us/stories/design/>
[Accessed 21st July 2021].
- Clifford, J., 1997. Museums as Contact Zones. In: *Routes. Travel and Translation in the Late Twentieth Century*. Cambridge MA: Harvard University Press, pp. 188-219.
- Conn, S., 2000. *Museums and American Intellectual Life, 1876-1926*. Chicago: University of Chicago Press.
- Cook, S., 2016. *Information: Documents of Contemporary Art*. London and Cambridge MA: Whitechapel Gallery and MIT Press.
- Countering Colston, 2015. *Countering Colston*. [Online]
Available at: <https://counteringcolston.wordpress.com/>
[Accessed July 7th 2021].
- Coxhall, H., 1999. 'Whose Story Is It Anyway?' Language and Museums. *Journal of Museum Ethnography*, Volume 12, pp. 87-100.

- Crane, S. A., 2020. Curious Cabinets and Imaginary Museums. In: S. A. Crane, ed. *Museums and Memory*. Stanford: Stanford University Press, pp. 60-80.
- Danto, A. C., 1992. *Beyond The Brillo Box: The visual arts in post-historical perspective*. Berkley and Los Angeles, California and London, England: University of California Press.
- Datareportal, 2021. *Digital 2021 April Global Statshot Report*. [Online]
Available at: <https://datareportal.com/reports/6-in-10-people-around-the-world-now-use-the-internet>
[Accessed 8th July 2021].
- Davis, B., 2016. *artnet news: Google's Sprawling New Art App Has Grand Ambitions But Is Still Pretty Clunky*. [Online]
Available at: <https://news.artnet.com/art-world/google-arts-culture-app-grand-ambitions-566183>
[Accessed 1st February 2022].
- Davis, P., 2007. Place, Exploration: museums, identity, community . In: S. Watson, ed. *Museums and Their Communities*. Abingdon: Routledge, pp. 53-75.
- Dede, C., 2008. A Seismic Shift in Epistemology. *New Horizons*, 43(3), pp. 80-81.
- Delbourgo, J., 2019. *Collecting the World: Hans Sloane and the Origins of the British Museum*. Cambridge, Massachusetts: Belknap Press of Harvard University Press.
- Delbourgo, J., n.d. *Collecting the World: Hans Sloane and the origins of the British Museum*. s.l.:s.n.
- Deleuze, F. & Guattari, G., 1987. *A Thousand Plateaus: Capitalism and Schizophrenia*. Minneapolis, London: University of Minnesota Press.
- Department for Digital, Culture, Media & Sport , 2022. *National Statistics: Museums - Taking Part Survey 2019-20*. [Online]
Available at: <https://www.gov.uk/government/statistics/taking-part-201920-museums/museums-taking-part-survey-201920>
[Accessed 21st July 2021].
- Desvallées, A. & Mairesse, F., 2010. *Key Concepts of Museology*. Paris: Armand Colin.
- Diagne, C. & Barradeau, N., 2017. *Free Fall*. [Online]
Available at: <https://experiments.withgoogle.com/free-fall>
[Accessed 1st February 2022].
- Diagne, C., Barradeau, N. & Doury, S., 2018. *t-SNE Map*. [Online]
Available at: <https://experiments.withgoogle.com/t-sne-map>
[Accessed 1st February 2022].

- Diagne, C. & Doury, S., 2017. *Curator Table*. [Online]
Available at: <https://artsexperiments.withgoogle.com/curatortable/>
[Accessed 1st February 2022].
- Diagne, C. & Hugo, G., 2017. *Tags*. [Online]
Available at: <https://experiments.withgoogle.com/tags>
[Accessed 1st February 2022].
- Diagne, C. & Hugo, G., 2017. *Tags*. [Online]
Available at: <https://artsexperiments.withgoogle.com/tags/>
[Accessed 1st February 2022].
- Ding, Y., 2009. Perspectives on Social Tagging. *Journal of the American Society for Information Science and Technology*, 60(12), pp. 2388-2401.
- DiNucci, D., 1999. Fragmented Future. *Print*, 53(4), pp. 221-222.
- Drucker, J., 2020. *Visualisation and Interpretation: humanistic approaches to display*. Cambridge MA: MIT Press.
- Duclos, R., 2004. The cartographies of collecting. In: S. J. Knell, ed. *Museums and the Future of Collecting*. Farnham and Burlington VT: Ashgate, pp. 84-101.
- Duncan, C., 1991. Art Museums and the Ritual of Citizenship. In: I. Karp & S. D. Lavine, eds. *Exhibiting Cultures: The Poetics and Politics of Museum Display*. Washington and London: The Smithsonian Institution, pp. 88-103.
- Duncan, C., 1995. *Civilising Rituals: Inside Public Art Museums*. London and New York: Routledge.
- Duncan, C. & Wallach, D., 1980. The Universal Museum Survey. *Art History*, 3(4).
- Dunne, A. & Raby, F., 2013. *Speculative Everything: Design, Fiction, and Social Dreaming*. Cambridge MA: MIT Press.
- Edwards, P. N., Bowker, G. C., Jackson, S. J. & Williams, R., 2009. Introduction: An Agenda for Infrastructure Studies. *Journal of the Association for Information Systems*, 10(5), pp. 364-74.
- El-Enany, N., 2017. *Things Fall Apart: From Empire to Brexit Britain*. [Online]
Available at: <https://blogs.bath.ac.uk/iprblog/2017/05/02/things-fall-apart-from-empire-to-brexit-britain/>
[Accessed 21st July 2021].
- Elgenius, G., 2014. National Museums as National Symbols. In: P. Aronsson & G. Elgenius, eds. *National Museums and Nation-Building in Europe 1750-2010*. London and New York: Routledge, pp. 145-166.

- Fabianski, M., 1990. Iconography of The Architecture of Ideal Musaea in the Fifteenth to Eighteenth Centuries. *Journal of the History of Collections*, 2(2), pp. 95-134.
- Fehr, M., 2000. A Museum and Its Memory: The Art of Recovering History. In: S. A. Crane, ed. *Museums and Memory*. Stanford: Stanford University Press, pp. 35-59.
- Finden, P., 2000. The Modern Muses: Renaissance Collecting and the Cult of Remembrance. In: S. A. Crane, ed. *Museums and Memory*. Stanford: Stanford University Press, pp. 161-178.
- Findlen, P., 2018. The Museum: Its Classical Etymology and Renaissance Genealogy. In: D. Preziosi & C. Farago, eds. *Grasping the World: The Idea of the Museum*. 2nd ed. London: Routledge, pp. 159 - 191.
- Finn, M. C., 2020. Material Turns in British History: III. Collecting: Colonial Bombay, Basra, Baghdad and the Enlightenment Museum. *Transactions of the Royal Historical Society*, Volume 30, pp. 1-28.
- Fleming, D., 2005. Creative Space. In: S. MacLeod, ed. *Reshaping Museum Space: architecture, design, exhibitions*. London and New York: Routledge, pp. 53-61.
- Fontes da Costa, P., 2002. The Culture of Curiosity at The Royal Society in the First Half of the Eighteenth Century. *Notes and Records of the Royal Society London*, 56(2), pp. 147-166.
- Foster, A., 2021. *LGBTQ+ VR Museum*. [Online] Available at: <https://lgbtqvrmuseum.com/> [Accessed 1st February 2022].
- Foucault, M., 1970. *The Order of Things: An archaeology of human sciences*. London: Tavistock Publications.
- Foucault, M., 1972. History, discourse, and discontinuity. *Salmagundi*, Volume 20, pp. 241-248.
- Foucault, M., 1974. *The Archaeology of Knowledge*. Tavistock Publications: London.
- Foucault, M., 1977. Nietzsche, genealogy, history. In: D. F. Bouchard, ed. *Language, Counter-Memory, Practice: Selected Essays and Interviews*. Oxford: Blackwell, pp. 139-164.
- Foucault, M., 1980. *Power/Knowledge*. New York: Pantheon Books.
- Foucault, M., 1986. Of Other Spaces. *Diacritics*, 16(1), pp. 22-27.
- Francis, E., 2019. *What is a museum?*, Brighton: Museum Association.

- Fraser, N., 1990. Rethinking the Public Sphere: A Contribution to the Critique of Actually Existing Democracy. *Social Text*, Volume 25, pp. 56-80.
- Fuad-Luke, A., 2009. *Design Activism: Beautiful Strangeness for a Sustainable World*. London: Earthscan.
- Funtowicz, S. O. & Ravetz, J. R., 1993. Science for the post-normal age. *Futures*, pp. 739-755.
- Fyfe, G. & Ross, M., 1995. Decoding the visitor's gaze: rethinking museum visiting. *Sociological Review Monograph Series: Theorizing Museums*, 43(1), pp. 127-150.
- Garberson, E., 2006. Libraries, memory and the space of knowledge. *Journal of the History of Collections*, 18(2), pp. 105-136.
- Gartner, R., 2016. *Metadata: Shaping Knowledge from Antiquity to the Semantic Web*. London: Springer.
- Genia, E., 2010. *Wokiksuye The Politics of Memory in Indigenous Art Monuments & Public Space*. Cambridge, Massachusetts: MIT .
- Getty, n.d. *The Getty Alchemy Collection*. [Online]
Available at: <https://archive.org/details/gettyalchemy?&sort=-week&page=2>
[Accessed 11th August 2021].
- Giatti, L. L., 2019. Adaptive Methods. In: *Participatory Research in the Post-Normal Age*. s.l.:Springer, Cham, pp. 85-108.
- Gilliland, A. J., 2012. Contemplating Co-creator Rights in Archival Description. *Knowledge Organisation*, 39(5), pp. 340-346.
- Giraldo, M., 2020. *Aereo: an experimental bird's eye view of the digital collections from the State Library of New South Wales*. [Online]
Available at: <https://dxlab.sl.nsw.gov.au/aereo/#/>
[Accessed 21st July 2021].
- Golding, V., 2009. *Learning at the Museum Frontiers: Identity, Race and Power*. Farnham: Ashgate.
- Gold, M., 2019. *Victorian Egyptology and the Making of a Colonial Field Science, 1850-1905*. Cambridge: University of Cambridge.
- Google Arts & Culture, 2012. *Arts & Culture*. [Online]
Available at: <https://artsandculture.google.com/>
[Accessed 6th July 2021].
- Google Arts & Culture, 2020. *Close to Heaven - Domed Halls on Museum Island*. [Online]

Available at: <https://artsandculture.google.com/exhibit/close-to-heaven-%E2%80%93-domed-halls-on-museum-island-bode-museum-staatliche-museen-zu-berlin/TgJSr4T-xv-1JA?hl=en>
[Accessed 11th August 2021].

- Gosden, C. & Larson, F., 2007. *Knowing Things: Exploring the Collections at the Pitts Rivers Museum 1884-1945*. Oxford: Oxford University Press.
- Greenhalgh, P., 1989. Education, Entertainment and Politics: Lessons from the Great International Exhibitions. In: P. Vergo, ed. *The New Museology*. London: Reaktion Books, pp. 74-98.
- Grinell, K., 2014. Challenging normality: Museums in/as public space. In: A. B. Fromm, P. B. Rekdal & V. Golding, eds. *Museums and Truth*. Newcastle upon Tyne: Cambridge Scholars Publishing, pp. 169-188.
- Guggenheim, 2014. *Shine On: The History and Vision behind the Guggenheim's Iconic Skylight*. [Online]
Available at: <https://www.guggenheim.org/blogs/checklist/shine-on-the-history-and-vision-behind-the-guggenheims-iconic-skylight>
[Accessed 11th August 2021].
- Halavais, A., 2008. The Hyperlink as Organizing Principle. In: J. Turrow & L. Tsui, eds. *The Hyperlinked Society: Questioning Connections in the Digital Age*. Michigan: University of Michigan Press, pp. 39-55.
- Hall, B. L. & Tandon, R., 2017. Decolonization of knowledge, epistemicide, participatory research and higher education. *Research for All*, 1(1), pp. 6-19.
- Hall, C., 2002. Histories, Empires and the Post-Colonial Moment. In: I. Chambers & L. Curti, eds. *The Postcolonial Question: Common Skies, Divided Horizons*. London and New York: Routledge, p. 66.
- Hall, S., 1999. Whose Heritage? Un-settling 'The Heritage', re-imaging the Post-nation. *Third Text*, Volume 49, pp. 3-13.
- Haraway, D., 1991. A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century. In: *Simians, Cyborgs and Women: The Reinvention of Nature*. New York: Routledge, pp. 149-158.
- Harmon, E. & Cherny, L., 2022. *Surfacing Women in Smithsonian History*. [Online]
Available at: <https://experiments.withgoogle.com/women-in-smithsonian-history>
[Accessed 1st February 2022].
- Hein, G. E., 1999. The constructivist museum. In: E. Hooper-Greenhill, ed. *The Educational Role of Museums*. Abingdon and New York: Routledge, pp. 73-79.

- Hein, H. S., 2000. *The Museum in Transition: A Philosophical Perspective*. Washington: Smithsonian Books.
- Hein, H. S., 2006. *Public Art: Thinking Museums Differently*. Oxford: Rowman.
- Hesse, B., 2002. Forgotten Like a Bad Dream: Atlantic Slavery and the Ethics of Postcolonial Memory. In: *Relocating Postcolonialism*. Oxford: Blackwell, pp. 143-173.
- Hetherington, K., 2011. Foucault, the museum and the diagram. *Sociological Review*, 59(3), pp. 457-475.
- Hetherington, K., 2015. Foucault and the Museum. *International Handbooks of Museum Studies: Museum Theory*, Volume 3, pp. 21-40.
- Hicks, D., 2020. *The Brutish Museums: The Benin Bronzes, Colonial Violence and Cultural Restitution*. London: Pluto Press.
- Hicks, D., 2021. Glorious memory. In: H. Carr & S. Lipscomb, eds. *What is History, Now? How the past and present speak to each other*. London: Weidenfeld & Nicolson, pp. 101-115.
- Hollows, V., 2019. The Activist Role of Museum Staff. In: R. R. Janes & R. Sandell, eds. *Museum Activism*. London & New York: Routledge, pp. 80-90.
- Hooper-Greenhill, E., 1992. *Museums and the Shaping of Knowledge*. London: Routledge.
- Hooper-Greenhill, E., 1999. Communication in theory and practice. In: E. Hooper-Greenhill, ed. *The Educational Role of the Museum*. Abingdon and New York: Routledge, pp. 28-43.
- Hooper-Greenhill, E., 1999. Education, communication and interpretation: towards a critical pedagogy in museums. In: E. Hooper-Greenhill, ed. *The Educational Role of the Museum*. Abingdon and New York: Routledge, pp. 3-27.
- Hooper-Greenhill, E., 1999. Museum learners as active postmodernists: contextualising constructivism. In: E. Hooper-Greenhill, ed. *The Educational Role of the Museum*. Abingdon and New York: Routledge, pp. 67-72.
- Hooper-Greenhill, E. S. R. O. H. M. T., 2000. *Museums and social inclusion: The GLLAM report*. Leicester: Group for Large Local Authority Museums & Leicester University .
- Horsman, P., Ketelaar, E. & Thomassen, T., 2003. New Respect for the Old Order: The Context of the Dutch Manual. *The American Archivist*, 66(2), pp. 249-270.

- Houlton, T., 2021. *Monuments as Cultural and Critical Objects: From Mesolithic to Eco-queer*. London and New York: Routledge.
- Huang, A. W. & Chuang, T., 2009. Social Tagging, Online Communication, and Peircean Semiotics: A Conceptual Framework. *Journal of Information Science*, Volume 35, pp. 350-357.
- Hunter, M., 2017. The Cabinet Institutionalized: The Royal Society's 'repository' and its background. In: O. Impey & A. MacGregor, eds. *The Origins of Museums: The Cabinet of Curiosities in Sixteenth- and Seventeenth- Century Europe*. Oxford: The Ashmolean Museum, University of Oxford , pp. 159-168.
- Huxley, A., 1959. *Brave New World Revisited*. London: Chatto & Windus.
- ICOM, 2019. *ICOM announces the alternative museum definition that will be subject to a vote*. [Online]
Available at: <https://icom.museum/en/news/icom-announces-the-alternative-museum-definition-that-will-be-subject-to-a-vote/>
[Accessed 21st July 2021].
- ICOM, I. C. o. M., 2019. *Museum Definition*. [Online]
Available at: <https://icom.museum/en/resources/standards-guidelines/museum-definition/>
[Accessed 21st July 2021].
- Impey, O. & MacGregor, A., 2017. *The Origins of Museums: The Cabinet of Curiosities in Sixteenth- and Seventeenth Century Europe*. Oxford: The Ashmolean Museum, University of Oxford.
- Ivens, G., n.d. *Museum of the Fossilised Internet*. [Online]
Available at: <https://hubs.mozilla.com/yenzhCn/museum-of-the-fossilized-internet/>
[Accessed 1st February 2022].
- Jenkins, D., 1994. Object Lessons and Ethnographic Displays: Museum Exhibitions and the Making of American Anthropology. *Comparative Studies in Society and History*, 36(2), pp. 242-270.
- Jenkins, H., 2006. *Convergence Culture*. New York: NYU Press.
- Jenkins, H., Ford, S. & Green, J., 2013. *Spreadable Media: creating value and meaning in networked culture*. New York: NYU Press.
- Jenkins, H., Mizuko, I. & Boyd, D., 2016. *Participatory Culture in a Networked Era*. Cambridge: Polity Press.
- Johnson, M. & Lakoff, G., 2003. *Metaphors We Live By*. 2nd ed. Chicago: University of Chicago Press.

- Jordanova, L., 1989. Objects of Knowledge: A historical perspective on museums. In: P. Vergo, ed. *The New Museology*. London: Reaktion Books, pp. 22-40.
- Kaplan, A. M. & Haenlein, M., 2010. Users of the world, unite! The challenges and opportunities of Social Media. *ScienceDirect*, Volume 53, pp. 59-68.
- Kaplan, F. E. S., 1995. Exhibitions as communicative media. In: E. Hooper-Greenhill, ed. *Museum, Media, Message*. London and New York: Routledge, pp. 37-58.
- Keltner, D., Cowen, A., Barradeau, N. & Cazier, R., 2021. *An Atlas of Emotions*. [Online]
Available at: <https://artsexperiments.withgoogle.com/art-emotions-map/>
[Accessed 1st February 2022].
- Kidd, C. & Hayden, B. Y., 2016. The psychology and neuroscience of curiosity. *Neuron*, 88(3), pp. 449-460.
- Klingemann, M. & Doury, S., 2018. *X Degrees of Separation*. [Online]
Available at: <https://experiments.withgoogle.com/x-degrees-of-separation>
[Accessed 1st February 2022].
- Knell, S., 2011. National Museums and the national imagination. In: S. J. Knell, et al. eds. *National Museums: new studies from around the world*. London and New York: Routledge, pp. 3-28.
- Knell, S. J., 2004. Altered values: searching for a new collecting. In: S. J. Knell, ed. *Museums and The Future of Collecting*. Farnham and Burlington VT: Ashgate, pp. 1-46.
- Knott, S. & Taylor, B., 2005. *Women, Gender and Enlightenment*. London: Palgrave Macmillan.
- Kreps, C., 2003. *Indigenous models of museums, curation, and concepts of cultural heritage preservation*. London and New York: Routledge.
- Kuhn, T. S., 1996. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
- Kuwakino, K., 2013. The great theatre of creative thought: The Inscriptiones vel theatri amplissimi ... (1565) by Samuel von Quiccheberg. *Journal of the History of Collections*, 25(3), pp. 303-324.
- Landsberg, A., 2004. *Prosthetic Memory: The Transformation of American Remembrance in the Age of Mass Culture*. New York: Columbia University Press.
- Lanier, J., 2017. *Dawn of the New Everything: A Journey Through Virtual Reality*. London: The Bodley Head.

- Latour, B., 1986. Visualisation and Cognition. *Knowledge and Society*, Volume 6, pp. 1-40.
- Latour, B., 2005. *Reassembling the Social-an Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.
- Law, J., 2019. *Material Semiotics*. [Online]
Available at:
<http://www.heterogeneities.net/publications/Law2019MaterialSemiotics.pdf>
[Accessed 6th July 2021].
- Lecointre, G. & Le Guyader, H., 2001. *The Tree of Life: A Phylogenetic Classification*. Cambridge, Massachusetts and London, England: Harvard University Press.
- Lewi, H., Smith, W., von Lehn, D. & Cooke, S., 2019. *The Routledge International Handbook of New Digital Practices in Galleries, Libraries, Archives, Museums and Heritage Sites*. London: Routledge.
- Lievrouw, L. A., 2011. *Alternative and Activist New Media*. Cambridge: Polity.
- Life Magazine, 1962. The Knowledge Box. *The Take-Over Generation*, 14th September, pp. 109-112.
- Lima, M., 2013. *Visual Complexity: Mapping Patterns of Information*. New York: Princeton Architectural Press.
- Lima, M., 2014. *The Book of Trees: Visualizing Branches of Knowledge*. New York: Princeton Architectural Press.
- Lima, M., 2014. *Visual Complexity*. [Online]
Available at: <http://www.visualcomplexity.com/>
[Accessed 1st October 2020].
- Lima, M., 2017. *The Book of Circles: Visualising Spheres of Knowledge*. New York: Princeton Architectural Press.
- Local Projects, 2014. *A Museum of Collective Memory*. [Online]
Available at: <https://localprojects.com/work/interactive-installations/a-museum-of-collective-memory/>
[Accessed 1st February 2022].
- Local Projects, 2016. *Umass Amherst Interactive Media Wall*. [Online]
Available at: <https://localprojects.com/work/institutional-hospital-university-college/umass-amherst-interactive-media-wall/>
[Accessed 1st February 2022].

- Local Projects, 2022. *Local Projects*. [Online]
Available at: <https://localprojects.com/>
[Accessed 1st February 2022].
- Logan, W. & Reeves, K., 2009. *Places of Pain and Shame: Dealing with 'difficult heritage'*. London and New York: Routledge.
- Lord, B., 2005. Representing Enlightenment Space. In: S. MacLeod, ed. *Reshaping Museum Architecture*. London and New York: Routledge, pp. 146-157.
- Lord, B., 2007. From the document to the monument: museums and the philosophy of history . In: S. J. Knell, S. MacLeod & S. Watson, eds. *Museum Revolutions: How museums change and are changed*. London and New York: Routledge, pp. 355-366.
- Lord, B., 2016. 'A Sudden Surprise of the Soul': Wonder in museums and early modern philosophy. *Royal Institute of Philosophy Supplement*, Volume 79, pp. 95-116.
- Lowry, G. D., 2012. Abstraction in 1936: Barr's diagrams. In: L. Dickerman, ed. *Inventing Abstraction, 1910-1925: how a radical idea changed modern art*. New York: Museum of Modern Art, pp. 359-363.
- Lynch, B. T. & Alberti, S. J. M. M., 2010. Legacies of prejudice: racism, co-production and radical trust in the museum. *Museum Management and Curatorship*, 25(1), pp. 13-35.
- Macaluso, L. A., 2019. *Monument Culture: International Perspectives on the Future of Monuments in a Changing World*. Washington : Rowman & Littlefield .
- MacArthur, M., 2007. Can museums allow online users to become participants?. In: H. Din & P. Hecht, eds. *The Digital Museum: A think guide*. Washington DC: American Association of Museums, pp. 57-66.
- MacDonald, G. F., 1992. Change and Challenge: Museums in the Information Society. In: I. Karp, C. M. Kreamer & S. Lavine, eds. *Museums and Communities — The Politics of Public Culture*. Washington: Smithsonian Institution Press, pp. 158-181.
- MacGregor, A., 2017. The Cabinet of Curiosities in Seventeenth-Century Britain. In: O. Impey & A. MacGregor, eds. *The Origins of Museums: The Cabinet of Curiosities in Sixteenth and Seventeenth Century Europe*. Oxford: Ashmolean Museum, University of Oxford, pp. 147-158.
- MacLeod, S., 2005. Rethinking museum architecture: towards a site-specific history of production and use . In: S. Macleod, ed. *Reshaping Museum Space: architecture, design, exhibitions*. London and New York: Routledge, pp. 9-25.

- MacLeod, S., 2011. Towards an Ethics of Museum Architecture. In: J. Marstine, ed. *The Routledge Companion to Museum Ethics: Redefining Ethics for the Twenty-First-Century Museum*. London and New York: Routledge, pp. 379-392.
- Malraux, A., 1974. *Voices of Silence*. St Albans: Paladin.
- Manovich, L., 1999. Database as symbolic form. *Convergence*, 5(2), pp. 80-99.
- Manovich, L., 2017. *Instagram and the Contemporary Image*. s.l.:s.n.
- Manovich, L., 2020. *Cultural Analytics*. 1st ed. Cambridge, MA: MIT Press.
- Manton, C., 2018. *Museum Collection Engine (Installation)*. [Art] (Birmingham Museums Trust).
- Manton, C., 2018. *Sanctuary Stories [oral history project]*, Birmingham : Asylum Matters & St. Chad's Sanctuary.
- Manton, C., 2019. *British Library Late Algorave*. [Online]
Available at: <https://blogs.bl.uk/digital-scholarship/2019/03/staying-late-at-the-library-to-algorave.html>
- Manton, C., 2019. *Shared Pasts: Decoding Complexity [Augmented Reality App]*. Bristol: SWCTN.
- Marche, J. D., 2005. *Theatres of Time and Space: American Planetaria 1930-1970*. New Brunswick, New Jersey and London: Rutgers University Press.
- Marc, L. C., 2013. The Bibliothèque Nationale: Between Rationalism and Illusionism. In: C. Belier, B. Bergdoll & M. Le Coeur, eds. *Henri Labrouste: Structure Brought to Light*. New York: MoMA.
- Marcus, J., 1991. Postmodernity and the museum. *Social Analysis: The International Journal of Anthropology*, Volume 30, pp. 10-19.
- Markus, T. A., 1985. Domes of enlightenment: Two Scottish university museums. *International Journal of Museum Management and Curatorship*, 4(3), pp. 215-242.
- Maroevic, I., 1995. The museum message: between the document and information. In: E. Hooper-Greenhill, ed. *Museum, Media, Message*. London and New York: Routledge, pp. 24-36.
- Maroevic, I., 1998. *Introduction to Museology: The European Approach*. Zagreb: Muller-Straten.
- Marotta, A., 2012. Topology: Museums. *The Architectural Review*.

- Mattern, S., 2014. *Library as Infrastructure*. [Online]
Available at: <https://placesjournal.org/article/library-as-infrastructure/>
[Accessed 20th August 2021].
- Mattern, S., 2015. *Middlewhere: Landscapes of Library Logistics*. [Online]
Available at: <https://urbanomnibus.net/2015/06/middlewhere-landscapes-of-library-logistics/>
[Accessed 20th August 2021].
- Mattern, S., 2016. Before BILLY: A Brief History of the Bookcase. *Harvard Design Magazine*, Issue 43.
- McCandless, D., 2012. *Information is Beautiful*. 2nd ed. London: William Collins.
- McGonagle, D., 2008. *Future of Museums: New thinking about museums of the future*. [Online]
Available at: <https://futuremuseums.wordpress.com/2008/09/25/the-museum-reconsidered-as-common-land-paper-by-declan-mcgonagle/>
[Accessed July 21st 2021].
- McLeod, M., 2004. Museums without collections: museum philosophy in West Africa. In: S. J. Knell, ed. *Museums and the Future of Collecting*. Farnham and Burlington VT: Ashgate, pp. 52-61.
- Message, K., 2006. *New Museums and the Making of Culture*. Oxford: Berg.
- Miksa, F., 1998. *The DDC, the Universe of Knowledge, and the Post-Modern Library*. New York: Forest Press.
- Morris, B. J. & Withers, D.-M., 2018. *The Feminist Revolution: The Struggle for Women's Liberation 1966-1988*. London: Verago Press.
- Morris, R., 2012. Imaginary museums: what mainstream museums can learn from them. In: S. MacLeod, L. Hourston Hanks & J. Hale, eds. *Museum making: narratives, architectures, exhibitions*. Abingdon and New York: Routledge, pp. 5-11.
- Mungwini, P., 2019. The Quest for Epistemic Liberation. *Journal of World Philosophies*, Volume 4, pp. 70-105.
- Murphy, O., 2021. The Changing Shape of Museums in an increasingly Digital World. In: *Connecting Museums*. Abingdon: Routledge .
- Museum Association, 1998. *Definition of Museum*. [Online]
Available at: <https://www.museumsassociation.org/>
[Accessed 21st July 2021].

- Museum Association, 2021. *Ideological rift persists as Icom restarts museum definition consultation*. [Online]
Available at: <https://www.museumsassociation.org/museums-journal/news/2021/03/ideological-rift-persists-as-icom-restarts-museum-definition-consultation/>
[Accessed 21st July 2021].
- Museums Are Not Neutral, 2022. *Join the movement*. [Online]
Available at: <https://www.museumsarenotneutral.com/>
[Accessed 1st February 2022].
- MVRDV, 2012. *Book Mountain*. [Online]
Available at: <https://www.mvrdv.nl/projects/126/book-mountain>
[Accessed 20th August 2021].
- MVRDV, 2017. *Tianjin Binhai Library*. [Online]
Available at: <https://www.mvrdv.nl/projects/246/tianjin-binhai-library>
[Accessed 12th August 2021].
- National Museums, 2004. *A National Manifesto for Museums: Building Outstanding Museums for the 21st Century*, s.l.: s.n.
- Natural History Museum Images, n.d. *Sloane Collection*. [Online]
Available at:
https://nhmimages.com/?service=set&action=show_content_page&language=en&set=66&ref=news
[Accessed 12th August 2021].
- Natural History Museum, n.d. *Collections*. [Online]
Available at: <https://www.nhm.ac.uk/discover/collections.html>
[Accessed 20th August 2021].
- Negroponte, N., 1995. *Being Digital*. London: Hodder & Stoughton.
- Nelson, R. S., 1997. The Map of Art History. *The Art Bulletin*, 79(1), pp. 28-40.
- Olmi, G., 2017. Science, honour, metaphor: Italian cabinets of the sixteenth and seventeenth centuries. In: O. Impey & A. MacGregor, eds. *The Origins of Museums*. Oxford: Clarendon Press.
- O'Neill, M., 2006. Essentialism, adaptation and justice: Towards a new epistemology of museums. *Museum Management and Curatorship*, Volume 21, pp. 95-116.
- O'Neil, M., 2016. Museums and their Paradoxes. *Royal Institute of Philosophy Supplement*, Volume 79, pp. 13-34.
- Painter, N. I., 2010. *The History of White People*. New York and London: W. W. Norton & Company.

- Parry, R., 2007. *Recoding the Museum: Digital heritage and the technologies of change*. London: Routledge.
- Parry, R., 2011. Transfer Protocols: Museum codes and ethics in the new digital environment. In: J. Marstine, ed. *The Routledge Companion to Museum Ethics: Redefining Ethics for the Twenty-First-Century Museum*. London and New York: Routledge, pp. 316-331.
- Parry, R. & Sawyer, A., 2005. Space and the machine: adaptive museums, pervasive technology and the new gallery environment. In: S. MacLeod, ed. *Reshaping Museum Space: architecture, design, exhibitions*. London and New York: Routledge, pp. 39-52.
- Pearce, S., 1995. Collecting as medium and message. In: E. Hooper-Greenhill, ed. *Museum, Media, Message+*. London and New York: Routledge, pp. 15-23.
- Pearce, S., 2004. Collecting and collecting. In: S. J. Knell, ed. *Museums and The Future of Collecting*. Farnham and Burlington VT: Ashgate, pp. 47-51.
- Pearce, S., 2012. Museum Objects. In: S. H. Dudley, ed. *Museum Objects: experiencing the properties of things*. Routledge: Abingdon and New York, pp. 23-25.
- Pettegree, A. & der Weduwen, A., 2020. *The Library: A Fragile History*. London: Profile Books .
- Poole, N., 2014. *CODE / WORDS: Technology and Theory in the Museum*. [Online] Available at: <https://medium.com/code-words-technology-and-theory-in-the-museum/change-cc3b714ba2a4> [Accessed 5th March 2021].
- Porter, J., 2008. *Design for the Social Web*. Berkeley CA: New Riders.
- Poulot, D., Bodenstein, F. & Lanzarote Guiral, J. M., 2011. *Great Narratives of the Past Traditions and Revisions in National Museums*. Paris, EuNaMus.
- Proctor, N. (., 2010. *The Museum as Distributed Network, a 21st Century Model*. [Online] Available at: <http://museum-id.com/museum-distributed-network-21st-century-model-nancy-proctor/> [Accessed 21st July 2021].
- Quiccheberg, S., 2013. *The First Treatise On Museums: Samuel Quiccheberg's Inscriptiones 1565*. Los Angeles: Getty Research Institute.
- Ravelli, L., 2006. *Museum Texts: Communication Frameworks*. London : Routledge.

- Raven, P. H., Berlin, B. & Breedlove, D. E., 1971. The Origins of Taxonomy. *Science*, 174(4015), pp. 1210-1213.
- Reilly, M., 2018. *Curatorial Activism: towards and ethics of curating*. London: Thames & Hudson.
- Renzel, P., 2017. 'How does online feminist activism offer the possibility for a truly intersectional feminist resistance?'. [Online]
Available at: <https://blog.chayn.co/how-does-online-feminist-activism-offer-the-possibility-for-a-truly-intersectional-feminist-651c6030ae16>
[Accessed 12th October 2017].
- Ridge, M., Blickhan, S. & Ferriter, M., 2021. *The Collective Wisdom Handbook: Perspectives on Crowdsourcing in Cultural Heritage - community review version*. [Online]
Available at: <https://britishlibrary.pubpub.org/the-collective-wisdom-handbook-perspectives-on-crowdsourcing-in-cultural-heritage---community-review-version>
[Accessed 2nd December 2021].
- Riello, G., 2009. Things that shape history: material culture and historical narratives. In: K. Harvey, ed. *History and Material Culture*. Abingdon and New York: Routledge, pp. 24-46.
- Rocco, F., 2013. *Museums: Temples of Delight*. [Online]
Available at: <http://www.economist.com/news/special-report/21591707-museums-world-over-are-doing-amazingly-well-says-fiammetta-rocco-can-they-keep>
- Ross, M., 2004. Interpreting the new museology. *Museum and Society*, 2(2), pp. 84-103.
- Roth, M. & Mostafavi, M., 2016. Talking Objects. *Harvard Design Magazine*, Issue 43.
- Royal Collection Trust, n.d. *The Libraries of George III*. [Online]
Available at: <https://www.rct.uk/collection/themes/Trails/the-libraries-of-george-iii/buckingham-house-the-octagon-library>
[Accessed 23rd August 2021].
- Royan, J., 2009. *Göttweig Abbey library, Austria*. [Online]
Available at: <http://www.royan.com.ar>
- Sadar, Z., 2010. Welcome to postnormal times. *Futures*, 42(5), pp. 435-444.
- Sandall, R., 2002. *Museums, society, inequality*. London: Routledge.
- Sandall, R., 2006. *Museums, Prejudice and the Reframing of Difference*. London and New York: Routledge.

- Sandall, R., 2011. On ethics, activism and human rights. In: J. Marstine, ed. *The Routledge Companion to Museum Ethics: Redefining ethics for the Twenty-First Century Museum*. London and New York: Routledge, pp. 129-145.
- Sandell, R., 2002. *Museums, Society, Inequality*. London: Routledge.
- Sandell, R., 2005. Constructing and communicating equality: the social agency. In: S. MacLeod, ed. *Reshaping Museum Space: architecture, design, exhibitions*. London and New York: Routledge, pp. 185-200.
- Scarborough Museums Trust, n.d. *Rotunda Museum*. [Online]
Available at: <https://www.scarboroughmuseumstrust.com/rotunda-museum/>
[Accessed 13th August 2021].
- Schmidt, J., 1989. The Question of Enlightenment: Kant, Mendelssohn, and the Mittwochsgesellschaft. *Journal of the History of Ideas*, 50(2), pp. 269-291.
- Scott, M., 2007. *Evolution in the Museum: Envisioning African Origins*. London: Routledge.
- See Red Women's Workshop , 2016. *Feminist Posters 1974-1990*. London: Four Corners Books.
- Seelig, L., 2017. The Munich Kunstkammer, 1565-1807. In: O. Impey & A. MacGregor, eds. *The Origins of Museums: The Cabinet of Curiosities in Sixteenth- and Seventeenth Century Europe*. Oxford: Ashmolean Museum, Oxford University, pp. 76-89.
- Shapiro, G., 2003. *Archaeologies of Vision: Foucault and Nietzsche on Seeing and Saying*. Chicago: University of Chicago Press.
- Sheldon, A., 1986. The Museum as a staging ground for symbolic action. *Museum*, 151(3), pp. 168-171.
- Sherman, D. J., 1994. Quatremère/Benjamin/Marx: Art Museums, Aura, and Commodity Fetishism. In: D. J. Sherman & I. Rogoff, eds. *Museum Culture: Histories, discourses, spectacles*. London: Routledge, pp. 123-143.
- Simon, N., 2010. *The Participatory Museum*. Santa Cruz: Museum 2.0.
- Sloan, K., 2004. *Enlightenment: Discovering the World in the Eighteenth Century*. London: British Museum Press.
- Small, J. P., 1997. *Wax Tablets of the Mind*. London and New York: Routledge.
- Snodgrass, S., 2012. Enter the Matrix: An Interview with Ken Isaacs. In: A. Blauvelt, ed. *Hippie Modernism: The Struggle for Utopia*. Minneapolis: Walker Arts Centre, pp. 369-371.

- Socks, 2016. *The Knowledge Box by Ken Isaacs (1962)*. [Online]
Available at: <https://socks-studio.com/2016/05/02/the-knowledge-box-by-ken-isaacs-1962/>
[Accessed 2nd December 2021].
- Sokal, R. R., 1974. Classification: Purposes, Principles, Progress, Prospects. *Science*, 185(4157), pp. 1115-1123.
- Sood, A., 2016. *Every piece of art you've ever wanted to see -- up close and searchable*. [Online]
Available at:
https://www.ted.com/talks/amit_sood_every_piece_of_art_you_ve_ever_wanted_to_see_up_close_and_searchable
[Accessed 1st February 2022].
- Sousa Santos, B. d., 2007. Beyond abyssal thinking: from global lines to ecologies of knowledges. *Eurozine*, Volume 33, pp. 45-89.
- Stack, J., 2020. *What the Machine Saw*. [Online]
Available at: <https://johnstack.github.io/what-the-machine-saw/index.html>
[Accessed 1st February 2022].
- Stafford, B. M., 1994. *Artful Science: Enlightenment entertainment and the eclipse of visual education*. Cambridge, Massachusetts: MIT Press.
- Stam, D. C., 1993. The Informed Muse: The Implications of 'The New Museology' for Museum PRactice. *Museum Management and Curatorship*, Volume 12, pp. 267-283.
- Star, S. L. & Rudleder, K., 1996. Steps towards an ecology of infrastructure: Design and access for large information spaces.. *Information Systems Research*, 7(1), pp. 111-134.
- Statista, 2021. *Hours of video uploaded to YouTube every minute as of May 2019*. [Online]
Available at: <https://www.statista.com/statistics/259477/hours-of-video-uploaded-to-youtube-every-minute/>
[Accessed 4th June 2021].
- Statista, 2021. *Most popular social networks worldwide as of April 2021, ranked by number of active users*. [Online]
Available at: <https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/>
[Accessed 8th July 2021].
- Statista, 2021. *Number of social network users worldwide from 2017 to 2025*. [Online]

- Available at: <https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/>
[Accessed 8th July 2021].
- Stefik, M., 1996. *Internet Dreams: Archetypes, Myths, and Metaphors*. Cambridge, MA: MIT Press.
- Stimac, J., 2020. *The City of Truth': A Closer Look at Bartolomeo Del Bene's Civitas veri sive morum*. [Online]
Available at: <https://www.prphbooks.com/blog/del-bene-civitas-veri>
[Accessed 11th August 2021].
- Stockwell, F., 2007. *A History of Information Storage and Retrieval*. Jefferson: McFarland & Co.
- Sugrue, C., 2020. *Magnify Miniatures*. [Online]
Available at: <https://artsexperiments.withgoogle.com/magnify-miniatures/>
[Accessed February 1st 2022].
- Sumarez-Smith, C., 1989. Museums, Artefacts, and Meanings. In: P. Vergo, ed. *The New Museology*. London: Reaktion, pp. 6-21.
- Sussman, R. W., 2014. *The Myth of Race: The Troubling Persistence of an Unscientific Idea*. Cambridge, Massachusetts and London, England: Harvard University Press.
- Sutton, G., 2015. *The Experience Machines: Stan VanDerBeek's Movie Drome and Expanded Cinema*. Cambridge: MIT Press.
- Szanto, A., 2020. *The Future of the Museum: 28 Dialogues*. Berlin: Hatje Cantz.
- Tate, 2016. *Timeline of Modern Art*. [Online]
Available at: <https://www.tate.org.uk/visit/tate-modern/bloomberg-connects-timeline-modern-art>
[Accessed 1st February 2022].
- Teslow, T., 2007. A Troubled Legacy: Making and Unmaking Race in the Museum. *Museums & Social Issues*, 2(1), pp. 11-44.
- Tharp, B. M. & Tharp, S. M., 2013. *Discursive Design Basics: Mode and Audience*. Copenhagen-Malmö, Nordic Design Research Conference.
- Tharp, B. M. & Tharp, S. M., 2018. *Discursive Design: Critical, speculative, and Alternative Things*. Cambridge and London : MIT Press.
- The Ashmolean, 2017. *The Ashmolean History Gallery*. [Online]
Available at: <https://www.ashmolean.org/the-ashmolean-story-gallery#/>
[Accessed 3rd August 2021].

The Ashmolean, 2017. *The Story of The World's First Museum: The New 'Ashmolean Story' Gallery*. [Online]
Available at: <https://www.ashmolean.org/article/the-story-of-the-worlds-first-public-museum>
[Accessed 3rd August 2021].

The Ashmolean, 2020. *The Ashmolean and Colonialism*. [Online]
Available at: <https://www.ashmolean.org/colonialism>
[Accessed 8th August 2021].

The British Museum , 2020. *Everything you ever wanted to know about the Great Court*. [Online]
Available at: <https://www.britishmuseum.org/>
[Accessed 8th August 2021].

The British Museum, 2018. *The Round Reading Room at the British Museum*. [Online]
Available at: <https://blog.britishmuseum.org/the-round-reading-room-at-the-british-museum/>
[Accessed 12th August 2021].

The British Museum, 2019. *Fact Sheet BM Collection*. [Online]
Available at: https://www.britishmuseum.org/sites/default/files/2019-10/fact_sheet_bm_collection.pdf
[Accessed 21st July 2021].

The British Museum, 2020. *Explore the collection*. [Online]
Available at: <https://www.britishmuseum.org/collection>
[Accessed 21st July 2021].

The British Newspaper Archive, The British Library , n.d. *The British Newspaper Archive*. [Online]
Available at: <https://www.britishnewspaperarchive.co.uk/>
[Accessed 12th August 2021].

The Council for Museums Archives and Libraries, 2003. *Renaissance in the Regions: a new vision for England's museums*, s.l.: The Museums Association.

Thorp, J., 2021. *Living in Data: a citizens guide to a better information future*. New York: MCD Farrar, Straus and Giroux.

Thylstrup, N. B., 2019. *The Politics of Mass Digitization*. Cambridge MA: MIT Press.

toon, R., 2005. Black box science and black box science centres. In: S. MacLeod, ed. *Reshaping Museum Space: architecture, design, exhibitions*. London and New York: Routledge, pp. 26-38.

- Turner, G., 2017. The Cabinet of Experimental Philosophy . In: O. Impey & M. Arthur, eds. *The Origins of Museums: The Cabinet of Curiosities in Sixteenth- and Seventeenth Century Europe*. Oxford: Ashmolean Museum, University of Oxford, pp. 214-222.
- Turner, H., 2016. The Computerization of Material Culture Catalogues: Objects and Infrastructure in the Smithsonian Institution's Department of Anthropology. *Museum Anthropology*, Volume 39, pp. 163-177.
- Turner, H., 2017. Organizing Knowledge in Museums: A Review of Concepts and Concerns. *Knowledge Organization*, 44(7), pp. 472-484.
- Turner, H., 2020. *Cataloguing culture; legacies of colonialism in museum documentation*. Vancouver and Toronto: UBC Press.
- Turner, H. E., 2015. *Information Infrastructures in the Museum: Documenting,,* Toronto : University of Toronto.
- Turow, J., 2008. On Not Taking the Hyperlink for Granted. In: J. Turow & L. Tsui, eds. *The Hyperlinked Society: Questioning Connections in the Digital Age*. Michigan: University of Michigan Press, pp. 1-18.
- UK Collections Trust , 2013. *What are museums for?.* [Online]
Available at: <https://culture360.asef.org/news-events/what-are-museums-analysis-uk/>
[Accessed 21st July 2021].
- V&A, n.d. *From the Collections*. [Online]
Available at: <https://www.vam.ac.uk/collections?type=featured>
[Accessed 20th August 2021].
- Valeonti, F., 2017. *USEUM*. [Online]
Available at: <https://useum.org/>
[Accessed 1st February 2022].
- Valeonti, F. & Valeonti, D., 2015. *USEUM*. [Online]
Available at: <https://useum.org/>
[Accessed 1st July 2021].
- Vander Wal, T., 2004. *Folksonomy*. [Online]
Available at: <https://vanderwal.net/folksonomy.html>
[Accessed 21st July 2021].
- Vartija, D. J., 2021. *The Color of Equality: Race and Common Humanity in Enlightenment Thought*. Philadelphia: University of Pennsylvania Press.
- Vergo, P., 1989. *The New Museology*. London: Reaktion Books.

- Waterton, C., 2010. Experimenting with the Archive: STS-ERs As Analysts and Co-Constructors of Databases and Other Archival Forms. *Science, Technology and Human Values*, 35(5), pp. 645-676.
- Watson, S. E. R., 2007. *Museums and Their Communities*. London and New York: Routledge.
- Weaver, W., 1948. Science and Complexity. *American Scientist*, 36(4), pp. 536-544.
- Weikart, R., 1993. The Origins of Social Darwinism in Germany, 1859-1895. *Journal of the History of Ideas*, 54(3), pp. 469-488.
- Weil, S., 2007. The Museum and The Public. In: S. Watson, ed. *Museums and Their Communities*. Abingdon: Routledge, pp. 32-46.
- Weinberger, D., 2006. *Taxonomies and Tags: From Trees to Piles of Leaves*. [Online] Available at: https://hyperorg.com/blogger/misc/taxonomies_and_tags.html [Accessed 19th April 2021].
- Weinberger, D., 2008. The Morality of Links. In: J. Turow & L. Tsui, eds. *The Hyperlinked Society: Questioning Connections in the Digital Age*. Michigan: University of Michigan Press, pp. 181-190.
- Weinberger, D., 2012. *Too Big to Know: Rethinking knowledge now the facts aren't the facts, experts are everywhere, and the smartest person in the room is the room*. New York: Basic Books.
- Wellcome Collection, n.d. *Utriusque cosmi maioris scilicet et minoris metaphysica, physica atque technica historia ... [Tractatus secundus de naturae simia seu technica macrocosmi historia] / [Robert Fludd]*. [Online] Available at: <https://wellcomecollection.org/works/fwbxhjr8> [Accessed 11th August 2021].
- Wernimount, J., 2021. Quantification. In: N. B. Thylstrup, et al. eds. *Uncertain Archives: Critical Keywords for Big Data*. Cambridge & London: MIT Press, pp. 574-580 .
- West, W. N., 2003. *Theatres and Encyclopaedias in Early Modern Europe*. Cambridge: Cambridge University Press.
- White, H., 1988. Historiography and Historiophoty. *The American Historical Review*, 93(5), pp. 1193-1199.
- Wikiarquitectura, n.d. *Stockholm Public Library*. [Online] Available at: <https://en.wikiarquitectura.com/building/stockholm-public-library/> [Accessed 12th August 2021].

- Wikimedia Commons, 2017. *Binhai Library Bookshelves*. [Online]
Available at:
https://commons.wikimedia.org/wiki/File:Binhai_library_bookshelves.jpg
[Accessed 12th August 2021].
- Wilson, C. S. J., 1996. *Wilson, Colin St John National Life Story Collection: Architects' Lives* [Interview] (9th September 1996).
- Wilson, K., 2008. *A New Imperial History: Culture, Identity and Modernity in Britain and the Empire, 1660–1840*. Cambridge: Cambridge University Press.
- Witcomb, A., 2002. *Re-imagining the museum: beyond the mausoleum*. London: Routledge.
- Witcomb, A., 2003. *Re-Imagining the Museum: Beyond the Mausoleum*. London and New York: Routledge.
- Witcomb, A., 2007. 'A Place for All of Us'? Museums and Communities. In: S. Watson, ed. *Museums and Their Communities*. London and New York: Routledge, pp. 133-157.
- Wyatt, S., 2021. Metaphors in critical Internet and digital media studies. *New Media & Society*, 23(2), pp. 406-416.
- Yates, F., 1999. *The Art of Memory*. 2nd ed. London and New York: Routledge.
- Zhang, G.-Q., Yang, Q.-F., Cheng, S.-Q. & Zhou, T., 2008. Evolution of the Internet and its cores. *New Journal of Physics*, 10(123027).
- Zuboff, S., 2015. Big Other: Surveillance Capitalism and the Prospects of an Information Civilisation. *Journal of Information Technology*, 30(1), pp. 75-89.

PUBLICATIONS:

- Aga, B. and Manton, C., (2021) 'Women Reclaiming AI' in R. Allen *Art Machines II* Proceedings of the International Symposium on Machine Learning and Art held in Hong Kong 10th – 14th June, School of Creative Media, City of Hong Kong University Press.
- Manton, C. (2017) 'Multimedia and Non-Text PhD Research Outputs: British Library ETHOS web service' in *Academic Book of the Future BOOC*, UCL Press.

CONFERENCE PRESENTATIONS & TALKS:

- Aga, B., and Manton, C., (2020) *Cutting together-apart: Creative and critical practices as agential cuts within digital economies* Dark Eden The Sixth International Conference on Transdisciplinary Imaging at the Intersections between art, science and culture, 6 November, Melbourne, Australia.
- Manton, C. (2019) *Diversity by design: mitigating gender bias in AI*, United Nations Specialised Agency Conference ITU Telecoms World, 12 September, Budapest, Hungary.
- Aga, B., and Manton, C. (2019) *Women Reclaiming AI*, Anthropology + Technology Conference, 3 October, Bristol, UK.
- Aga, B., and Manton, C. (2019) *Women Reclaiming AI*, Inclusive AI Applied, European Artificial Intelligence Lab, ARS Electronica, 8 September, Linz, Austria.
- Aga, B., and Manton, C. (2018) *Human Bias In Artificial Intelligence: Can we fix it?* KWMC, 29 November, Bristol, UK.
- Aga, B., and Manton, C. (2018) *Disobedient AI*. Random String, 16 November, Coventry, UK.
- Aga, B., and Manton, C., (2018) *Things That Talk. AI In Art – A FACT Late Night*, 25 October, Liverpool, UK.
- Manton, C. (2017) *Multimedia and non-text research in theses and British Library ETHOS web service* ETD2017 Exploring Global Connections 20th International Symposium on the Networked Digital Library of Theses and Dissertations, 8 August, Washington, D.C.
- Manton, C. (2017) *Data Ache*. The 21st International Conference on Digital Research in the Humanities and Arts, Plymouth University, 11 October, Plymouth, UK.

WORKSHOPS:

- Aga, B., Bentley, C., Manton, C., Vasconcelos, E. (2021), *A hyper-local nanosecond protest on the future representation of women in gendered technology*, Mozfest, 15 March, London, UK
- Aga, B., and Manton, C., (2019) *Become an AI activist*, KWMC, 28 October, Bristol, UK

- Aga, B., and Manton, C., (2019) *Women Reclaiming AI*. Mozfest, 25 October, London, UK
- Aga, B., and Manton, C., (2019) *Women Reclaiming AI*. ARS Electronica, 7 September, Linz, Austria.
- Aga, B., and Manton, C., (2019) *Women Reclaiming AI*. The Cell, 29 June, London, UK.
- Aga, B., and Manton, C., (2019) *Women Reclaiming AI*. BOM, Birmingham Open Media, Birmingham, UK, 24 May.
- Aga, B., and Manton, C., (2019) *Women Reclaiming AI*. BOM, Birmingham Open Media, 24 May, Birmingham, UK.
- Aga, B., and Manton, C., (2019) *Women Reclaiming AI*. AI: More Than Human, The Barbican, 17 May, London, UK.
- Aga, B., and Manton, C., (2019) *Women Reclaiming AI*. Automate Me, Northern Sound Collective, 10 May, Leeds, UK.
- Aga, B., and Manton, C., (2019) *Women Reclaiming AI*. Near Now, 13 April, Nottingham, UK.
- Aga, B., and Manton, C., (2018) *Women Reclaiming AI*. Birmingham Open Media, UK,
- Aga, B., and Manton, C., (2018) *Women Reclaiming AI*. Random String, 16 November, Coventry, UK.
- Aga, B., and Manton, C., (2018) *Women Reclaiming AI*. Random String, 13 June, Knowle West Media Centre, Bristol, UK
- Aga, B., and Manton, C., (2018e) *Women Reclaiming AI*. KARST, 3 September, Plymouth, UK.
- Aga, B., and Manton, C., (2018f) *The Infinite Guide Prototyping Workshop*. FACT, 30 June – 1 August, Liverpool, UK.
- Aga, B., Manton, C., *Women Reclaiming AI*. Knowle West Media Centre, Bristol, 13 June 2018.

EXHIBITIONS:

- Manton, C. (2020) *Shared Pasts: Decoding Complexity*. South West Creative Technology Network, Arnolfini Arts, Bristol, UK
- Aga, B., and Manton, C., (2019) *Women Reclaiming AI*. ARS Electronica, Linz, Austria.

Aga, B., and Manton, C., (2019) *Women Reclaiming AI*. The Eden Arts Festival, 14 September, the Eden Project, Cornwall, UK

Aga, B., and Manton, C., (2018) *Women Reclaiming AI*. Birmingham Open Media, UK,

Aga, B. and Manton, C. (2018) *Women Reclaiming AI* [online prototype]. Available at: <https://www.womenreclaimingai.com>