Curating Climate Change: Collecting, Interpreting and Exhibiting the Changing Planet in UK Science Museums

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Abstract

Climate change has profound implications on museum curators' approaches to temporality: how they draw meaning from the *past*, how they situate the *present*, and how they contemplate the *future*. In this thesis, I explore these implications through the testimonies of curators who engage with the changing planet. By foregrounding activities in collecting and developing permanent galleries and temporary exhibitions—assessing the nuances between these practices—I examine how climate change impacts curators' interpretation of the past, present and future. I draw particular attention to curators' application of anticipatory and speculative futures thinking within their work.

For greater specificity, I study products and processes of *science* curatorship, taking an expansive view to assess current trends and speculate future directions. I therefore seek to fill a gap in curatorial literature, which is largely skewed towards the theory and practice of curating art. Primarily, I investigate the curatorial practices of the Science Museum (London), but central to my analysis is to cross-examine them with practices taking place across Thinktank (Birmingham), Glasgow Science Centre (in the Museums for Climate Action project), National Museums Scotland and the Sainsbury Centre.

I position the experiences and perspectives of museum practitioners—their thoughts, actions and decisions—at the heart of my research. Therefore, my methodology centres around oral history-style interviews with both curators and individuals whose work intersects with curating. This echoes one of my principal findings: that curating is relational, taking place through multiple, interacting agencies. Inspired by Bronfenbrenner's Ecological Systems Theory, I examine curatorship in relation to curators' spheres of influence: their microsphere, mesosphere, exosphere, macrosphere and chronosphere. I argue that ecological systems thinking provides a tool for marking out new directions and effecting change across individual and institutional practices. To conclude, I propose a new paradigm for science curatorship: curating for sustainable and equitable futures.

Author's declaration of originality.
I declare that all the material contained in this thesis is my own work.
Dorothea Fox, September 2025.
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Contents

Table of Contents

List of Tables

List of Illustrations

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0 | Introduction

Overview

Human-induced climatic and environmental change is fundamentally impacting how we, as a collective humankind, make sense of our world, our past, present and future, and ourselves. The situation is critical. If humans continue to breach planetary boundaries—exploiting, polluting and degrading the environment for short-term economic gain—our Earth will become ever more inhospitable to human and nonhuman life, leading to mass extinction of species.[1] In the face of a mounting inter-species existential crisis, what part do curators play?

With their unique role in drawing meaning from the world and sharing these significances with audiences—making connections, telling stories, imparting knowledge, provoking dialogue, asking questions, rousing curiosity and demonstrating principles of care—curators have much to contribute to nurturing people's understanding and promoting transformative action on the changing planet. In this thesis, I examine the ways in which curators are rising to this task, activating their practice to help audiences make sense of the changing planet and what can be done about it. I analyse how the changing planet—and its complex, multi-dimensional, interconnected issues—affects how curators engage with temporality: how they interpret the past, present and future for their publics.

Running throughout my study is a focus on curatorial practices of futures thinking, exploring how curators anticipate and speculate hopeful futures on a changing planet, as well as how they attribute agency in bringing about these futures. But that does not mean that I situate interpreting the future as a separate, mutually exclusive endeavour to interpreting the past and the present. From a psychological perspective, imagining, simulating and forecasting future events takes place through many of the same cognitive and neural processes as remembering past events.[2] And from the perspective of heritage studies, practices of selectively preserving the 'past' actively contribute to shaping future worlds. Indeed, they are carried out on behalf of future generations.[3]

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[1] For example, see Robert H. Cowie, Philippe Bouchet and Benoît Fontaine, 'The Sixth Mass Extinction: Fact, Fiction or Speculation?', *Biological Reviews*, Vol.91 (2022), 640-663.
[2] For example, see Daniel L. Schacter and Kevin P. Madore, 'Remembering the Past and Imagining the Future: Identifying and Enhancing the Contribution of Episodic Memory', *Memory Studies*, Vol.9(3), (2016), 245.
[3] For example, see Rodney Harrison et al. (eds.) *Heritage Futures: Comparative Approaches to Natural and Cultural Heritage Practices* (UCL Press, 2020).

However, I draw particular attention to the future-oriented aspects of curators' work because of the future-oriented nature of climate change. While our current anthropogenic climate change has been a reality—actual and perceived—for decades, it poses particular dilemmas for the future by virtue of the uncertainties around its future impacts, their scale and timing. To many people on our changing planet, the future is an uncertain and frightening prospect. It is a pertinent moment, therefore, to document and examine how, and why, curators are applying themselves to present positive visions of the future, and consider what is unique about their contributions to such visions. In the years, decades, centuries to come, I wonder if their anticipations and speculations will come to pass, and I wonder whether they will be recognised as key actors in society for their role in future-making.

Without the benefit of hindsight, I cannot quantify nor qualify the future-making abilities of curators—the extent to which they have a *real* impact on transforming society and shaping the future. Instead, I am more concerned with the curators themselves, analysing how they have engaged in *thinking* about the future of the changing planet through the processes and products of their curatorship. To do so, I distinguish three forms of curatorial activity and examine them individually. I assess their nuances in terms of how curators apply themselves to these practices, their challenges and opportunities as modes of engaging with climate change, and how they provide unique contributions to futures thinking. These curatorial activities are: collecting objects, developing permanent galleries and producing temporary exhibitions.

Through interviews, I gathered curators' accounts of their aims, motivations, perspectives, approaches, experiences, decisions and critical reflections regarding these activities and the ways that they address the changing planet. In the process, it became clear that curatorship does not reside with the curator alone. Their thoughts, actions and decisions in their work—and the ways that they engage with the changing planet—are guided by a diverse, complex, interconnected network of agents, both human and nonhuman. Therefore, in this thesis, I analyse practices and products of *curating climate change* as taking shape through the interactions between these agents, examining how the thoughts, actions and decisions of individual curators relate to the contexts in which they live and work.

Herein lies my distinct contribution to the study of curating climate change: I investigate curatorial engagements with the changing planet as situated in ecological systems of interacting agents. As I explore in more detail below, this theoretical framework—whereby curatorship is embedded in wider ecosystems beyond the individual curator—is broadly

inspired by the Ecological Systems Theory of the developmental psychologist, Urie Bronfenbrenner, who studied human development as taking place through the individual's social contexts, relationships and environments.[4]

I also distinguish my research from other studies of curating climate change by drawing particular attention to modes of *science curatorship*. Through my case studies, I compare the work of curators who oversee collections pertaining to the history of science and technology in the Science Museum (London), with curators whose work intersects with science and science spaces in other ways. These include a curator of technology working within a multidisciplinary collective of national museums; a curator of science and industry who works across an independent, city-based trust of multidisciplinary museums; a curator of natural sciences from that same museum collective; independent curators who developed an exhibition that was hosted by a science centre; and a curator in a university art museum whose position was devised in collaboration with a scientific research unit. In one of my case studies, moreover, I spotlight archaeologists for their role in assisting science curators with content development for a museum gallery.

By collating these different forms of curatorial practice, I explore the characteristics and boundaries of 'science' curatorship—probing how it compares and overlaps with other taxonomies of curatorship—and foreground the unique opportunities afforded by these different practices in their engagement with the changing planet. In this way, a unique aspect of my project—compared to other studies of curating climate change—is an investigation into what *science curatorship* is, who performs it, where it takes place, and how it functions. My intentions in carrying out such an investigation are motivated by the gap in curatorial literature pertaining to science curatorship. Curatorial studies, in great measure, are dominated by the concerns of art curatorship. I seek to bring the oft-neglected practices and principles of science curatorship to the fore, identifying what makes them unique. In addition to this, I focus on science museums because I believe there is a particularly compelling dynamic at play in their engagement with human-induced climate change. This is the dynamic between their traditional role in celebrating historic 'achievements' in science, technology and industry—interpreted as markers of human 'progress'—while also respecting the complicity of scientific, technological and industrial agendas and processes in damaging environments and disrupting planetary systems.

[4] See Urie Bronfenbrenner, *The Ecology of Human Development: Experiments by Nature and Design* (Harvard University Press, 1979). Also see Nancy Darling, 'Bronfenbrenner and the Ecology of Human Development', in Tricia David, Kathy Goouch and Sacha Powell (eds.) *The Routledge International Handbook of Philosophies and Theories of Early Childhood Education and Care* (Routledge, 2016), 234-245.

By drawing attention to science museums and science curatorship, I do not purposely set out to present 'science' and 'art' as completely binary modes of curatorial theory and practice. Rather, I aim to explore the fluid boundaries between different disciplines of curating, contemplating the intersections between 'science', 'technology', 'art', 'social history', 'cultural history', 'natural history', 'archaeology', and so on. In a time of planetary change that requires wholescale paradigm shifts, I consider the value of rethinking traditional taxonomies and siloes in curatorial practice. In particular, expanding and deconstructing the boundaries of 'science'.

The Science Museum supplies my primary case study of curating climate change. All other case studies serve a comparative role, expanding my conceptualisation of science curatorship beyond that which is practised at the Science Museum. In my analysis of the Science Museum, I highlight the remarkable extent to which its curators are integrating a focus on the changing planet across different aspects of their work. As my timeline in Appendix A illuminates, the Science Museum has been prolific in programming around climate change since its first exhibition on the subject in 2002. If one were to take a more expansive view of the human-induced changing planet, its programming extends back even further, to 1992, with an exhibition on the depletion of the ozone layer.

Throughout the first decade of the twenty-first century, the Science Museum developed multiple exhibitions on the changing planet. In this regard, it was ahead of the game, being one of the few museums in the UK and across the globe to integrate climate change into its intellectual remit and consistently address it in public-facing activities. This was in spite of the widespread public scepticism, denialism and mistrust of climate science at that time, particularly in the wake of the Climategate controversy (see below). For example, the Science Museum's exhibition *Prove It!: All the Evidence You Need to Believe in Climate Change* (2009-2010) took climate change as a non-negotiable reality. Given that the sceptic and denialist position was still being platformed and legitimised in public discourse, the Museum received a lot of backlash for its stance as a 'believer' (rather than as a 'neutral' arbitrator), which left its then Director, Chris Rapley, 'badly burned and shaken'.[5] Despite this context, the Museum persevered in its programming around the changing planet, maintaining a role that it created for itself to support public understanding of anthropogenic

[5] Quoted in George Marshall, *Don't Even Think About It: Why Our Brains Are Wired to Ignore Climate Change* (Bloomsbury, 2014), 102.

climate change and combat any confusion or scepticism around its existence.[6] Through its engagement with climate change, the institution brought into sharp relief how museums are contested spaces, with contested roles and responsibilities regarding how they serve and benefit their publics.

That the Science Museum is a contested space and a site of controversy is still brought into sharp relief by its current engagement with the changing planet. However, this time, in a context of widespread public acceptance that climate change is real, as well as widespread support for mitigative action on it. The controversy that now surrounds the Museum relates to its ongoing financial relationships with fossil fuel companies, whether directly or indirectly through subsidiary companies. The Science Museum, of course, is not the only major UK institution to accept fossil fuel sponsorship. But it receives heavy criticism for the hypocrisy of its efforts to empower audiences to take action on climate change, to champion the sustainable transition, and to promote equitable science education, while also taking money from—hence arguably legitimising—corporations that have a vested interest in upholding the power and wealth of the fossil fuel industry.[7]

Investigating the Science Museum's ties with the fossil fuel industry, and analysing the impacts of this, would itself be a huge research project. Therefore, in this thesis, I draw attention to the matter of sponsorship—and its related controversies—when I consider it is apt to do so in my contextualisation of curatorial practice. While I personally critique the act of partnering with companies whose agendas are incommensurate with emissions reductions, sustainable transitions and climate justice,[8] I do not let this cloud my judgement of Science Museum curatorship. Nor do I let it inhibit me from celebrating the personal investment that curators bring to their work and highlighting their personal successes. The issue of sponsorship provides context to my analysis, but it is not the primary focus.

To analyse how Science Museum curators have harnessed their practice to engage with the changing planet, I argue, is an important contribution to the historiography of the institution.

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[6] See Chris Rapley 'A Forum to Make Sense of Climate Science', *The Guardian*, 27 May 2010. Available at: https://www.theguardian.com/environment/cif-green/2010/may/27/science-museum-climate-gallery [accessed 17 September 2025].

[7] See Culture Declares Emergency, 'Open Letter from Culture Declares Emergency in Solidarity with Campaigners for the Science Museum Group to Drop Fossil Fuel Sponsors', 30 July 2021. Available at: https://www.culturedeclares.org/letter-from-cde-for-the-science-museum-group-to-drop-fossil-fuel-sponsors/ [accessed 17 September 2025].

[8] For example, see International Energy Agency, 'The Oil and Gas Industry in Net Zero Transitions | Executive Summary' (2023). Available at: https://www.iea.org/reports/the-oil-and-gas-industry-in-net-zero-transitions/executive-summary [accessed 17 September 2025].

As such, I aim to document a significant moment in the long and varied history of the Science Museum, adding to the rich body of literature that charts the evolution of the organisation, from its origins in the Great Exhibition to the present day, and in turn, contemplate its future. In this endeavour, I am building on the work of authors who had themselves held prominent positions in the Museum, such as Alison Boyle, Tim Boon and Robert Bud, but also authors who have examined the institution as external scholars, such as Sharon Macdonald and Fiona Cameron. As a researcher, I straddle these two positions, being both an 'insider' and an 'outsider'. My unique positionality grants me a hitherto uninhabited position in analysing climate change curatorship in this major national museum.

I am simultaneously an insider and outsider to the Science Museum due to the nature of my PhD as a Collaborative Doctoral Partnership (CDP). It is one of many research projects that was devised collaboratively between employees of a UK museum, library, archive or heritage organisation, and academics at a UK university. Such research is intended to support the work and objectives of the organisation and often concerns its collections or working practices. Therefore, my work is supervised jointly by two academics at the University of East Anglia (UEA) and two curators at my partner organisation, the Science Museum. My primary supervisor at the UEA (Sarah Wade) and my co-supervisors at the Science Museum (Alexandra Rose and Rupert Cole) initially formulated the project.

Although my thesis title locates a primary concern for *science museums*—positioning the Science Museum as the linchpin of my research—I nonetheless call attention to other spaces of *science curatorship* and *public engagement with science*, broadly defined, through my case studies. I compare how modes of curating the changing planet vary between institutions—science museum or otherwise—and in doing so, assess the parallels and divergences between them. Illuminating the work of curators in other institutions provides a basis to demonstrating how science museum curators are working in idiosyncratic contexts with particular priorities, objectives and frameworks for practice. This is underlined by my examination of the ecological systems in which curators operate.

Nevertheless, I also hope to activate these *alternative* modes of curating as sources of inspiration to science museum curators, encouraging them to take risks and expand the realms of their thinking and practice. The climatic and environmental crises demand substantial transformations across human societies towards ways of living in sustainable reciprocity with the planet, its environments and ecosystems that also address social injustices, thus promoting the health and wellbeing of everybody. As I have observed from my diverse case studies, science curators have a unique and valuable role to play in

supporting these wholescale transitions, particularly through their practices of interpreting the past, present and future in ways that manifest ethics of sustainability, equity, justice, compassion and care for human and nonhuman beings alike.[9]

Defining Science Museums and Science Curatorship

Through the course of my research, I have come to appreciate how enigmatic and fluid the disciplinary boundaries are that exist between and within museum institutions. To define what exactly a 'science museum' or a 'science curator' is, would be a long and complex discussion. So, for the purposes of this thesis, I take an expansive view of science curatorship, situating it as a mode of practice that is conceptually oriented around 'science'; a practice of telling stories about science, promoting scientific inquiry and knowledge, and drawing attention to science's agential impact over society, culture, economics, politics and the environment. *Curating* science is not the same as *practising* science. Ironically, the curators at the Science Museum function more like historians than they do scientists, unlike their curatorial neighbours at the Natural History Museum, for whom scientific methodologies are a key part of their work.[10]

Another common denominator of science museums (although this is dependent on context) is that their conception of 'science' is often heavily skewed towards physical sciences—such as chemistry and physics—and applied sciences—such as engineering, computer science and sometimes medicine. By and large, 'natural' sciences such as biology and geology are less of a concern to science museums and instead fall under the remit of 'natural history' museums. However, one of my case studies—Thinktank Birmingham Science Museum—does not conform to this tendency, possessing natural history collections within its curatorial scope. Moreover, as I explore in the latter part of this thesis, curators at the Science Museum are moving towards embracing a greater focus on biological sciences, especially ecology. In doing so, these curators are deliberately 'pushing the boundaries of what counts as science and technology', drawing attention to scientific pluralism.[11] But, in general, by focusing on the physical and applied sciences at the exclusion of the biological sciences, it makes it impossible to define science museums simply in terms of their being broadly concerned with 'science'. Rather, it is more apt to characterise science museums as

[9] I acknowledge that 'sustainability', 'equity', 'justice', 'compassion' and 'stewardship' are not objective, universal concepts, and can be interpreted and acted upon in a variety of ways for a variety of ends. See below for my analysis of 'sustainability' and 'justice' as modes of framing the future of the changing planet.
[10] See Natural History Museum, 'Our Science'. Available at: https://www.nhm.ac.uk/our-science.html [accessed 17 September 2025].
[11] Interview with Rupert Cole (Science Museum). 29 May 2025.

possessing a greater material focus on the *human* endeavours of producing and applying scientific knowledge, rather than the *natural* data from which that scientific knowledge is derived.

A core part of the material basis and intellectual focus of science museums, therefore, is 'technology'. Science is an intellectual mode of making sense of the world through systematic processes of observing, measuring, experimenting, collecting evidence, calculating, verifying and theorising.[12] In museum collections, these intangible qualities of science can be given material, object form through technology, which include instruments of scientific observation along with technologies that were engineered through the application of scientific knowledge and principles.[13] Thus, a traditional conceptualisation of a science curator—working in a museum context—would be someone who draws meaning from technologies for the ways in which they speak to scientific processes and ways of knowing, and the broader implications of these on human lives and societies. Sam Alberti, Director of Collections in the multidisciplinary National Museums Scotland, corroborates this framing of science and technology curators, juxtaposing their work with that of natural history curators. A science collection supplies 'evidence of the exploration and understanding of nature, but it is not natural phenomenon itself, unlike the specimens in a *natural* science collection' [emphasis in original].[14] The science curator thus employs objects as 'historical texts':[15] as positioned in time and carrying meanings that extend beyond their physical being.

One of the factors underpinning this technological basis of science museums and science collections stems from their historical origins. Many science museums and science collections—including some of the world's most prominent institutions: the Science Museum in London, the Musée des Arts et Métiers in Paris, and the Deutsches Museum (von Meisterwerken der Naturwissenschaft und Technik) in Munich—were originally founded on a rationale to promote education in science and engineering for the advancement of industry.[16] In short, they associated 'science' with the application of scientific principles towards technological innovation, increased productivity, the accumulation of capital and subsequent

[12] For example, see Science Council, 'Our Definition of Science'. Available at: https://sciencecouncil.org/about-science/our-definition-of-science/ [accessed 17 September 2025].
[13] See Stella Butler, *Science and Technology Museums* (Leicester University Press, 1992), 1-2.
[14] Samuel J.M.M. Alberti, ''Why Collect Science?', *Journal of Conservation and Museum Studies*, Vol.15(1), (2017), 4.
[15] Ibid., 4.
[16] Samuel J.M.M. Alberti, *Curious Devices and Mighty Machines* (Reaktion Books, 2022), 10-12.

economic growth. Science in these contexts is entangled with the socio-economic paradigm of capitalism.[17]

Although their methods and means of doing so have changed since the nineteenth century, many science museums continue to operate under a broad economic ambition to promote science skills and inspire audiences into science careers, often through the acronym of STEM: Science, Technology, Engineering and Mathematics (or STEMM, if Medicine is included). In the UK, there has been a growing concern in government, policy and economics that the nation is lagging behind other countries in terms of productivity and economic growth because it lacks sufficient 'STEM skills' in the workforce to foster technological innovation. This has been particularly pertinent since the early 2000s, with the rapid technological changes that have accompanied the rise of the internet.[18] Seeking to address this skills gap and carve a niche for themselves in society, many science museums situate the promotion of STEM skills, and the encouragement of audiences into STEM careers, as key strategic missions and priorities for their institution.

This is an ambition that they share with science centres. In this thesis, I do not examine in detail the practical and conceptual differences between 'science museums' and 'science centres'. But for the purposes of this introduction, I will point out that, traditionally, they are distinguished by the former being centred around collections, utilising objects as historical texts of science and its social impacts, and the latter being centred around interactive experiences, utilising hands-on, play-based learning to demonstrate physical principles of science.[19] Nevertheless, these distinctions are blurry, given that many science museums contain interactive exhibits, and many science centres contain static object- and text-based exhibits.

What unites them—which underpins my conceptualisation of science curatorship (even though curating is not a profession that is commonly employed in science centres)—is that they share a practical and conceptual function to tell stories about science and support

[17] See Lukas Rieppel, Eugenia Lean and William Deringer (eds.), *Osiris*, Special Issue: 'Science and Capitalism: Entangled Histories', Vol.33, (2018).
[18] Amyas Morse, 'Delivering STEM (Science, Technology, Engineering and Mathematics) Skills for the Economy' [Report by the National Audit Office for the Department for Business, Energy & Industrial Strategy and the Department for Education], (2018), 5. Available to download at: https://www.nao.org.uk/reports/delivering-stem-science-technology-engineering-and-mathematics-skills-for-the-economy/ [accessed 17 September 2025].
[19] For example, see Karen A. Rader, 'Hands-on Science Centers as Anticollections? The Origins and Implications of the Exploratorium Exhibits Model', in Alison Boyle and Johannes-Geert Hagmann (eds.), *Challenging Collections: Approaches to the Heritage of Recent Science and Technology* (Smithsonian Institution Scholarly Press, 2017), 198-213.

scientific understanding in the hope of emboldening audiences to participate in science.[20] In the Conclusion, I speculate a future for science curatorship on the changing planet wherein 'science' is actively dissociated from the paradigm of infinite economic growth and instead situated as a way of knowing and acting on the world that can help to build sustainable and equitable futures. By arguing for a 'paradigm shift' in science curatorship, I am drawing on the ideas of Thomas S. Kuhn that transformations in scientific knowledge and frameworks are embedded in, and shaped by, the socio-cultural, economic and political contexts through which they take place.[21]

Curating Climate Change: Research Context

Review of Practice and Literature

Across the globe, curators and practitioners in the arts, culture and heritage sector are harnessing their unique abilities in storytelling to address how climate change is fundamentally transforming the Earth and human societies. Museums and art galleries have been particularly active in this area, and many curators are critically re-examining their remit to incorporate a focus on the changing planet, consciously shifting their approaches to collecting, interpreting and exhibiting in ways that speak to the causes, impacts and solutions to the human-induced planetary crisis.[22] Some institutions have even created dedicated curatorial roles.[23] In the UK, they include Lucia Pietroiusti, Head of Ecologies at Serptentine (London); Marleen Boschen, Adjunct Curator of Art and Ecology for Tate (London, Liverpool and St Ives); John Kenneth Paranada, Curator of Art and Climate Change at the Sainsbury Centre (Norwich); and Leanne Melbourne, Senior Curator of Climate Change and the Dynamic Coast for Norfolk Museums. And internationally, they include Soren Brothers, Curator of Climate Change at the Royal Ontario Museum (Toronto); and Jenny Newell, Curator for Climate Change at the Australian Museum (Sydney). Meanwhile, there are some innovative organisations that have been established with an

[20] See Ecsite, 'About Us'. Available at: https://www.ecsite.eu/ABOUT-Ecsite [accessed 17 September 2025].
[21] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (University of Chicago Press, 1962).
[22] See Sarah Wade, 'Emerging Exhibition Ecologies: Curating Contemporary Art at a Time of Climate Crisis', in John Kenneth Paranada and Vanessa Tothill (eds.), *Planet for Our Future: How Do We Adapt to a Transforming World?* (Sainsbury Centre for Visual Arts, 2023), 12-21.
[23] See Louisa Buck, 'Curators in the Climate Crisis: Who Are the New Museum Hires Turning Art Institutions Green?', *The Art Newspaper*, 22 May 2023. Available at: https://www.theartnewspaper.com/2023/05/22/curators-in-the-climate-crisis-who-are-the-new-museum-hires-helping-to-turn-their-institutions-green [accessed 17 September 2025].

explicit and exclusive focus on the changing planet.[24] They include The Climate Museum (New York), Climate Museum UK, Klimahaus Bremerhaven, the Jockey Club Museum of Climate Change (Hong Kong) and Klimahuset (Oslo).

While today the changing planet and the sustainable transition are on the radar of virtually every museum and art gallery—in both their public-facing and behind-the-scenes activities—the momentum was relatively slow to build, spanning about two decades. In the process of my research, I have charted a chronological timeline of exhibitionary activities in museums, galleries and other heritage spaces that concern the changing planet (with a particular focus on the UK), relating them to significant moments in climate change research, discourse and impacts (see Appendix A).[25] Notwithstanding that the internet has meant that curatorial activities are much better documented and more accessible now than they were twenty-plus years ago, as my timeline shows, there was a steady build-up of exhibitionary activities over the 1990s and 2000s (with a concentration of activity in 2009), but since the late 2010s, they have proliferated rapidly and the trend is ongoing.

Many of these activities were responding to their contemporary socio-political context of the changing planet: the ways in which it was being engaged with in public, political and legislative discourse. For example, from the early 1990s to 2010, exhibitions and galleries such as the American Natural History Museum's *Global Warming: Understanding the Forecast* (1992-1993);[26] the Deusches Museum's *Climate: The Experiment with the Planet Earth* (2002);[27] and the Science Museum's (London) *Climate Change* (2002), *Prove It!* (2009) and *Atmosphere* (2010-2021), were devised to address a 'deficit' in public understanding around the science of climate change, its causes, impacts and potential solutions.

They were confronting an intellectual context in which climate change was gaining ever greater prominence and legitimacy in scientific research, notably through the Intergovernmental Panel on Climate Change (IPCC), established in 1988 to carry out

[24] See Jenny Newell, 'Climate Museums: Powering Action', in *Museum Management and Curatorship*, Special Issue: 'Museums and Climate Action', Vol.35(6), (2020), 599-617.
[25] Also see Museums and Climate Change Network, 'Exhibitions'. Available at: https://mccnetwork.org/exhibitions [accessed 17 September 2025].
[26] See John H. Falk. and Lynn D. Dierking, '*Global Warming: Understanding the Forecast*', *Museum Anthropology*, Vol.16(3), (1992), 72-78; Eva Zelig and Stephanie L. Pfirman, 'Handling a Hot Topic—*Global Warming: Understanding the Forecast*', *Curator: The Museum Journal*, Vol.36(4), (1993), 256-271.
[27] See Luke Keogh and Nina Möllers, 'Pushing Boundaries: Curating the Anthropocene at the Deutsches Museum, Munich', in Fiona R. Cameron and Brett Nielson (eds.), *Climate Change and Museum Futures* (Routledge, 2015), 84.

assessments on the evidence, rate and impacts of climate change and suggest courses of action to policymakers. But they were also confronting a social context of widespread confusion and misinformation around climate change, much of which was kindled under the agendas of prominent climate sceptics and deniers, which included a proportionally smaller number of scientists along with politicians, journalists, organisations and corporations. In these contexts, exhibitions and galleries such as those listed above served a didactic purpose, presenting publics with the scientific evidence of climate change in the hope that their being more informed would inspire them to act accordingly, such as making sustainable lifestyle choices.

Many exhibitionary activities from the 1990s and 2000s followed a formulaic narrative from 'causes' to 'impacts' to 'solutions'. But particularly since the mid- to late-2010s, there has been a decreased focus on evidencing how humans have caused climate change, and an increased focus on how it has impacted (and will impact) the Earth and humankind, and how people have responded to these challenges. So, rather than explaining the science of climate change and proving that it exists, there has been a shift in emphasis towards engaging publics in affective ways, reflecting on the broader socio-cultural dimensions of the changing planet and using this as the basis for thinking about alternative futures. An early example of such an approach was *Climate Control* at Manchester Museum (2016). The exhibition developers aimed to go beyond 'well-worn stories' of the physical causes and consequences of climate change and instead invite audiences to participate in dialogue around its socio-cultural aspects, encouraging them to incorporate their ideas of the future into the physical display.[28]

Therefore, over the last decade, I discern that the primary emphasis of museological engagements with the changing planet has been to rouse feelings of hope for the future and subsequently inspire meaningful change. Such change can be for the individual visitor or for the collective community or society. It can denote tangible actions and solutions, but also intangible modes of thinking, feeling and relating to the Earth, to other living beings, and to other humans. Many art exhibitions have sought to inspire such intangible modes of engagement, wherein artworks are tools for connecting to the changing planet on emotional levels.[29]

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[28] See Henry McGhie, Sarah Mander and Ralph Underhill, 'Engaging People with Climate Change Through Museums', in Walter Leal Filho et al. (eds.) *Handbook of Climate Change Communication: Vol. 3. Case Studies in Climate Change Communication*. (Springer, 2018), 336-343.

[29] See Jonathan Knott, 'How Art Exhibitions Are Changing in the Face of the Climate Crisis', *Museums Journal*, 20 January 2023. Available at: https://www.museumsassociation.org/museums-journal/features/2023/01/how-art-exhibitions-are-changing-in-the-face-of-the-climate-crisis/ [accessed 17 September 2025].

I argue that the spike in activity since the late 2010s (despite the interruption of Covid-19) correlates to various factors. These include the surging rate at which climate change is taking place, leading to global heating and increasing the frequency of extreme weather events;[30] the rise in public concern over climate change and the increased prominence of environmental activism in public discourse (in particular, from the campaign movements Youth Strikes for Climate and Extinction Rebellion); [31] the stronger policies that have been set in motion to mitigate climate change (such as the Paris Agreement and the UK Government's commitment to 'net zero'); and the subsequent transformations that are taking place across multiple levels—from large-scale infrastructure to individual lifestyles—that fall under the transition to 'sustainability'. (See the 'Climate Change' sub-section for a fuller exploration of these contexts, their associated terminology and their connotations in futures thinking). These macro-level contexts, in varying ways, signal that scientists, politicians and society have moved beyond the 'debate' of whether climate change exists towards *what should be done about it*. Hence exhibitions and galleries on the changing planet have also been increasingly oriented around 'solutions', whether tangible or intangible, and how they can contribute to building positive, hopeful futures.

Besides this shift in emphasis from 'evidence' to 'solutions', there are also many more exhibitionary activities that engage with the changing planet in dialogue with a broader set of subjects and issues, rather than focusing on climate change alone. For example, the changing planet was brought into discourse with the culture, rights and resilience of Indigenous Arctic communities in *Arctic Culture and Climate* at the British Museum (2020-2021), curated by Jago Cooper. It provided context to explore the environmental impacts of farming and eating meat, and how this is galvanising change across agricultural science, food production and dietary habits, in *Meat the Future* at Oxford University Museum of Natural History (2021-2022). And it offered a pertinent backdrop to explore the impact of flooding on local communities in *Waters Rising* at Perth Museum (Scotland) (2024-2025), which led to the creation of an archive of flood memories, past and present.

Lastly, another major shift in practices of curating the changing planet relate to modes of framing these changes, particularly through the use of terminology. Exhibitions and galleries

[30] See World Meteorological Agreement, 'Rate and Impact of Climate Change Surges Dramatically in 2011-2020', 5 December 2023. Available at: https://wmo.int/news/media-centre/rate-and-impact-of-climate-change-surges-dramatically-2011-2020 [accessed 17 September 2025].
[31] See Elena Ares and Paul Bolton, 'The Rise in Climate Change Activism?', House of Commons Library, 24 June 2020. Available at: https://commonslibrary.parliament.uk/the-rise-of-climate-change-activism/ [accessed 17 September 2025].

from the 1990s and early 2000s were more prone to take ‘global warming’ to signify the changing planet than they are today, given that it only designates one of its impacts and does not do justice to the whole range of effects. A case in point being the American Natural History Museum’s *Global Warming: Understanding the Forecast* from 1992. In any case, scientists’ preferred terminology for the rise in planetary temperatures is now ‘global heating’.[32] While I have not undertaken any substantive quantitative examination into the terminology utilised in exhibitions and galleries, I conjecture that ‘climate change’ dominates.

Although, correlating with the rise in climate activist movements since the late 2010s, the language of ‘climate crisis’ and ‘climate emergency’ have become increasingly prominent in museological and curatorial discourse. This is particularly evident through the emergence of ‘Culture Declares Emergency’ in April 2019: a network of individuals and organisations in the arts, culture and heritage who collaborate to share knowledge and provide support in taking regenerative action. To participate in the community, the individual or organisation must first declare a climate and ecological emergency, officially recognising that ‘the Earth’s life-supporting systems are in collapse, threatening biodiversity and human societies everywhere.’[33] Among the 1,857 signatories of Culture Declares Emergency (to date) are many UK-based museums, galleries and heritage organisations. They include Tate, Museums Association, Birmingham Museums Trust, People’s History Museum (Manchester) and Museums Galleries Scotland.[34]

Finally, since the introduction of the term into scientific discourse—and its subsequent uptake across the humanities, arts and society more broadly—the ‘Anthropocene’ has been widely adopted by museological and curatorial practitioners.[35] For instance, educators and curators from Manchester Museum collaborated with young people to create a display on *Inheriting the Anthropocene* (2019). Meanwhile, the Royal Albert Memorial Museum and Art Gallery in Exeter worked with eight artists to explore the concept through the lens of contemporary witchcraft, in *Earth Spells: Witches of the Anthropocene* (2023). Two of my

[32] Jonathan Watts, ‘Global Warming Should be Called Global Heating, Says Key Scientist’, *The Guardian*, 13 December 2018. Available at: https://www.theguardian.com/environment/2018/dec/13/global-heating-more-accurate-to-describe-risks-to-planet-says-key-scientist [accessed 17 September 2025].
[33] Culture Declares Emergency, ‘Declare’. Available at: https://www.culturedeclares.org/declare/ [accessed 17 September 2025].
[34] See Culture Declares Emergency, ‘Declarers’. Available at: https://www.culturedeclares.org/declarers/ [accessed 17 September 2025].
[35] See Libby Robin et al., ‘Three Galleries of the Anthropocene’, *The Anthropocene Review*, Vol.1(3), (2014), 207-224; Lotte Isager, Line Vestergaard Knudsen and Ida Theilade, ‘A New Keyword in the Museum: Exhibiting the Anthropocene’, *Museum & Society*, Vol.19(1), (2021), 88-117.

subsidiary case studies employed the term, and I explore the implications of this framing in my analyses.

Given the *practical* focus of my research—drawing attention to and examining the experiences, perspectives, thoughts, decisions and actions of curatorial practitioners—I consider it befitting to have first granted attention to the *practical* context of 'curating climate change'. I locate my case-study exhibitions and galleries as belonging to this wider field of practice. I nonetheless appreciate the rich and expanding body of museological and curatorial literature that engages with the changing planet, and the broader philosophies that such literature builds upon. These texts range greatly from the more pragmatic reflections of practitioners on their own work, to more theoretical contributions that seek to reconceptualise paradigms of curating.

One early example of such work is the international collaborative research project funded by the Australian Research Council, *Hot Science, Global Citizens: The Agency of the Museum Sector in Climate Change Interventions* (2008-2011). This project, carried out by museum scholars including Fiona Cameron, Juan Francisco Salazar and Bob Hodge, interrogated the role of museums in providing information about climate change issues, stimulating and arbitrating discussions, and becoming agents of change. Through their findings from surveys, interviews and focus groups, the research team put forward nine propositions for museums to transform their rationale and practice to meet the challenges being posed by climate change. They situate museums as key actors in making sustainable futures—in 'building a common world' through supporting and galvanising systems change.[36]

Much like *Hot Science, Global Citizens*, much subsequent literature on how the changing planet is being addressed in museums has been collaborative and polyvocal in nature. Edited volumes include *Climate Change and Museum Futures* (2015),[37] *Curating the Future: Museums, Communities and Climate Change* (2017),[38] and *Museums and the Climate Crisis* (2024).[39] And special issues of journals include a publication of *Museum Management and Curatorship* dedicated to 'Museums and Climate Action' (2020),[40] and a publication of

[36] See Fiona R. Cameron, Bob Hodge and Juan Francisco Salazar, 'Representing Climate Change in Museum Space and Places', *WIREs Climate Change*, Vol.4, (2013), 9-21.
[37] Fiona R. Cameron and Brett Neilson (eds.), *Climate Change and Museum Futures* (Routledge, 2015).
[38] Jennifer Newell, Libby Robin and Kirsten Wehner (eds.), *Curating the Future: Museums, Communities and Climate Change* (Routledge, 2017).
[39] Nick Merriman (ed.), *Museums and the Climate Crisis*. (Routledge, 2024).
[40] Joy Davis (ed.), *Museum Management and Curatorship*, Special Issue: 'Museums and Climate Action', Vol. 35, (2020).

Museum International which explored 'Museum Sustainabilities' (2023).[41] Through their variety of contributions—spanning multiple cultures, institutions, disciplines, practices and experiences—they call attention to the heterogeneity of museums, situating this as a key strength in the sector's ability to bring people together to share a diversity of perspectives, ideas and stories. Each museum, and each individual who works in these museums, brings unique insight to contribute to climate action and sustainable transitions, and collectively, they hold immense power to effect meaningful change in society, culture and politics.

Besides their polyvocality and heterogeneity, another key theme across these bodies of work is the deconstruction of traditional binaries between 'nature' and 'culture'. Many of the texts advocate for theories and practices of curatorship to be reconceptualised in ways that stress the ecological relationality between different forms of being—human and nonhuman, animate and inanimate—highlighting the power of curators to inspire ontological transformation.[42] They stress that such work is necessary to recognise that environmental and social justice are interconnected, and that the separation of 'people' from 'planet' obscures how a thriving Earth and thriving biodiversity ultimately underpin human flourishing.[43]

A key theorist and champion for museums to deconstruct nature-culture ontologies is Fiona Cameron, Associate Professor of Contemporary Museologies at Western Sydney University. In her 2015 co-edited volume, *Climate Change and Museum Futures*, Cameron first laid down her manifesto for 'ecologizing experimentations'. She proposed that museums should dismantle their humanist perspectives, harnessing their unique capacities in interpretive storytelling and embodied experiences towards breaking down the supposed binaries between nature/culture, human/nonhuman, subject/object and active/passive that 'prevent us from thinking ecologically'.[44]

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[41] Jane Legget and Anna Maria Theresa P. Labrador (eds.), *Museum International*, Special Issue: 'Museum Sustainabilities', Vol.75(1-4), (2023).

[42] For example, see Jennifer Newell, Libby Robin and Kirsten Wehner, 'Introduction: Curating Connections in a Climate-Changed World', in Jennifer Newell, Libby Robin and Kirsten Wehner (eds.) *Curating the Future: Museums, Communities and Climate Change*, 2-3.

[43] For example, see Nick Merriman, 'The Role of Museums and Galleries in Addressing the Climate and Ecological Crisis', in Nick Merriman (ed.), *Museums and the Climate Crisis*, 3-7.

[44] Fiona R. Cameron, 'Stirring up Trouble: Museums as Provocateurs and Change Agents in Polycentric Alliances for Climate Change Action', in Walter Leal Filho, Bettina Lackner and Henry McGhie (eds.), *Addressing the Challenges in Communicating Climate Change Across Various Audiences*. (Springer, 2019), 667; Fiona R. Cameron, 'Ecologizing Experimentations: A Method and Manifesto for Composing a Post-humanist Museum', in Fiona R. Cameron and Brett Neilson (eds.), *Climate Change and Museum Futures*, 16-33.

To Cameron, museums have a responsibility to view the world—through the lens of their collections—as entangled, dynamic, sociobiological systems. Dissolving the binaries between nature/culture and human/nonhuman in Western worldviews—and empowering beings who are subjugated in such binaries by granting them agency—she argues, is crucial to sustaining the habitability of the planet and multi-species survival. And museums are uniquely placed to lead such work in advancing paradigms, philosophies and practices of ecological relationality.[45]

Later, Cameron extended her concept of 'ecologizing experimentations' to re-work and redefine notions of curatorship. To emphasise how processes of curating and curatorial thinking are entangled with nonhuman agents—demonstrating that curatorship cannot be isolated from the multitude of nonhuman actors and environments that make such work possible—she propounds the framework of 'eco-curating'. In this conceptualisation, the curator would recognise themselves as embedded, embodied and entangled with other humans, nonhumans and Earthly processes, and as such bestow agency upon these beings in practices of co-making.[46] Cameron's theorisation of eco-curating, in part, responded to her macro context of the Covid-19 pandemic, which made evident the deeply intertwined relationship between the human and nonhuman worlds.[47]

Scholars and practitioners such as Cameron who espouse a curatorship that decentres the humanist perspective—recognising nature and culture as deeply enmeshed and empowering the agency of the nonhuman—builds upon broader philosophies of feminist posthumanism and new materialism. A particularly active proponent in this area is Donna Haraway, who has consistently challenged the oppositional dualism between nature and culture, human and nonhuman. For feminists like Haraway, deconstructing these binary categories is an opportunity to deconstruct the power dynamics inherent within them, and thus open up new modes of resisting oppressors as well as new, relational modes of thinking and being in the world.[48] She calls for a framework of 'science' that collapses the long-standing, artificial binaries between active/passive, nature/culture and human/nonhuman.[49] She uses the entangled concept of *natureculture*s to underline the inherent relationality between 'nature' and 'culture', situating the world as a 'co-construction among humans and

[45] Fiona R. Cameron, 'Ecologizing Experimentations', 16-17.
[46] Fiona R. Cameron, *Museum Practices and the Posthumanities: Curating for Planetary Habitability* (Routledge, 2024).
[47] Ibid., 166-200.
[48] Caroline Ramazanoglu and Janet Holland, *Feminist Methodology: Challenges and Choices* (SAGE Publications, 2002), 89.
[49] Donna Haraway, *Primate Visions: Gender, Race and Nature in the World of Modern Science* (Routledge, 1989), 8.

nonhumans'.[50] At the heart of her endeavours is to decentre the (White, male) human from the top of their supposed hierarchy of being. In a macro sense, her philosophies seek to inspire more ethical, sustainable and ecological ways of living on the planet.[51]

Karen Barad's concept of 'agential realism' continues Haraway's rejection of hierarchical binarism between humans and nonhumans. Similar to Haraway, she calls for paradigms and practices of 'science' that challenge and overcome this binary. Through agential realism, Barad draws together all things—human and nonhuman—as agential forces in the unfolding of reality. Barad therefore collapses the distinctions between human and nonhuman—the observer and the object-being-observed—in processes of perceiving and producing knowledge about the world. The nonhuman 'object' is instead a *subject* that actively constructs facts, knowledge and meanings.[52]

Haraway, too, asserts the agency of the nonhuman in processes of meaning-making: 'on the join between *materiality* and *semiosis*' [emphasis added].[53] Situating matter as an active participant in producing knowledge and significance, interprets that matter as possessing 'liveliness', 'vibrancy' and 'energy' to impact—and be impacted by—the world around it. It is an agent in the world. Likewise, Jane Bennett proclaims that all matter is 'vibrant', containing a 'thing power'. Similar to Haraway, behind her emphasising the lifeforce and agency of nonhumans is an ethical motivation to undo the human hubris that engendered the changing planet.[54]

Posthumanist and new materialist philosophies such as Haraway's, Barad's and Bennett's have had a significant impact on practical and theoretical conceptualisations of curatorship, particularly in the context of the changing planet. Such philosophies are foundational to the scholarship that decentres the human to empower the nonhuman, thus shifting paradigms away from the dualism between nature and culture. However, these scholars and practitioners do not always pay sufficient heed to, or indeed cite, the Indigenous worldviews,

[50] Donna Haraway, *The Haraway Reader* (Routledge, 2004), 66.
[51] Helen Merrick, 'Naturecultures and Feminist Materialism', in Sherilyn MacGregor (ed.), *Routledge Handbook of Gender and Environment* (Routledge, 2017), 110.
[52] Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Duke University Press, 2007)
[53] Donna Haraway and Thyrza Nichols Goodeve, *How Like a Leaf* (Routledge, 2000), 86.
[54] Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Duke University Press, 2010).

ontologies and literature that have long promoted an ethic of reciprocity with nonhuman beings.[55]

My purpose in laying down this broader research context—outlining philosophies of posthumanism and exploring their contribution to museological and curatorial scholarship in a time of planetary change—is to premise my theoretical framework for curatorship as taking place in an 'ecosystem': a system comprising of all the living and non-living components contained within an environment, which interact with this environment and with each other.[56] Building on posthumanist thinking—and an ethic of empowering more-than-human actors—I examine curatorship as an ecological mode of being and acting in the world. I recognise museums as ecosystems in the sense that they function through the interactions taking place between human and nonhuman, living and non-living, components of that system, but also because the museum ecosystem is just one part of a broad network of interrelated ecosystems in the social, cultural, political, economic and intellectual environment.[57]

A final key tenet of my research is that curators, through their diverse practices, actively participate in *futures thinking* and critical discourse about the future. Futures thinking, broadly, denotes the mental act of envisaging, conceptualising, deliberating, analysing and simulating future scenarios that may or may not become a reality.[58] Scholarship on futures thinking—known as 'future studies' or 'futurology'—is inherently multi-disciplinary, drawing on and taking place in sociology, anthropology, political sciences, media studies, philosophy, literary studies, computer science, business studies, education studies and history, among many other disciplines.[59]

Futures thinking, moreover, is a growing area of research in the museums and heritage field. Certainly, a fundamental precept of heritage is the concept and practice of preserving the past for the benefit of future generations. As such, many museum and heritage scholars are thinking critically about the diverse and unique ways in which their sector engages in futures thinking, analysing how—through acts of preservation—they are actively constructing future

[55] See Jerry Lee Rosiek, Jimmy Snyder and Scott L. Pratt, 'The New Materialisms and Indigenous Theories of Non-Human Agency: Making the Case for Respectful Anti-Colonial Engagement', *Qualitative Inquiry*, Vol.26(3-4), (2020), 331-346.
[56] Oxford English Dictionary, 'Ecosystem' (noun). Available at: https://www.oed.com/dictionary/ecosystem_n [accessed 17 September 2025].
[57] Yuha Jung, 'The Art Museum Ecosystem: A New Alternative Model', *Museum Management and Curatorship*, Vol.26(4), (2011), 327-328.
[58] Scott Cole and Lia Kvavilashvili, 'Spontaneous and Deliberate Futures Thinking: A Dual Process Account', *Psychological Research*, Vol.85, (2021), 464.
[59] See John Potts, 'Futurism, Futurology, Future Shock, Climate Change: Visions of the Future from 1909 to the Present', *PORTAL Journal of Multidisciplinary International Studies*, Vol.15(1/2), (2018), 101-102.

worlds.[60] The Museum of Tomorrow—which opened in Rio de Janeiro, Brazil, in 2015—is a notable example of an institution that was established on a foundation of futures thinking. With this purpose, 'different approaches coexist in complementarity within the same space.'[61] These different approaches comprise the 'science-based logic of forecasting and scenario-building'; practices and thinking around decolonisation; and its focus on 'Planetary Wellbeing and Regenerative Anticipation' (which is supported by the institution's UNESCO Chair on Futures Literacy).[62] 'Inspiring futures', moreover, underpins the stated mission of the Science Museum Group, which oversees my partner organisation and primary case study in this thesis.[63] This mission grounds the work of Science Museum curators in future-oriented perspectives, wherein historic and contemporary collections of science, technology and medicine are mobilised as tools for thinking about and inspiring future worlds.

Building on this practice and scholarship, I examine how curators, in different ways and through different forms of activity, engage in conceptualising futures that are built upon our present reality of a changing planet. I thus situate curatorship as a form of practice that has important, compelling and transformative impacts on society. Through processes of interpretation, curators help their audiences to understand how their present reality of the changing planet connects with past realities and leads to possible future realities. Curators are mediators between past, present and future worlds, and in turn, mediate these concepts of temporality to their publics. In doing so, they wield great power in stimulating audiences' own thinking around possible futures, fostering shared visions of preferable futures, and exploring pathways of action to attain such futures.[64] While many historians would denounce it as 'presentism', I argue that museum curators have a valuable role in society to analyse history with a future-oriented lens; utilising the past to supply information and inspiration to shape our choices in the present and guide our paths into possible futures of a flourishing Earth and a flourishing humanity.[65]

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[60] See Rodney Harrison et al. (eds.) *Heritage Futures*; Kristin Alford (ed.), *Cultivating Futures Thinking in Museums* (Routledge, 2025).
[61] Fabio Rubio Scarano et al., 'Engaging with Futures at the Museum of Tomorrow in Rio de Janeiro', in Kristin Alford (ed.), *Cultivating Futures Thinking in Museums*, 101.
[62] Ibid.
[63] Science Museum Group, 'Inspiring Futures: Strategic Priorities 2022-2030', (2022), 6. Available to download at: https://www.sciencemuseumgroup.org.uk/about-us/policies-and-reports/inspiring-futures-strategic-priorities-2022-2030 [accessed 17 September 2025].
[64] See Steven Cork et al., 'Exploring Alternative Futures in the Anthropocene', *Annual Review of Environment and Resources*, Vol.48, (2023), 29.
[65] David Armitage, 'In Defense of Presentism', in Darrin M. McMahon (ed.) *History & Human Flourishing*. (Oxford University Press, 2023), 64.

In the following sub-sections, I unpack, expand and explore the two key concepts of my research: ‘curating’ and ‘climate change’.

Curating

Throughout this thesis (and as I already have done so in this Introduction), I employ the terms ‘curator’, ‘curating’, ‘curatorial’ and ‘curatorship’ to denote the people, practices and modes of thinking that work to communicate and engage audiences with the changing planet through visual and material media. In large part, I refer to conventional modes of curating in its familiar environments of museums and art galleries (albeit in one of my case studies, I analyse practices of ‘external’ curatorship for an exhibition in a science centre). By ‘conventional modes of curating’, I mean practices that are grounded in a rationale to collect, interpret and/or exhibit material and visual culture, whereby curators *care* for the objects and artworks under their oversight.

This conceptualisation of curatorship has a long history. With the emergence of the first modern museums, the term ‘curator’ was reclaimed from its Latin root—*curare*, meaning ‘to care’—and reemployed to designate a keeper, guardian and steward of collections.[66] For many museum curators today, their practice continues to be grounded in this *material* basis, having responsibility for a collection or multiple collections in their organisation. But their role is not to care for these collections for their own sake. Rather, to curate is to research, interpret and harness the objects under their care for the purpose of ‘public engagement’ and ‘public benefit’.[67]

This public-centred aspect of curatorship—its conceptualisation as serving a public good—was solidified and granted a theoretical grounding by the ‘new museology’. Across the 1970s, 1980s and 1990s, museological theorists and practitioners advocated for a shift of focus in museums from ‘collections’ to ‘audiences’. This ‘new museology’ was shorthand for framing museums as actors in society, drawing attention to their entanglement with their socio-cultural environment and their agency in shaping it.[68] Curators of the old museology were criticised for their assumption that the meanings and significances of historical

[66] Janet Marstine and Oscar Ho Hing Kay, ‘Curating as a Relational Practice’, in Janet Marstine and Oscar Ho Hing Kay (eds.), *Curating Art* (Routledge, 2022), 1.
[67] See Jean-Paul Martinon, ‘Curators Serving the Public Good’, *Philosophies*, Vol.6(2), (2021), 1-18.
[68] Rhiannon Mason, Alistair Robinson and Emma Coffield, *Museums and Gallery Studies: The Basics*. (Routledge, 2017), 20-22; See Peter Vergo (ed.), *The New Museology*. (Reaktion Books, 1989).

collections were static, fixed and neutral by virtue of their being in the museum, regardless of wider value shifts in society, culture and politics.[69]

One implication of the new museology was the growing prominence of the museum 'mission', and the reconfiguration of departments and staff towards serving this mission. Many proponents of new museology criticised 'traditional' museum structures that strictly siloed the work of curators from that of other departments: conservation, education, administration, and so on. Instead, they called for the integration of curatorship with other museum operations so that they all may better serve the institutional mission.[70] At least in theory, then, curatorship was oriented away from the service of collections in and of themselves, towards the service of the visitors and 'publics' of the museum.

In turn, this led to a reconceptualisation of curators. Generally speaking, their prior role was as a subject specialist and scholar of their collection(s), which were conceived as possessing innate significance regardless of context. However, following the emergence of new museological thinking, the more 'generalist' curator was favoured, and their approach to curatorship was centred around storytelling, wherein collections' significance was interpreted in relation to context and according to overarching narratives. The curator was redirected towards their audiences, and their relationship with collections was redefined to situate those objects as means of creating meaningful experiences for audiences.[71]

The purpose of highlighting these tenets of the new museology is to emphasise my conceptualisation of curatorship as taking place at the intersection between the *material* and the *immaterial* (see Conclusion). The curator is a mediator between the objects/artworks they oversee and the abstract public they serve. The curatorial theorist, Jean-Paul Martinon, demarcates the material and the immaterial dimensions of curatorship by distinguishing 'curating' from the 'curatorial': *curating* denotes the physical work, while the *curatorial* denotes the philosophical, theoretical work.[72] However, in this thesis, I do not uphold this semantic distinction, but employ 'curating' and 'curatorial' interchangeably to describe the thoughts, actions and decisions of curators.

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[69] Charles Saumarez Smith, 'Museums, Artefacts and Meanings', in Peter Vergo (ed.), *The New Museology*, 9.
[70] Deirdre C. Stam, 'The Informed Muse: The Implications of 'The New Museology' for Museum Practice', *Museum Management and Curatorship*, Vol.12, (1993), 275.
[71] Mathieu Viau-Courville, 'Museums Without (Scholar-)Curators: Exhibition-Making in Times of Managerial Curatorship', *Museum International*, Special Issue: 'The Role of Museums in a Changing Society', Vol.68(3-4), (2016), 11-32.
[72] Jean-Paul Martinon (ed.), *The Curatorial: A Philosophy of Curating*. (Bloomsbury Academic, 2013).

Activities of curatorship that I examine in this research—as evinced by my thesis title—are collecting, interpreting and exhibiting. But I acknowledge that not all curators are engaged in these activities, and when they are, they often collaborate with a variety of individuals beyond the curatorial team. 'Collecting' provides the focus of Chapter 1, where I examine how curators have incorporated a focus on the changing planet into their remit and rationale for acquiring objects. Simply put, collecting—as carried out by curators in a museum context—represents a formal arrangement to obtain and care for an object/artwork or a group of objects/artworks.[73] Curators acquire objects/artworks to perform particular roles and convey particular significances in the 'spaces' of the museum or gallery, both physical and intellectual, public and private.

Given the interconnectedness between 'interpreting' and 'exhibiting', rather than granting them their own space, my second and third chapters concern both of these activities and how they are employed in the development of permanent galleries (Chapter 2) and temporary exhibitions (Chapter 3). By 'interpreting', I denote the practices of discerning and conveying the significances of objects and artworks: from the processes of research around those objects/artworks, to the development of interpretive devices that convey meanings and stories about them, such as object labels, text panels, tours, audio guides, videos, soundscapes, games, digital interactives, infographics, diagrams and images.[74] And by 'exhibiting', I am referring to the act of displaying objects and artworks in a given space (which can be physical or digital), where they are deliberately made accessible to a public audience.[75]

Particularly with regard to permanent galleries and temporary exhibitions, I also speak to practices of 'content development'. While this activity has significances of its own in the realm of social media, in this research, I use 'content development' to designate the ways in which curators produce and present experiences, information, stories, meanings and provocations for their audiences. In this way, it encompasses practices and products of both interpretation and exhibiting.

[73] Rhiannon Mason, Alistair Robinson and Emma Coffield, *Museum and Gallery Studies: The Basics*, 71.
[74] See Juliette Fritsch, 'Introduction', in Juliette Fritsch (ed.), *Museum Gallery Interpretation and Material Culture* (Routledge, 2011), 1-10.
[75] François Mairesse (ed.), *Dictionary of Museology* (Routledge, 2023), 179.

Climate Change

> 'Climate change, of course, is an established scientific fact. The climate change *idea* is the way in which climate change is understood by others, discussed, debated, and addressed.'[76]

The human-induced changing planet is a phenomenon (comprising multiple phenomena) that is subject to interpretation. Certainly, as Leckie emphasises in the above quote, the Earth's transformations exist in physical, nonhuman dimensions beyond the realms of human cognition. But the changing planet also exists in a boundless, intangible, conceptual sense. It is subject to human 'perception' and 'understanding', and develops meaning from a pre-existing foundation of knowledge, experience, belief and emotion.[77] And these acts of sensing, interpreting and understanding the changing planet take place in context—they are shaped by the physical, cultural and social environment of the 'interpreter'.[78] In this thesis, I examine how curators interpret the changing planet for their audiences. That is why, throughout, I frequently employ the term 'changing planet'. Being a somewhat neutral, detached way of signifying the transformations taking place across all the Earth's systems—the lithosphere (rocks), hydrosphere (water), cryosphere (ice), atmosphere (air) and biosphere (living things)—I free myself to analyse the different framings adopted by curators within their practice.

I must clarify that with the 'changing planet', I am always referring to the current anthropogenic (human-induced) changing planet brought about by unsustainable practices of extraction, consumption, agriculture, industry, travel, pollution and settlement that have disturbed the Earth's natural cycles of carbon, nitrogen and water as well as disrupted the balance of ecosystems. As my thesis title demonstrates, I also employ 'climate change' to signify these processes, even though the changes taking place on Earth extend well beyond the climate. I do so in recognition of the ubiquity of 'climate change' in the English-speaking world. However, I acknowledge the Global North-centric, colonialist underpinnings of climate science and its conceptualisations of the climate.[79]

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[76] Barbara Leckie, *Climate Change, Interrupted: Representation and the Remaking of Time* (Stanford University Press, 2022), x.
[77] See Lorraine Whitmarsh and Stuart Capstick, 'Perceptions of Climate Change', in Susan Clayton and Christie Manning (eds.), *Psychology and Climate Change: Human Perceptions, Impacts, and Responses* (Elsevier Academic Press, 2018), 13.
[78] See Elke U. Weber, 'What Shapes Perceptions of Climate Change?', *WIREs Climate Change*, Vol.1(3), (2010), 332-342.
[79] See Candis Callison, 'Rethinking Our Histories and Relations with Climate Change', in Zeke Baker et al. (eds.), *Climate, Science and Society: A Primer*, 19-26.

The ‘idea’ of the climate is a product of deriving intangible meaning from the experience of tangible phenomena. And the scientific interpretation of climate through statistical abstraction of weather over a set period of time is only a recent one, emerging from the development of meteorological instruments and scientific methodologies in the Global North.[80] Climate science is inextricably bound to histories of colonialism and globalisation. From the Enlightenment, the incursions of Europeans across the globe facilitated a boom in meteorological observations, forming the basis of global understandings of the atmosphere.[81] In recent times, the ‘globalisation’ of the atmosphere and climate has been carried out by the IPCC. This scientific organisation amplifies notions of climate change as a risk to the global environment—and a concern of global politics—as opposed to a localised issue that is apprehended and acted upon by distributed authorities, in place-specific ways.[82] Understandings and perceptions of climate and climate change—therefore—are not ‘natural’ and ‘inevitable’, but underpinned by complex interactions between historical agents. Neither are understandings of climate change set in stone.

The language of the changing planet has been constantly shifting—and a subject of hot debate—since the United Nations (UN) and the IPCC emerged as global leaders of climate governance. One of the most notable shifts was the replacement of ‘global warming’ by ‘climate change’ in common parlance between the 1980s and early 2000s.[83] This semantic shift partly emerged from political consultants and lobbyists who perceived ‘global warming’ to be too threatening, directing too much attention towards the negative impacts of burning fossil fuels and therefore jeopardising the future of the industry.[84] Even so, ‘climate change’ more successfully encompasses the findings from climate modelling which demonstrate that ‘warming’ is too simplistic and obscures the other extremes of weather resulting from human disruption of planetary systems.[85] Global warming, instead of defining the changing planet, has been relegated as one of the many side-effects of climate change. And, in more recent years, global warming has been losing status in favour of ‘global heating’: a term which

[80] See James Rodger Fleming, *Historical Perspectives on Climate Change* (Oxford University Press, 1998), 5-6; Zeke Baker et al., ‘Introduction’, in Zeke Baker et al. (eds.), *Climate, Science and Society: A Primer* (Routledge, 2024), xviii.
[81] Martin Mahony, ‘Meteorology, Climate Science, and Empire: Histories and Legacies’, in Zeke Baker et al. (eds.), *Climate, Science and Society: A Primer*, 11-18.
[82] Clark A. Miller, ‘Climate Science and the Making of a Global Political Order’, in Sheila Jasanoff (ed.), *States of Knowledge: The Co-production of Science and Social Order* (Routledge, 2004), 46-66.
[83] See Steven Poole, *Unspeak: How Words Become Weapons, How Weapons Become a Message, and How That Message Becomes a Reality* (Grove Press, 2006), 42-49.
[84] See George Lakoff, ‘Why it Matters How We Frame the Environment’, *Environmental Communication*, Vol.4(1), (2010), 71.
[85] See Andrew J. Knight, *Science, Risk, and Policy* (Routledge, 2016), 164.

denotes more emphatically the dangers of global warming, while also being more technically accurate in terms of the shifting energy balance of the planet.[86]

Another recent semantic shift has been the proliferation of language around 'crisis', 'emergency' and 'breakdown'. For example, *The Guardian* declared in May 2019 that it was updating its 'style guide' to introduce changes in reporting climate and environmental issues.[87] Diverging from 'climate change', it now prefers the terms climate emergency, crisis or breakdown, in a move away from the passivity and gentleness of the former term. This linguistic move followed less than one month after Extinction Rebellion's 'Shut Down London!' protests, which had brought the capital to a standstill and amplified the movement's slogan demand for governments and media to 'tell the truth' about the severity of climate change.[88] Since the late 2010s, numerous governments—national to local—and organisations have responded, participating in the linguistic transition by 'declaring a climate emergency'. The UK Government was the first national government to make such a declaration.[89]

The semantics of all these terms—global warming, climate change, global heating, and climate crisis—nevertheless continue to obscure their embeddedness in the human world (unless prefaced by 'anthropogenic' or 'human-induced'). The 'Anthropocene' has therefore gained currency in the twenty-first century precisely because it illuminates this complex entanglement between humankind and the changes taking place on the planet. Proposed by the atmospheric chemist, Paul Crutzen, and the ecologist, Eugene Stoermer, to designate a new geological era—the 'age of humans'—it communicates the immense, pervasive, transformative impact that humans have exerted not only over the climate, but over every system on Earth.[90] To date, the Anthropocene is not officially recognised as the current epoch of geological time. The International Union of Geological Sciences continues to uphold the Holocene. Nevertheless, that has not prevented the widespread uptake of the

[86] Mike Hulme, Brigitte Nerlich and Warren Pearce, 'Global Warming is Dead. Long Live Global Heating?', *University of Nottingham Blog*, 4 February 2014. Available at: https://blogs.nottingham.ac.uk/makingsciencepublic/2014/02/04/global-heating/ [accessed 17 September 2025].
[87] Damian Carrington, 'Why the Guardian is Changing the Language it Uses About the Environment', *The Guardian*, 17 May 2019. Available at: https://www.theguardian.com/environment/2019/may/17/why-the-guardian-is-changing-the-language-it-uses-about-the-environment [accessed 17 September 2025].
[88] Oscar Berglund and Daniel Schmidt, *Extinction Rebellion and Climate Change Activism: Breaking the Law to Change the World* (Palgrave Macmillan, 2020), 2.
[89] Christian Turney, 'UK Becomes First Country to Declare a 'Climate Emergency'', *The Conversation*, 2 May 2019. Available at: https://theconversation.com/uk-becomes-first-country-to-declare-a-climate-emergency-116428 [accessed 17 September 2025].
[90] See Paul J. Crutzen and Eugene F. Stoermer, 'The "Anthropocene"', *IGBP* [International Geosphere-Biosphere Programme] *Newsletter*, No.41, 2000. 17-18; Paul J. Crutzen, 'Geology of Mankind', *Nature*, Vol.415, (2002), 23.

Anthropocene across multiple disciplines involved in communicating and engaging publics with the changing planet. In particular, it has had a profound impact on ways of thinking about the past, present and future of the Earth and humankind.[91]

The *Anthropos* in 'Anthropocene' and 'anthropogenic' represents a collective 'we' of humankind—signifying that all humans share blame for carrying out practices that are damaging to the environment. To counteract this generalised view, many critics contend that culpability for the changing planet ultimately lies with the small elite of White people in the Global North (relatively speaking, compared to the Global Majority in the Global South). People who have possessed, from the past and into the present, greater agency in an eco-social hierarchy defined by exploitation of labour and biophysical resources.[92] To better illustrate the socio-economic contexts in culpability for the changing planet—and the embeddedness of the changing planet in systems of racism, oppression and exploitation—other terms have been suggested, such as 'Capitalocene',[93] 'Plantationocene',[94] and 'White Supremacy Scene'[95].

These alternative framings of the Anthropocene are underpinned by principles of justice. Climate and environmental justice—in both scholarship and social movements—demand a recognition of the imbalances in ecological and climatic agencies, and that the issues that face the planet cannot be solved until such imbalances have been addressed. Moving on from narratives of a collective 'we', justice framings take a localised view on impacts, experiences and vulnerabilities, while also stressing the importance of community sovereignty and grassroots action.[96] While there is not yet a unifying, dominant framework for climate justice, the movement coalesces around the core principle that actors who are historically responsible for the changing planet—countries, industries and businesses that have obtained vast amounts of wealth from environmentally-destructive practices—have an ethical obligation to support countries and communities that hold a lesser culpability, but are

[91] See Dipesh Chakrabarty, 'The Climate of History', *Critical Inquiry*, Vol.35(2), (2009), 197-222.
[92] For example, see Andreas Malm and Alf Hornborg, 'The Geology of Mankind? A Critique of the Anthropocene Narrative', *The Anthropocene Review*, Vol.1(1), (2014), 62-69; Rob Nixon, 'The Anthropocene: The Promise and Pitfalls of an Epochal Idea', in Gregg Mitman, Marco Armiero and Robert Emmett (eds.), *Future Remains: A Cabinet of Curiosity for the Anthropocene* (The University of Chicago Press, 2018), 1-18.
[93] See Jason W. Moore (ed.), *Anthropocene or Capitalocene: Nature, History and the Crisis of Capitalism* (PM Press, 2016).
[94] See Maan Barua, Rebeca Ibáñez Martín and Marthe Achtnich, 'Introduction: Plantationocene', *Society for Cultural Anthropology: Theorizing the Contemporary*, 24 January 2023. Available at: https://www.culanth.org/fieldsights/introduction-plantationocene [accessed 17 September 2025].
[95] See NIck Mirzoeff, 'It's Not the Anthropocene, It's the White Supremacy Scene; or, The Geological Color Line', in Richard Grusin (ed.), *After Extinction* (University of Minnesota Press, 2018), 123-150.
[96] See David Schlosberg and Lisette B. Collins, 'From Environmental to Climate Justice: Climate Change and the Discourse of Environmental Justice', *WIREs Climate Change*, Vol.5(3), (2014), 359-374.

nonetheless being disproportionately impacted by the changing planet.[97] By calling attention to the unequal distribution of resources and participation in global governance between the Global North and South, the climate justice movement is intertwined with decolonisation, and builds on the foundations of the civil rights movements of Black people, Indigenous people and People of Colour.[98] If an integrated, global framework for climate justice were to be established, it would probably take place through the legal system: through legislation for climate reparations to countries and communities that were (and are) subjugated by (neo)colonial powers.[99]

Another mode of interpreting the 'solutions' to the changing planet is the concept of 'sustainability'. This expansive term denotes the ability to support, maintain and endure the long-term survival and flourishing of something, and can signify both the *process* and *product* of these efforts.[100] One of the most pervasive and comprehensive framings of sustainability—being embraced by businesses, governments, educational institutions and other civic organisations (including the museums and heritage sector), and traversing social, economic, political and environmental priorities—is that provided by the 2030 Agenda for Sustainable Development, which was adopted in 2015 by member states of the UN.[101] Through its seventeen Sustainable Development Goals (SDGs),[102] it serves as 'a shared blueprint for peace and prosperity for people and the planet'.[103] In contrast to the localised and dispersed framings of solutions by the climate and environmental justice movement, the

[97] See Jason Hickel, 'Quantifying National Responsibility for Climate Breakdown: An Equality-based Attribution Approach for Carbon Dioxide Emissions in Excess of the Planetary Boundary', *The Lancet: Planetary Health*, Vol.4(9), (2020), e399-e404.
[98] Jan Wilkens and Alvine R.C. Datchoua-Tirvaudey, 'Researching Climate Justice: A Decolonial Approach to Global Climate Governance', *International Affairs*, Vol.98(1), (2022),125-143.
[99] See Sahar Shah and Joy Reyes, 'Advancing Legal Perspectives on Climate Reparations', *University of Bristol Law School Blog*, 7 July 2025. Available at: https://legalresearch.blogs.bris.ac.uk/2025/07/advancing-legal-perspectives-on-climate-reparations/ [accessed 17 September 2025].
[100] Helen Kopnina and Eleanor Shoreman-Ouimet, 'Introduction: The Emergence and Development of Sustainability', in Helen Kopnina and Eleanor Shoreman-Ouimet (eds.), *Sustainability: Key Issues* (Routledge, 2015), 3.
[101] Giovanni Carrosio, 'Framing Sustainability', in Stefano Fantoni et al. (eds.), *Quantitative Sustainability: Interdisciplinary Research for Sustainable Development Goals* (Springer, 2024), 139.
[102] [1] No poverty; [2] Zero hunger; [3] Good health and wellbeing; [4] Quality education; [5] Gender equality; [6] Clean water and sanitation; [7] Affordable and clean energy; [8] Decent work and economic growth; [9] Industry, innovation and infrastructure; [10] Reduced inequalities; [11] Sustainable cities and communities; [12] Responsible consumption and production; [13] Climate action; [14] Life below water; [15] Life on land; [16] Peace, justice and strong institutions; [17] Partnerships for the goals.
[103] United Nations Department of Economic and Social Affairs: Sustainable Development, 'The 17 Goals'. Available at: https://sdgs.un.org/goals [accessed 17 September 2025].

SDGs are consciously global, working towards a common vision for humanity through the collective, transnational efforts of governments and civic institutions.[104]

A crucial structure for global action on the changing planet is supplied by the United Nations Framework Convention on Climate Change (UNFCCC). At the 1992 gathering of world leaders in Rio de Janeiro for the UN Conference on Environment and Development—the 'First Earth Summit'—almost all nations signed the UNFCCC: an agreement of global climate governance that is unprecedented in world history. Its aim is to stabilise atmospheric greenhouse gas concentrations 'at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system.'[105] The UNFCCC is a global commitment to climate change *mitigation*, whereby members have pledged to reduce and remove greenhouse gas emissions from the atmosphere in order to limit global heating and avoid the worst impacts of climate change.[106] The 197 signatories to the UNFCCC and the subsidiary bodies that advise them meet annually to discuss their efforts and formulate targets for mitigative action at the Conferences of the Parties (COPs).

After years of inaction, delays, and non-binding agreements, spirits were lifted in 2015 by the climate negotiations in Paris at COP21.[107] The influential Paris Agreement commits the Parties to limit global temperatures to 'well below 2ºC above pre-industrial levels', but ideally 'to limit the temperature increase to 1.5ºC above pre-industrial levels, recognising that this would significantly reduce the risks and impacts of climate change'.[108] Following model pathways where there is no or limited overshoot of the 1.5ºC target, the IPCC recommends that global emissions are brought to 'net zero': where the quantity of carbon dioxide (CO_2) being emitted is in equilibrium with the quantity of CO_2 being removed from the atmosphere.[109] Responding to the legally-binding targets of the Paris Agreement, the IPCC's

[104] See José Noronha Rodrigues, 'The Globalization of Human Rights for a Global Citizenship: New Challenges', in Joseph Zajda, Nitza Davidovitch and Suzanne Majhanovich (eds.), *Discourses of Globalisation, Multiculturalism and Cultural Identity* (Springer, 2022), 44-45.
[105] United Nations Climate Change, 'What is the United Nations Framework Convention on Climate Change?'. Available at: https://unfccc.int/process-and-meetings/what-is-the-united-nations-framework-convention-on-climate-change [accessed 17 September 2025].
[106] See United Nations Climate Change, 'Introduction to Mitigation'. Available at: https://unfccc.int/topics/introduction-to-mitigation [accessed 17 September 2025].
[107] See Mark A. Maslin, John Lang and Fiona Harvey, 'A Short History of the Successes and Failures of the International Climate Change Negotiations', *UCL Open: Environment*, Vol.5, (2023), 1-16.
[108] United Nations Framework Convention on Climate Change, 'Paris Agreement', (2016), 4. Available at: https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf [accessed 17 September 2025].
[109] IPCC, 'Summary for Policymakers', in Valérie Masson-Delmotte et al. (eds.), *Global Warming of 1.5ºC. An IPCC Special Report on the Impacts of Global Warming of 1.5ºC Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty* (Cambridge University Press, 2018).

recommendations, along with the growing pressure from the environmental protest movement, in June 2019 the UK Government amended the Climate Change Act (2008) to legally commit the nation to net-zero carbon emissions by 2050 compared to 1990 levels, which constitutes a 100% reduction in emissions. Previously, it was committed to achieve an 80% reduction compared to 1990 levels.[110]

My purpose in exploring different modes of interpreting the *changing planet*, as well as summarising key frameworks of *action* and *solutions*, is to underline how in their practices, curators are making active choices, shaped by their environment(s), in the ways that they frame and engage with the changing planet. While in a museum context, 'interpretation' often refers to processes of interpreting objects and heritage, in my analysis, I consider interpretation to extend into the ways in which curators (among other museum practitioners) interpret the changing planet and its causes, impacts and solutions. In the following sub-section, I contemplate how modes of interpreting the changing planet and its 'solutions' impact futures thinking.

Implications on Temporality

Time is at the heart of scientific understandings of climate change. Certainly, as a scientific concept, climate change denotes the long-term changes in weather patterns, surface air temperatures, sea surface temperatures, humidity, air pressure, sea levels, carbon dioxide concentration, and so on, that have been observed through meteorological instruments and discerned through climate proxies (such as tree-rings, fossils, ice cores and sediments), and charted over time.[111] In turn, the changing planet has huge ramifications on how people perceive and manage time. Particularly on preparing for the future, anticipating future events and imagining future worlds. One of the defining facets of the changing planet—and how it is interpreted—is its long-term extension into an unpredictable and uncertain future.[112]

Policymakers, state authorities, social movements, and scientific bodies such as the IPCC all engage time to mobilise climate action. On the policy and governance side, this includes the

[110] Chris Skidmore and Department for Business, Energy & Industry Strategy, 'UK Becomes First Major Economy to Pass Net Zero Emissions Law', GOV.UK, 27 June 2019. Available at: https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law [accessed 17 September 2025].
[111] See Science Museum, 'Making Climate Change Visible: Instruments, Observation and Data', 4 April 2024. Available at: https://www.sciencemuseum.org.uk/objects-and-stories/making-climate-change-visible-instruments-observations-and-data [accessed 17 September 2025].
[112] Sabine Pahl et al. 'Perceptions of Time in Relation to Climate Change', *WIREs Climate Change*, Vol.5(3), (2014), 376.

time-bound pathways to achieve decarbonisation and carbon neutrality, such as the deadline for net zero by 2050. But it also includes the short-term, deadline-ist language of 'running out of time' that is used to inspire urgent action, such as the IPCC's dire warning in its Special Report of 2018 that humankind has only 'twelve years left' to prevent global temperatures from rising above the 1.5ºC target.[113] Taking a more extreme approach, Extinction Rebellion harnesses rhetoric and imagery of societal collapse and multi-species extinction—envisioning an imminent apocalypse—to rouse public action and legitimise their tactics of civil disobedience.[114] Climate 'crisis', 'emergency' and 'catastrophe' are ways of interpreting the changing planet that exercise this short-term temporal frame of rapidity, urgency and running out of time, invoking apocalyptic visions of the future as warnings of what would happen if humankind and its leaders fail to act *now*.[115]

Unlike climate crisis—which connotes a short-term temporal framing—the Anthropocene is an inherently long-term, deep interpretation of time, extending into the far-distant future. As the historian Julia Nordblad discerns, 'the signature characteristic of the Anthropocene concept shaping its temporal character is that it is declared from an imagined point in a future millions of years from now.'[116] Essentially, one of the underpinning principles of the Anthropocene epoch is that millions of years into the future, even if *Homo sapiens* no longer exist as a species, traces of our impact on planetary systems will still be evident. However, a point of contention amongst scholars—across the sciences, arts and humanities—is the question of how far back into the past the temporal frame of the Anthropocene can be extended. Some scholars argue that it originated in the activities of the Industrial Revolution, while others argue that it began thousands of years ago when humans first started to transform their environment through deforestation and agriculture.[117]

Also contrary to climate crisis, the Anthropocene has been mobilised in both pessimistic and optimistic futures thinking. As a temporal framing, the Anthropocene invokes multiple

[113] See Christopher J. Rhodes, 'Only 12 Years Left to Readjust for the 1.5-degree Climate Change Option – Says International Panel on Climate Change Report: Current Commentary', *Science Progress*, Vol.102(1), (2019), 73-87. Also see Patrice A. Kohl and Neil Stenhouse, '12 Years Left: How a Climate Change Action Deadline Influences Perception and Engagement', *Environmental Communication*, Vol.15(7), (2021), 986-1000.
[114] Aaron Thierry, '"Heading for Extinction": The Representation of Scientific Knowledge in Extinction Rebellion's Recruitment Talks', *Frontiers in Communication*, Vol.8, (2023), 1-15.
[115] See Joe P.L. Davidson and Luke Kemp, 'Climate Catastrophe: The Value of Envisioning the Worst-case Scenarios of Climate Change', *WIREs Climate Change*, Vol.15(2), (2023), 1-14.
[116] Julia Nordblad, 'On the Difference Between Anthropocene and Climate Change Temporalities', *Critical Inquiry*, Vol.47(2), (2021), 331.
[117] See Tim Edensor, Lesley Head and Uma Kothari, 'Time, Temporality and Environmental Change', *Geoforum*, Vol.108, (2020), 256.

futures.[118] In discourse about the future—spanning such realms as geopolitics, environmental science and fiction—the Anthropocene is often employed to signify a time of uncertainty, danger, loss, sorrow and irreparable damage to the Earth, leading to the potential collapse of human civilisations.[119] At the other end, some futures discourse situates the Anthropocene in a positive light. As the 'age of humans', it can be used to evoke a future in which humans are 'planetary stewards': an active force for 'good', wherein humans are responsible for maintaining healthy conditions that support life on Earth.[120] Ecomodernists, meanwhile, envision a 'good Anthropocene' in which humankind is a benevolent master over the Earth. From their perspective, it is an opportunity to accelerate 'progress' and 'prosperity' within neoliberal paradigms of technological development and economic growth. The Anthropocene thus serves as an emblem and catalyst of human exceptionalism, resilience, innovation and ingenuity.[121]

'Sustainable development' is another optimistic mode of futures thinking centred on the anticipated success of human responses to the changing planet. In many cases, such as the SDGs, it does not signify wholescale paradigm shifts in societal, political and economic regimes. Rather, through processes of transition—such as the transitions to low-carbon energy, transport and agriculture—sustainable development signals a modified continuity of present systems of power, production, consumption and civic organisation. It anticipates optimistic futures that are not too dissimilar to the present but have nonetheless been successful in mitigating the worst impacts of climate change.[122] However, this implication of the continuity of present regimes—of maintaining the status quo—has been a target of critique. Namely, through its upholding of the concept of *development*, it persists the Global North-centric agenda of neoliberal capitalism, economic growth and neocolonial globalisation. It obscures the specific needs and grassroots agencies of marginalised communities, such as Black and Indigenous people and People of Colour, while also prioritising human issues over the rights and wellbeing of nonhumans, which are subsumed

[118] Frans Berkhout, 'Anthropocene Futures', *The Anthropocene Review*, Vol.1(2), (2014), 154-159.
[119] See Eva Lövbrand, Malin Mobjörk and Rickard Söder, 'The Anthropocene and the Geo-political Imagination: Re-writing Earth as Political Space', *Earth System Governance*, Vol.4, (2020), 1-8. Also see Joe P.L. Davidson, 'Two Cheers for Collapse? On the Uses and Abuses of the Societal Collapse Thesis for Imagining Anthropocene Futures', *Environmental Politics*, Vol.32(6), (2023), 969-987.
[120] Will Steffen et al., 'The Anthropocene: From Global Change to Planetary Stewardship', *Ambio*, Vol.40(7), (2011), 739-761.
[121] John Asafu-Adjaye et al., 'An Ecomodernist Manifesto', (2015). Available at download at: https://www.ecomodernism.org/manifesto-english [accessed 17 September 2025].
[122] Kyrre Kverndokk and Anne Eriksen, 'Climate Change Temporalities: Narratives, Genres and Tropes', in Kyrre Kverndokk, Marit Ruge Bjærke and Anne Eriksen (eds.), *Climate Change Temporalities: Explorations in Vernacular, Popular, and Scientific Discourse* (Routledge, 2021), 8.

to serving humankind.[123] Others critique 'sustainable development' as an oxymoron, pointing to the inherent incompatibility between economic growth and environmental sustainability agendas in the SDGs.[124]

As I argue in this thesis, curators—particularly those who work with the spaces and resources of museums and galleries—perform unique and powerful roles in thinking and discourse around the future of the changing planet. By outlining how different approaches and language to framing the changing planet impact futures thinking, I am introducing a core part of my analysis: that curators' interpretation of the changing planet underpins the modes of futures thinking that they engage in. Through an ecological framework (see 'Theoretical Framework'), I examine how curators' modes of framing the changing planet—and thus the kinds of futures that they contemplate—are shaped by various factors and actors in their spheres of influence; in the contexts and environments in which they live and work.

Hope, Anticipation and Speculation in a time of Planetary Change

Across my case studies, curators engage in *hopeful* futures thinking, envisioning *positive* futures, however they are interpreted. In the broader field of climate change communication, hope is often intended as a crucial mode of affective engagement as well as a key outcome of such engagement. Many actors in the field of climate and environmental action are conscious to strike an inspiring tone in their work, galvanising optimism and hope for the different 'solutions' that could restore the Earth and safeguard the future of humanity.[125] And as numerous studies find, being hopeful is linked to greater support of, and contribution to, actions to protect the climate and environment.[126] Building on this premise that *hope* is key to visitor engagement and inspiring action on the changing planet, many museums and museum curators are looking to their collections and communities for stories of adaptation, resilience, ingenuity and achievement as models of 'success against great odds'.[127]

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[123] For example, see Fiona R. Cameron, 'From Sustainable Development to Sustaining Practices for Human, More-than and Other-than Human Worlds', *Museum International* Special Issue: 'Museum Sustainabilities', Vol.75(1-4), (2023), 214-221.
[124] For example, see Viktoria Spaiser et al., 'The Sustainable Development Oxymoron: Quantifying and Modelling the Incompatibility of Sustainable Development Goals', *International Journal of Sustainable Development & World Ecology*, Vol.24(6), (2017), 457-470.
[125] For example, see Christiana Figueres and Tom Rivett-Carnac, *The Future We Choose: The Stubborn Optimist's Guide to the Climate Crisis* (Manilla Press, 2020); Elin Kelsey, *Hope Matters: Why Changing the Way We Think Is Critical to Solving the Environmental Crisis* (Greystone Books, 2020); Maude Barlow, *Still Hopeful: Lessons from a Lifetime of Activism* (ECW Press, 2022).
[126] For example, see Wendy Ring, 'Inspire Hope, Not Fear: Communicating Effectively About Climate Change and Health', *Annals of Global Health*, Vol.81(3), (2015), 410-415.
[127] Sarah W. Sutton, 'Museums as Agents and Settings for Climate Hope', *Nordic Museology*, Special Issue: 'Curating Climate', Vol.30(3), (2020), 14-28.

In my research, I identify two distinct modes of futures thinking being employed: *anticipatory* futures thinking and *speculative* futures thinking. While 'anticipation' and 'speculation' are often equated in common parlance, I draw on anthropological and philosophical perspectives to contend that there *is* a heuristic distinction between them as modes of futures thinking. I take 'anticipation' to denote the translation into action of what has first been identified through forecast and foresight.[128] Anticipatory thinking, therefore, signifies the mental act of planning to take such actions that prepare for expected scenarios.[129] In other words, anticipation is a cognitive state of being that brings the 'present and future into the same activity timespace'; it is an 'act of looking forward that also pulls [the onlooker] in the direction of the future and prepares the groundwork for that future to occur.'[130] From my conversations with curators and my observations of their work in curating climate change, I examine how they have employed anticipation and anticipatory modes of thinking about the future; how they foresee future scenarios, and subsequently how they have acted—or how they think about acting—in preparation for such possibilities.

While anticipation has connotations of *action*, 'speculation' is a more abstract mode of thinking that does not necessarily build on a foundation of present reality. Unlike anticipation, speculation can involve looking to the past *as well as* looking to the future; it can involve thinking about both *what could have been* and *what could be*.[131] Philosophy is a notable field in which speculative thinking has been theorised and applied, being a mental mode that is transcendent and metaphysical, going beyond the empirical realm to derive conclusions about the nature of the universe and the place of humankind within it.[132] Providing some freedom of thought from physical, empirical reality, speculation provides scope for reconceptualisation and reimagining. As a form of futures thinking, it permits the onlooker to imagine a radically different world and radically different ways of being in the world. Therefore, 'by opening new possibilities, [it] could free us from the destructive trajectories of

[128] Roberto Poli, 'Anticipation', in Vlad Petre Glăveanu (ed.), *The Palgrave Encyclopedia of the Possible* (Palgrave Macmillan, 2022), 100.
[129] See Laura M. Hiatt, 'The Role of Priming in Anticipatory Thinking', *AI Magazine*, Special Issue: 'Anticipatory Thinking', Vol.44(2), (2023), 144-154.
[130] Rebecca Bryant and Daniel M. Knight, *The Anthropology of the Future* (Cambridge University Press, 2019), 22; 28.
[131] Lun Huang, Yibo Xie and Xiaolin Chen, 'A Review of Functions of Speculative Thinking', *Frontiers in Psychology*, Vol.12, (2021), 1-10.
[132] Nicholas Bunnin and Jiyuan Yu, *The Blackwell Dictionary of Western Philosophy* (Blackwell Publishing, 2009), 654.

current civilisation.'[133] It can be used as a tool for empowerment and hope for future worlds that are free from inequality, oppression, suffering and despair.[134]

Curating Climate Change: Approaches to Research for this Thesis

Research Questions and Objectives

The research questions that I set out to confront in this thesis are:

- How have curators working in science-based contexts engaged with the changing planet in their practices of collecting, interpreting and exhibiting?
- How are the thoughts, decisions and actions of science curators shaped by their contexts and environments?
- What is the unique contribution of science curatorship to interpreting and communicating the changing planet?
- What are the challenges and opportunities for curators in representing the changing planet in permanent collections, permanent galleries and temporary exhibitions?
- What is unique about curatorial practice in the Science Museum?

By investigating these questions, my objectives are:

- To examine the diverse contextual agencies that shape curators' actions and decision-making.
- To compare practices of curatorship taking place in different environments, drawing attention to their unique capacities to convey information, stories and significances pertaining to the changing planet.
- To consider how engaging with the changing planet is transforming institutions and their practices and paradigms of curatorship, with a particular focus on the Science Museum.
- To cross-examine practices of curating that broadly relate to 'science' and discern their commonalities, with an aim to discern what 'science curatorship' is and how it contributes to discourse on the changing planet.
- To analyse the personal agencies, outlooks and experiences of curators in their practices of curating the changing planet, revealing the legacies of their work.

[133] Arran Gare, 'Speculation', in Vlad Petre Glăveanu (ed.) *The Palgrave Encyclopedia of the Possible*, 1534.
[134] See Lesley-Ann Noel, 'Dreaming Outside the Boxes that Hold Me In: Speculation and Design Thinking as Tools for Hope and Liberation Against Oppression', *Journal of Futures Studies*, Vol.26(3), (2022), 71-82.

- To suggest future directions in science curatorship that address the challenges of the changing planet.

Theoretical Framework

The theoretical framework through which I analyse practices of curating climate change is inspired by the research and practice of the museologist, Fiona Cameron. In particular, her theorisation of 'ecologizing' curatorship[135] and her subsequent concept of 'eco-curating'.[136] She draws her proposition for 'ecologizing experimentations' in museums from Bruno Latour's Political Ecology. In Latour's philosophy of politics on a human-induced changing planet, 'ecologizing' is the antidote to 'modernizing'. To ecologize is to bring nonhuman beings into structures and systems of power—into democratic procedure and political decision-making—halting the current historical trajectory of capitalist 'modernization' and its ontological binarism between 'nature' and 'culture', and subsequent oppression of the nonhuman in service of the human.[137]

Taking on this philosophy and applying it to museology, Cameron argues that museums are key sites through which to embrace principles and practices of ecologizisation—assembling more-than-human social collectives—and thus reject paradigms of 'modernity' in the Global North. This would indeed be a transformative task, given that museums, she recognises, are major historical actors that have promulgated the othering of human/nonhuman, object/subject, nature/culture through processes of taxonomic categorisation (and separation).[138] Cameron then continued this work into her conceptualisation of 'eco-curating'. With the 'impending socio-ecological collapse', she sees museums as 'facing a crisis of curation': a crisis resulting from curatorial practices being 'routinely based on hubris, exceptionalism, and the cognitive interpretations that foreground teleological, anthropocentric, and essentialist thinking.'[139] To counteract the crisis and its root causes in the 'modern' worldview, she advances 'eco-curating' as novel forms of working in empowering, relational, caring and respectful ways with other beings, both human and

[135] Fiona, R. Cameron, 'Ecologizing Experimentations'.
[136] Fiona R. Cameron, *Museum Practices and the Posthumanities*.
[137] For example, see Bruno Latour, 'To Modernize or Ecologize? That Is the Question', in Bruce Braun and Noel Castree (eds.), *Remaking Reality: Nature at the Millennium* (Routledge, 1998), 221-242; Bruno Latour, *Politics of Nature: How to Bring the Sciences into Democracy* (Harvard University Press, 2004). Also see Anders Blok and Torben Elgaard Jensen, *Bruno Latour: Hybrid Thoughts in a Hybrid World* (Routledge, 2011), 75-101.
[138] Fiona R. Cameron, 'Ecologizing Experimentations'.
[139] Fiona R. Cameron, *Museum Practices and the Posthumanities*, 246.

nonhuman. Curatorial practice, as such, 'is refigured as human, more-than-and non-human collaborations.'[140]

Like Cameron, I also apply modes of 'systems thinking' to conceptualise and analyse curatorship. Inspired by Gilles Deleuze and Félix Guattari's theory of the 'rhizome' and Manuel DeLanda's theory of 'assemblage', Cameron proposes the concept of the 'liquid museum' wherein museums are refashioned as 'heterogeneous assemblages made up of material and expressive forms enmeshed in diverse collectives comprising many human and nonhuman elements.'[141] In effect, viewing museums as 'liquid' provides a lens onto the ecological, interconnected distribution of agencies that actively shape museum processes and products, but also situates museums as actively shaping their environment. By locating museums in these broader ecologies of agency, one can examine institutional change as taking place through the interactions between these various, multi-scalar agents.[142]

While I am fascinated by her ideas and approaches to curating in ways that deconstruct binaries of human/nonhuman, object/subject and nature/culture—and understand the significance of doing so in a time of socio-environmental upheaval—in my research, I do not set out to appraise curatorial activities in terms of how they conform, or not, to principles and practices of ecologizisation and eco-curating. If Cameron were to critique my case studies of curatorship, she would discern evidence of anthropocentrism, human exceptionalism, modernist worldviews and assumptions of nature/culture, human/nonhuman dualism. Instead, her work has inspired me to analyse the *curator* and curatorial *process*—rather than the curatorial *product*—as ecologically entangled.

I am exploring curatorial practice on the basis that it is a necessarily collaborative endeavour between the curator and other human and nonhuman actors, and from this foundation, assess how and why curators made certain choices and took certain actions in their approaches to collecting, interpreting and exhibiting the changing planet. I argue that it is important to contextualise the work of curators so that they feel inspired to reflect critically on their own practice and how it relates to their environments, and in turn, conjecture how they could adapt their methods, in practicable ways, to meet the shifting challenges of the changing planet.

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[140] Ibid., 248.
[141] Fiona R. Cameron, 'Stirring up Trouble', 669. Also see Fiona R. Cameron, 'The Liquid Museum: New Institutional Ontologies for a Complex, Uncertain World', in Andrea Witcomb and Kylie Message (eds.), *Museum Theory* (Wiley & Sons, 2020), 345-363.
[142] Fiona R. Cameron, 'Stirring up Trouble', 669.

To define and demarcate the ecological agencies in a curator's environments that guide their thinking and practice, I take inspiration from psychologist Urie Bronfenbrenner's Ecological Systems Theory of child development. Furthermore, by analysing curatorship in a systematic way, I draw on scholarship that promotes systems thinking in sustainable transitions. Systems thinking can provide a tool for understanding the web of interrelations that cause complex problems—such as the unsustainable practices that have engendered the changing planet—and from there, propose contextualised solutions that support transitions to sustainable ways of living.[143] Thinking across systems in this way, challenging the exceptionalism of the individual human, builds on posthumanist and new materialist philosophies and Indigenous worldviews.[144]

In arguing that curatorship is enmeshed in ecological systems, I therefore hope to encourage curators to evaluate their own practice in a systematic and holistic way, and from there consider how they might embed sustainable modes of thinking and acting in their work and throughout their working environment. To consciously situate curatorship as ecological, I argue, is to embrace an altruistic paradigm that is inclusive of, responsive to, and caring for the human and nonhuman actors who comprise that system.[145] As museum scholar-practitioner Robert Janes argues in *Museums in a Troubled World*, recognising that museum practice emerges from an ecological network of interdependencies and interconnections is necessary to safeguard their future relevance to audiences; it is 'the bedrock of successful adaptation in a complex, and increasingly severe, world.'[146] Adopting an ecological mode of thinking and acting is an opportunity to enact ethics of collectivity and decentralisation over individualism and hierarchy. In the context of the changing planet and sustainable transitions, this is to invite a worldview that respects and nurtures the diverse relationships that underpin life on Earth.

So, inspired by Bronfenbrenner's structuring of the ecological systems that determine human development, I make sense of the interacting agencies that shape curatorial decision-making and practice by allocating them into spheres of influence around the curator: the

[143] See Nikolaos Voulvoulis et al., 'Systems Thinking as a Paradigm Shift for Sustainability Transition', *Global Environmental Change*, Vol.75, (2022), 1-7; Miles Weaver et al., 'Systems Thinking for Sustainability: Shifting to a Higher Level of Systems Consciousness', *Journal of the Operational Research Society*, (2025) [ahead of print], 1-14.
[144] See Olga Cielemecka and Christine Daigle, 'Posthuman Sustainability: An Ethos for Our Anthropocenic Future', *Theory, Culture & Society*, Vol.36(7-8), (2019), 67-87.
[145] See Yuha Jung and Ann Rowson Lowe, 'Systems Thinking and Museum Ecosystem', in Yuha Jung and Ann Rowson Lowe (eds.), *Systems Thinking in Museums: Theory and Practice* (Rowman & Littlefield, 2017), 7-9.
[146] Robert R. Janes, *Museums in a Troubled World: Renewal, Irrelevance or Collapse?* (Routledge, 2009), 25.

microsphere, mesosphere, exosphere, macrosphere and chronosphere. In Bronfenbrenner's figuration of these systems in child development, he defines them in the following ways:[147]

Microsystem: The person's immediate environment and the relationships within that environment. The home and family unit, for one, is a major aspect of an individual's microsystem, wherein their development is shaped by their interactions with parents, siblings and other individuals present in the home. The microsystem can also extend to settings and people outside the home, providing that the person has frequent and sustained contact with them, such as close friends and school. Given that they are also key factors shaping an individual's development and are likewise contained within their immediate 'environment', the microsystem encompasses the individual's personality, beliefs, mental abilities, behaviour, attitudes, emotions and ambitions.

Mesosystem: Bronfenbrenner defined the meso layer as a system of interacting microsystems, denoting the relationships and processes taking place between two or more of the individual's microsystems. It describes, for example, how a child's life at home impacts their performance at school, or how their relationships with friends and peers shapes their personality. Another example is that a child's school, its student body and the staff who oversee those students function as a mesosystem, given that they contain multiple, interacting microsystems for that child, such as their classroom and their friendship groups.

Exosystem: Like the mesosystem, the exosystem comprises of interacting microsystems. However, it differs from the mesosystem in that at least one of these contexts does not contain the person being studied at the centre of it. So, there is a degree of separation between the individual and their exosystem, containing aspects that are external to them and that they do not have direct involvement in. The exosystem therefore has a secondary, indirect impact on the child, such as their parents' working environments, or extended relatives who had a direct relationship with a parent but no relationship with the child. It also includes local politics and governance.

Macrosystem: The macrosystem signifies the overarching socio-politico-economic structures of power, societal norms and customs, laws, cultures, belief systems and

[147] Urie Bronfenbrenner, 'Ecological Models of Human Development', in Mary Gauvain and Michael Cole (eds.) *Readings on the Development of Children*. (Scientific American Books, 1993), 37-43; Richard M. Lerner, *Concepts and Theories of Human Development* (Lawrence Erlbaum Associates, 2002), 41; Marcus Crawford, 'Ecological Systems Theory: Exploring the Development of the Theoretical Framework as Conceived by Bronfenbrenner', *Journal of Public Health Issues and Practices*, Vol.4(2), no. 170, (2020), 1-6.

ideologies, lifestyles, bodies of knowledge, education systems, mass communication systems, natural resources and hazards, and so on, in which an individual is embedded. The macrosystem is important to shaping all interactions and experiences across microsystems, mesosystems and exosystems. These systems, in turn, work together in shaping the macrosystem.

Chronosystem: Lastly, the chronosystem is arguably the most abstract and intangible system that impacts an individual's development, added by Bronfenbrenner to the Ecological Systems model in his later work. This system relates to the individual's passage through time and perception of time, and the ways that they situate themselves in the present in relation to their past and future. Beyond the course of their own life, it can also include the historical past. Rather than just denoting a linear progression, the chronosystem identifies how the timing of an event, at a particular moment, can impact the future trajectory of the individual, instigating a process of change, adaptation and/or rupture. For example, the timing of a parent's death can be more impactful on a child's development at certain moments in their life compared to others.

In this model of interacting ecological systems, the individual is situated at the centre, and they are nested within concentric spheres that gradually become larger, more complex, more abstract and more distanced from their direct environment and experiences.

Of course, in this thesis, I am not concerned with child development. As such, I have adjusted Bronfenbrenner's framework to suit my own ends. Generally, rather than 'systems', I more often refer to curators' 'spheres of influence'. This is because I recognise the parameters of my research methods. If I were to speak to a curator's 'microsystem', that would imply that I have knowledge of *all* the components that comprise that system for the individual curator, which I do not. That being so, I isolate the components that I *can* discern and refer to them 'agencies' (or sometimes 'actors') that form part of the spheres, levels, environments or contexts that influence curators' practice. In the table below (Table 0.1), I overview some examples of agencies that I identify within the spheres of influence of curators.

In my application of Bronfenbrenner's Ecological Systems framework, I am not undertaking a psychological, sociological or anthropological study into the personal, social, intellectual and working lives of curators. I am instead using his ecological model as an adapted tool to aid my thinking and analysis of curating as it takes place in distinct contexts, making sense of, and compartmentalising, the webs of relationships and agencies that together shape the

practices and products of curatorship. And for ease of representation in this thesis, rather than encapsulate these relational networks in visual diagrams—given that concentric circles do not lend themselves to detailed description—I summarise and separate the ecological spheres into tables, each cell constituting a different agency. These tables summarise my findings on the diverse agencies shaping curatorial decisions and practices and differentiate them according to the spheres in which they are located.

I have not probed *deeply* into the personal experiences, backgrounds, thoughts and lives of individual curators. Therefore, in my tables summarising the ecologies of their practice, I have not done so from the basis of one individual curator at the centre. Rather, in the 'microsphere' columns, I have (generally) collated aspects relating to the microspheres of multiple curators. The microsphere, in this case, works from the basis that the 'curatorial team' or collaborating curators is a microsystem. I locate the individuals that curators work with who fall outside their curatorial microcosm in the mesosphere.

If a curator were to employ the Ecological Systems framework as a tool for their own reflective and reflexive practice, I would recommend that they situate themselves alone at the centre and focus on factors belonging to their personal microsphere of influence. Certainly, this can include how their thoughts and actions have been impacted and inspired by their close colleagues in the microcosm of their immediate working environment, such as the team that they may form part of. But after that, the agencies that influenced those colleagues, and the agencies that shaped those agencies, and so on, will become increasingly separated and abstract from the individual curator's microsphere. Rather than over-complicate this exercise into ecological thinking and praxis, it is best to extrapolate curatorial ecologies from a foundation of personal experience, outlook and reflection.

Table 0.1 Examples of Possible Agencies in Curators' Spheres of Influence: Factors and Actors that May Shape Their Thoughts, Decisions and Practices (Specifically if They Work in the Context of a Museum, Heritage or Arts Organisation)

Microsphere	Mesosphere	Exosphere	Macrosphere	Chronosphere
The curator's unique responsibilities and oversight that differentiates their work from their colleagues'.	Teams and individuals who work in the same organisation, but do not interact regularly with the curator.	Conceptualisations and intellectual frameworks of the disciplines/subjects that the organisation engages with.	Political discourse and policymaking in national and international governance.	Experiences of moving through time.
The immediate resources available to the curator to carry out their work.	The organisation's structuring of curatorial roles, remits and responsibilities.	Broader concepts, issues, debates and trends within the subject fields that the curator/organisation engages with.	Current affairs and public discourse in mass media and social media.	Collective and personal memories of past events.
The curator's colleagues that they collaborate with and interact with daily.	The organisation's executives and trustees who do not interact regularly with the curator.	The broad and abstract 'public' that the curator/organisation conceptualises as serving.	Social movements and prominent campaign groups.	Conceptualisations of legacy, heritage and historical significance on the present.
The curator's educational background and training.	The organisation's branding and market positioning.	Organisations that the curator's workplace forms partnerships with.	Cultural trends.	Perceptions of the 'contemporary' and the 'zeitgeist'.
The curator's occupational background and work experience.	The organisation's mission, vision, aims and strategic plans and priorities.	Policies and strategies of local councils, business networks, tourism boards and other external stakeholders.	The economic climate and functioning of the economy.	Speculations and anticipations about future worlds.
The curator's upbringing and childhood.	The organisation's framework for learning and engagement.	Local and national curriculums in schools.	Weather events and natural disasters.	

The curator's close family, friends and relationships.	The organisation's 'real' and 'target' audiences.	Donors of objects and resources to the organisation.	Endemic and pandemic diseases.	
Intellectual, creative and recreational pursuits that the curator is involved in outside of work.	Internal sources of funding and revenue for the organisation. E.g., ticket sales.	External sources of funding for the organisation. E.g., corporate, public and charity.		
Communities that the curator forms a part of outside of their work environment.	Opportunities for training, learning and development provided by the organisation.	Specific laws and policies pertaining to the organisation's sector. E.g., the National Heritage Act.		
The curator's personal beliefs, values, ethics and lifestyle choices.	The organisation's official workflows and frameworks for project management.	Inter-organisational collectives and networks that the organisation forms part of.		
The curator's hopes, desires and ambitions.	External parties who are invited into processes of collaborative curating.	External advisory boards and panels for the organisation.		
The curator's personal experiences, reflections and lessons learned from previous activities.	Practices and findings of evaluation and audience research carried out within the organisation.	External experts who curators consult in their research and content development.		
Aspects of the curator's identity that they consider important to their practice, such as gender, ethnicity, ability and religion.	The organisation's policies and strategies. E.g., for collecting, exhibitions and sustainability.	Providers of goods and services procured for the organisation. E.g., for design, construction, couriering and equipment.		
	Inter-organisational communities of practice that the curator takes part in.			

Methodology

My research paradigm for this study is qualitative, involving the interpretation and analysis of interviews and documentary evidence to discover meaningful patterns, draw out conclusions and generate hypotheses.[148] Qualitative data, moreover, is well suited to examining lived experiences, discerning the meanings that people place on events, processes and structures, and connecting these meanings to the environments in which they are embedded.[149] My research pivots around the outlooks, experiences, actions and decision-making practices of curators and how these relate to the multiple, interconnected contexts in which they live and work. This is *not* a study into audience engagement with climate change in museums, and as such, I do not apply methodologies of audience research.

Given that curators do not always comprehensively document their perspectives, reflections and step-by-step processes of their work, interviews—which function somewhat like oral histories—supply the rich, primary data that inform my analyses of case studies. These interviews allow me to assess curatorial practices from the curators' own frames of reference. When I conducted these interviews—at least at first, before I discerned any 'gaps' in the information that I had gathered—I approached them as descriptive, subjective, exploratory, discovery-oriented, process-oriented and expansionist exercises. From this groundwork, I applied inductive reasoning to draw out broader generalisations and discussions.[150] I identified the interview participants through organisations' websites, social media platforms, gatekeepers and personal contacts. Most of the participants are 'curators' in a formal, permanent role, but some work(ed) in different capacities.

To facilitate the exploratory, discovery-oriented nature of my data collection, while ensuring a concentration on relevant topics, I conducted semi-structured interviews. Structured interviews, based on a prepared, strict script of questions, would have been too rigid to permit interviewees to expand on their reflections and add an extra level of detail and insight. Unstructured interviews, on the other hand, would have been led entirely by the participant, which would have opened them to diverging significantly from the issue at hand. The semi-

[148] Carl F. Auerbach and Louise B. Silverstein, *Qualitative Data: An Introduction to Coding and Analysis* (New York University Press, 2003), 3-4.
[149] Matthew B. Miles, A. Michael Huberman and Johnny Saldaña, *Qualitative Data Analysis: A Methods Sourcebook* (SAGE Publications, 2014), 11.
[150] See Charles S. Reichardt and Thomas D. Cook, 'Beyond Qualitative *Versus* Quantitative Methods', in Thomas D. Cook and Charles S. Reichardt (eds.), *Qualitative and Quantitative Methods in Evaluation Research*. (SAGE Publications, 1979), 10.

structured interview therefore maintains a thematic focus while also making room for organic conversation, flexibility, elaboration and follow-up questioning.[151]

I sent key questions and discussion points to the participants in advance of the interviews in the hope that they would help them to understand my research aims, as well as give them more time to reflect on their thoughts and experiences and thus provide more detailed and considered responses. For example, one of the big, 'umbrella' questions that I addressed in the introductory section of the interviews concerned the ways in which participants conceptualised curatorship and the kinds of activities that fall under this practice. My purpose in asking this was manifold. One reason was that it addressed my research objectives that involve contextualising, comparing, relating and differentiating practices of curatorship. Another intention was to provide an opening into contemplating whether curators' conceptualisation of their practice and their responsibilities within those roles influenced—consciously or subconsciously—their frameworks and approaches to engaging with the changing planet. Lastly, I was interested to discern whether there were patterns between concepts and contexts of curatorship; whether curators in the same working environment shared similar understandings of what it is to be a curator.

From the outset, it has been central to my methodological and theoretical approaches that I analyse curatorial activities with a pragmatic mind to the contexts in which they live and work. I seek to avoid, as much as possible, critiquing curatorial practices from my own standpoint as an 'outsider', examining the processes and products of their work through a framework that is alien to their perspectives and lived experiences. Moreover, I hope to be empathetic and conscious of the unique challenges, constraints and pressures that curators are working under. This is why I value the interviews—the oral testimonies of curators—as so central to my project.

However, I understand the limitations of interviews as a primary source of evidence. First, I realise that there is a constructivist element to carrying out interviews, whereby I brought my own thoughts, opinions and experiences to the production of knowledge in 'conversational relation'.[152] In other words, I recognise my own positionality as the interviewer in shaping the responses and information that I gathered from interviewees. Second, in writing this thesis, I

[151] Simon Carter and Lesley Henderson, 'Approaches to Qualitative Data Collection in Social Science', in Ann Bowling and Shah Ebrahim (eds.), *Handbook of Health Research Methods: Investigation, Measurement and Analysis* (Open University Press, 2005), 217-220.
[152] Steinar Kvale and Svend Brinkmann, *InterViews: Learning the Craft of Qualitative Research Interviewing* (SAGE Publications, 2009), 17-18.

feel the effects of not being able to interview *everyone* who was involved in my case-study activities of collecting, interpreting and exhibiting the changing planet, curators or otherwise. On the one hand, I made active decisions to limit the number of interviewees to people who worked in explicitly curatorial capacities. There are exceptions to this, however, in my interviews with non-curatorial individuals whom curators suggested I had conversations with. On the other hand, there are individuals that I would have ideally interviewed, but circumstances complicated this. For example, if they had been made redundant from the case-study organisation, this would have created an ethical issue in my research. In other cases, individuals simply did not agree to take part in an interview.

To corroborate or challenge my interview findings, when it was available, I refer to documentary evidence. This includes sources pertaining to the operation of the organisation in/for which the curator is working. For example, organisational policies, such as collecting and exhibition policies; organisational guidelines for practice, particularly those that relate to the work of curators; organisations' statements of missions, aims, objectives and strategic priorities; and organisations' frameworks and strategies for learning and engagement. I also consult written sources of curatorial work and planning. These include curators' or curatorial teams' own guidelines and recommendations for practice; curators' 'formal' reflections on their practice, for example, in published works, blogs or symposium papers; project briefs; interpretation plans; and acquisition proposals. And lastly, specifically in the case of galleries and exhibitions, I look to visual and written records of these spaces. They include my own photographs of displays, objects, text panels and labels, but in the absence of this, other people's documentary evidence of exhibitions and galleries, such as that published online or in books and articles.

Introduction to Case Studies

Crucial to my qualitative research paradigm is that I collect rich, descriptive, subjective and contextual data. As such, I structure my project and findings around case studies. I deliberately selected a diverse range of institutions—from across the UK—to expand my perspectives on curatorial practice. I grant most of my attention to the Science Museum, which I designate as my *primary* case study. On a practical level, I admit that personnel, resources and data from the Science Museum were significantly more accessible to me, as one of its PhD students, than they were from the other case-study organisations. Unsurprisingly, this facilitated my strong and sustained focus on the institution. I therefore position the other case-study organisations as *secondary* and *tertiary*. This is not to

downgrade my interest in their activities, but rather, to reflect that the data I collected from them is conspicuously less substantial and varied compared to that which I collected from the Science Museum, due to my novel position there as both insider and outsider. In large part, this is because of the barriers and constraints around accessing curatorial and organisational working documents, but also due to the time pressures on curators which hindered their ability to track down and share primary material with me.

The secondary case-study organisations are Thinktank Birmingham Science Museum and Museums for Climate Action. I designate the latter as an 'organisation', but a proper term for it would be 'project team', existing for the purpose of collaboratively developing an exhibition, *Reimagining Museums for Climate Action* (which I often shorten to *Reimagining Museums*). Museums for Climate Action was a distributed group of individuals who were not tied to a particular space or employer.[153] Through interview data, I utilise these organisations to supply modes of curatorship for comparison with the Science Museum. In my analysis, I draw significant attention to the actors in these case studies. My tertiary case-study organisations are National Museums Scotland, Glasgow Science Centre and the Sainsbury Centre (Norwich). I designate them as tertiary because I explore these organisations in considerably less detail than the other case studies. Nevertheless, I find them compelling to bring into play in my analysis because they provide insight into different contexts, possessing unique conceptions and remits of curatorship.

As can be discerned below, there is an overlap in the individuals comprising Museums for Climate Action and Glasgow Science Centre. I treat these groups as separate case-study organisations because I grant more attention to the exhibition developed by the Museums for Climate Action team than I do to the spaces and activities of Glasgow Science Centre. Moreover, my intention is to make it clear that *Reimagining Museums* was *not* curated by Glasgow Science Centre, but that they hosted the exhibition. Nevertheless, I still consider it important to grant some attention to the operations and spaces of the Science Centre given that they were brought into proximal relation with the exhibition.

In the following sub-sections, I provide brief overviews for the case-study organisations—their histories, characteristics and modes of operating—along with introductions to the individuals that I interviewed. In introducing these individuals, where I can, I outline their job title(s) and remit(s) of responsibility, pointing out any changes in their position at the

[153] See Museums for Climate Action, 'Rethink | Why Rethink Museums? | Project Background'. Available at: https://www.museumsforclimateaction.org/rethink/background [accessed 17 September 2025].

organisation. I supply such information as context to examine their practices, outlooks, experiences and approaches to engaging with the changing planet.

Science Museum (Science Museum Group)

The history of the Science Museum is long, rich and well-documented. So much so that it has been the subject of many studies, including an entire edited volume dedicated to exploring diverse perspectives on the history of the institution.[154] As such, I only provide a summary of its origins and present situation and governance. The early beginnings of the Science Museum are rooted in the Great Exhibition of 1851 in Crystal Palace. The Exhibition had an enormous political, social and cultural impact, so much so that it is often characterised as an epoch-making event, particularly with regards to the history of museums.[155] In this space, exhibits of industrial machinery were perceived to engender civic pride in the triumphs of science and technology and embody Victorian ideals of 'progress'.[156] Nevertheless, to the organisers, the upshot of exhibiting the industrial and technological prowess of other nations was the realisation that Britain needed to play catch-up.[157]

The surplus funds generated by the Exhibition, therefore, provided the foundation for an institution in South Kensington, London (on a site that was later named Exhibition Road), whose mission was to help bridge this gap, '[serving] to increase the means of Industrial Education and extend the influence of Science and Art upon Productive Industry'.[158] The resulting South Kensington Museum was accordingly predicated on the ambition that exhibiting objects—across science, technology, art and culture—would first address a deficit in public knowledge of historical and contemporary innovations, and that this would then lead to innovative practice, thus boosting the nation's industrial output and subsequent economic reward.[159]

Precisely when the 'Science Museum' came into being as a separate endeavour can be disputed. In 1876, the exhibition of the Special Loan Collection of Scientific Apparatus set in

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[154] Peter J.T. Morris (ed.), *Science for the Nation: Perspectives on the History of the Science Museum* (Palgrave Macmillan, 2010).
[155] See Louise Purbrick (ed.), *The Great Exhibition of 1851: New Interdisciplinary Essays* (Manchester University Press, 2001).
[156] Stella Butler, *Science and Technology Museums*, 19.
[157] Alison Boyle, '"Not for Their Beauty": Instruments and Narratives at the Science Museum, London', in Silke Ackermann, Richard Kremer and Mara Miniati (eds.), *Scientific Instruments on Display* (Brill, 2014), 38.
[158] Cited in Stella Butler, *Science and Technology Museums*, 18.
[159] Thaddeus Parsons, *Science Collection, Exhibition and Display in Public Museums in Britain from World War Two Through to the 1960s* [Doctoral Thesis] (University of Oxford, 2009), 21.

course the first efforts to demarcate the science collections as worthy of an independent space from the art and design collections of the South Kensington Museum (which later formed the Victoria and Albert Museum). In 1883, the science collections of the South Kensington Museum received a significant boost by their being amalgamated with the Patent Office Museum. In 1885, the South Kensington Museum's Department of Science and Art first separated, nominally, the science collections and art collections into 'the Science Museum' and 'the Art Museum'. In 1893, the first Director of this newly conceived 'Science Museum' was appointed: Major-General Edward Festing. In 1909, an independent Science Museum officially came into being. And lastly in 1928, the building's construction was completed, and the Science Museum, in its entirety, opened to the public for the first time.[160]

Another landmark in the history of the institution was the *Report of the Departmental Committee on the Science Museum and the Geological Museum*, published in two parts in 1911 and 1912-1913. It is otherwise known as the 'Bell Report', being overseen by the steel magnate Hugh Bell. In its long-term development plan for the Museum, the Report recommended that it continued an educational role that had already been established in the South Kensington Museum: 'so far as is possible by means of exhibited scientific instruments and apparatus, machines and other objects, the Collections in the Science Museum ought to afford illustration and exposition of the various branches of Science within its field and of their applications in the Arts and Industries'. But simultaneously, it proposed that the Museum should fulfil a role to collect, house and preserve 'appliances which hold honoured place in the progress of Science or in the history of invention'.[161]

To the former Keeper of Science Collections at the Museum, Alison Boyle, the two-pronged focus on the 'history of science' and 'current practice' set out by the Bell Committee has been hugely influential on collecting practices, becoming the 'defining dichotomy of the Science Museum throughout its existence.'[162] To both Boyle and Tim Boon—the former Chief Curator, then Head of Research and Public History at the Science Museum—this 'dichotomy' within the structures and mission of the institution was further entrenched by Director Neil Cossons' restructuring across the 1980s and 1990s, creating a rupture between the Collections Management Division—overseeing the work of collections curators—and the

[160] Peter J.T. Morris, 'Introduction', 1.
[161] Cited in Alison Boyle, '"Not for Their Beauty"', 40.
[162] Ibid., 40.

Public Services Division—overseeing the work of interpretation, presentation and education.[163]

Spurring this transition was a growing strategic emphasis on the market positioning of the Science Museum as providing 'fun', 'entertaining' and 'accessible' learning experiences to its 'consumers'. This 'cultural revolution' was captured by Sharon Macdonald in her ethnographic study of the organisation, *Behind the Scenes at the Science Museum*: a study which has been particularly inspirational in my approaches to this thesis.[164] This 'revolution', in large part, stemmed from the fact that in 1984, following the neo-liberal agenda of Margaret Thatcher's government, the Museum was devolved from direct State control and passed into the management of a Board of Trustees, effectively becoming a quasi-independent organisation. In consequence, the Museum became increasingly aware of itself as situated in the 'market', vying with other organisations and businesses for the public's leisure time and disposable income.[165]

Shortly before that, in 1983, the Science Museum Group (SMG) had been established under the National Heritage Act of the same year. The Group acts as a non-departmental public body and an exempt charity that manages a collective of five national museums dedicated to science, technology, mathematics, industry, transport, media and medicine.[166] The other four museums working alongside the Science Museum are: the Science and Industry Museum (Manchester), the National Railway Museum (York), Locomotion (County Durham) and the Science and Media Museum (Bradford). These museums form part of a group of fourteen national museums in the UK that were established by Acts of Parliament and are overseen and provided funding by the Department for Digital, Culture, Media and Sport (DCMS).

'Science capital' currently provides the framework through which public-facing activities at the Science Museum are shaped and articulated, scaffolding its philosophy and approaches to learning and engagement.[167] A prior learning framework (from the 1990s) was the 'Public Understanding of Science' (PUS), which was managed by a designated PUS division in the

[163] Ibid., 54-55; Timothy Boon, 'Parallax Error? A Participant's Account of the Science Museum, c. 1980-2000', in Peter J.T. Morris (ed.), *Science for the Nation*, 111-135.
[164] Sharon Macdonald, *Behind the Scenes at the Science Museum* (Berg, 2002).
[165] Timothy Boon, 'Parallax Error?', 118.
[166] Science Museum Group, 'Statement of Public Task'. Available at: https://www.sciencemuseumgroup.org.uk/about-us/policies-and-reports/statement-of-public-task [accessed 17 September 2025].
[167] See Science Museum Group Learning Team, 'What is Science Capital?', *Science Museum Group Blog*, 1 June 2016. Available at: https://learning.sciencemuseumgroup.org.uk/blog/what-is-science-capital/ [accessed 17 September 2025].

Museum. PUS was premised on the idea that the majority of the public were 'largely ignorant' of contemporary ideas and practices in science. As such, it conceived its role as addressing this deficit, whereby *more knowledge* was deemed to foster a more scientifically literate society that was better 'equipped for life in an economy dependent upon science and technology.'[168]

Moving on from the PUS framework—which was criticised for its top-down methodologies that assumed a 'public deficiency' in scientific literacy and accordingly set out to fill this 'knowledge vacuum'—[169] the SMG's current framework of 'science capital' emphasises the social constructed-ness of scientific understanding and engagement. It recognises that science-related knowledge is entangled with people's interests, attitudes, social networks and resources to engage with science. With an overarching ambition to help fill a UK-wide gap in 'STEM skills', science capital seeks to dismantle preconceptions around what a scientist or engineer is and does, and subsequently inspire people to realise that a career in science and engineering is accessible and desirable to them.[170] The aim 'to grow science capital through all we do'—to 'actively promote greater equity, inclusion and diversity in science, in culture and in wider society'—forms the basis of the SMG's strategic priority for 'Equity'.[171]

Science capital, moreover, supplies the framework to the overarching mission of the SMG to engage in futures discourse and inspire people to think about their future.

> 'Our mission to inspire futures acts as our 'North Star' for the creative exploration of science, for building science literacy through a 'science capital' approach, and for inspiring the next generations of scientists, inventors and engineers.'[172]

The rationale that the SMG constructs for itself, therefore, situates practitioners of science—scientists, inventors and engineers—as crucial agents in world-building. The purpose of its

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[168] John R. Durant, Geoffrey A. Evans and Goeffrey P. Thomas, 'The Public Understanding of Science', *Nature*, Vol.340, 6 July 1989, 13.
[169] See Steve Miller, 'Public Understanding of Science at the Crossroads', *Public Understanding of Science*, Vol.10(1), (2001), 116.
[170] Louise Archer and Heather King, 'Session 1: Understanding Science Capital', in *Transforming Practice: Science Capital Seminar at the Science Museum*, 9 October 2015, 7-11. Available at: https://learning.sciencemuseumgroup.org.uk/wp-content/uploads/2020/04/transforming-practice-conference-report.pdf [accessed 17 September 2025]. Also see Louise Archer et al. '"Science Capital": A Conceptual, Methodological, and Empirical Argument for Extending Bourdieusian Notions of Capital Beyond the Arts', *Journal of Research in Science Teaching*, Vol.52(7), (2015), 922-948.
[171] Science Museum Group, 'Inspiring Futures: Strategic Priorities 2022-2030', 7.
[172] Ibid., 6.

institutions, in this reckoning, is to activate stories of scientific innovation, success and adaptation—emphasising their transformative impact on society and in constructing future worlds—towards encouraging audiences into STEM careers. Although the frameworks of articulating this goal have changed, this is not too dissimilar to the earliest ambition for the Science Museum, when it was the South Kensington Museum, to serve as an inspiration to the public to participate in and boost 'productive industry' and thereby contribute profitably to the national economy. Behind practices to promote STEM skills, there is often an underlying economic agenda, along with an ideology of economic growth equalling socio-cultural flourishing.[173]

Now that I have outlined some of the key facets of their institutional context—which are significant to the history and identity of the Science Museum—I now introduce the individuals that I interviewed from this organisation. Objects underpin the work of many curators at the Science Museum.[174] Sitting in the Collections Team, Collections Curators are responsible for the care, research and display of the numerous collections that fall under the broad subject categories of Science, Medicine, and Technologies and Engineering, which themselves are managed by a Keeper.

- **Dr Oliver Carpenter**, who is the Curator of Infrastructure and the Built Environment. Before overseeing this collection, he worked as an Associate Curator in the Technologies and Engineering team. In his current role, he is managed by the Keeper of Technologies and Engineering.
- **Dr Rupert Cole**, who is currently the Curator of Chemistry collections. Prior to this, he has worked in the Science Museum's curatorial team as an Associate Curator of Chemistry, a Curator of Contemporary Science and Curator of Scientific Instruments. In all of these roles, he has been managed by the Keeper of Science Collections.
- **Dr Roger Highfield**, who acts as the Science Director across the whole Science Museum Group. Before that, he was Director of External Affairs for the SMG—a position that he entered following a career in science journalism. As Science Director, he sits within the SMG Executive team, where he is responsible to Ian Blatchford, the Director and Chief Executive of SMG.
- **Dr Alexandra Rose**, who was the Curator of Climate and Earth Science collections (being employed in this role during the course of my research). Her former roles at the

[173] See Heidi Ashton, 'Cutting the STEM of Future Skills: Beyond the STEM vs Art Dichotomy in England', *Arts and Humanities in Higher Education*, Vol. 22(2), (2023), 148-149.
[174] The exception is the comparatively small team of Exhibitions Curators who focus on developing exhibition narratives and selecting objects for display.

Museum extended beyond the curatorial team and included Content Developer [*Atmosphere*], Exhibition Development Manager [*Unlocking Lovelock: Scientist, Inventor, Maverick*] and Associate Curator of Science. Her final curatorial remit was previously designated as the Earth Sciences and Astronomy collections. In her curatorial roles, she was managed by the Keeper of Science Collections. She is now Head Curator of the Royal Engineers Museum in Kent.

- **Anonymous participant**. For the purposes of their requested anonymity, I will not share any specific details about the role and position of this individual in the Science Museum.

Being my primary case study, I analyse curatorial activities of the Science Museum in all of the chapters of this thesis. Collecting practices in the Science Museum provide the principal focus of Chapter 1, and they are brought into brief comparison with acquisition in National Museums Scotland. In Chapter 2, I examine the Science Museum's permanent gallery, *Energy Revolution: The Adani Green Energy Gallery* (2024-) in comparison with a permanent gallery at Thinktank Birmingham Science Museum: *Our Changing Planet* (2021-). And in Chapter 3, I consider the Science Museum's temporary exhibition *Our Future Planet* (2021-2022) chiefly in relation to Museums for Climate Action's *Reimagining Museums for Climate Action* exhibition (Glasgow Science Centre, 2021), but also with a comparative lens on the Sainsbury Centre's *Sediment Spirit: The Activation of Art in the Anthropocene* (2023-2024).

Thinktank Birmingham Science Museum (Birmingham Museums Trust)

In contrast to London's Science Museum, Thinktank Birmingham Science Museum—which I hereafter refer to as Thinktank—is not a publicly-funded national museum. Instead, it forms part of the Birmingham Museums Trust (BMT), which operates on behalf of Birmingham City Council to care for the city's collection of over one million objects.[175] Answering to municipal government, and being part of a collective of nine interdisciplinary museums, Thinktank stands in contrast to the national government-funded Science Museum that forms part of a collective of museums that are united by science disciplines. Birmingham Museums was formed in 2012 as an independent charitable trust. It manages Thinktank alongside Birmingham Museum & Art Gallery (BMAG), the Museum of the Jewellery Quarter, the

[175] Birmingham Museums Trust, 'Resilient Heritage: Laying Foundations | Brief for Evaluation', 30 January 2024, 1. Available to download at: https://www.contractsfinder.service.gov.uk/Notice/7f166b04-f620-4fcd-8127-02d48ee22846 [accessed 17 September 2025].

Museum Collection Centre, Aston Hall, Blakesley Hall, Sarehole Mill, Soho House and Weoley Castle.

Before Thinktank, the city's collections of science, technology and industry were housed in Birmingham Museum of Science and Industry, which opened in 1951 on Newhall Street. And prior to that, some of these collections had been cared for by the Birmingham City Museum and Art Gallery. These collections had been supported by, and added to, by Birmingham-based industrialists since the late nineteenth century. Some of the notable, early industrial objects in the city collections include the Woolrich generator and William Murdoch's locomotive. Throughout the first few decades of the twentieth century, local educationalists and learned societies successfully advocated for the accession of natural history specimens into the City Museum and Art Gallery.[176] The collections of BMT, as such, have been historically rooted in interdisciplinarity since the first museum was established in Birmingham. After the closure of the Birmingham Museum of Science and Industry in 1997, Thinktank was opened in 2001, relocating the city's science collections to a site on the Millennium Point complex. The building housing Thinktank is leased by the Millennium Point Charitable Trust, which also provides pots of funding for the museum.

In 2020, Birmingham Museums came under the joint directorship of two CEOs: Zak Mensah and Sara Wajid. They initiated and continue to lead a multi-year transformation for the Trust towards 'a socially purposeful museum service rooted in the distinctive cultural heritage of this region.'[177] Reflecting this, the BMT's current 'purposeful vision' is to:

> 'harness all the people's collections, heritage and creativity to tell stories that make meaning. This embraces Birmingham's super-diversity, generating hope, building social trust and increasing belonging and solidarity. We will empower people and communities to imagine and shape an ambitious, vibrant, creative, multicultural city.'[178]

[176] Kylie Little, Felicity McWilliams and Ellie Swinbank, ''South Kensington is Practically as Far Away as Paris or Munich': The Making of Industrial Collections in Edinburgh, Newcastle and Birmingham', *Science Museum Group Journal*, Autumn 2022: Congruence Engine. Available at: https://journal.sciencemuseum.ac.uk/article/south-kensington-is-practically-as-far-away-as-paris-or-munich-the-making-of-industrial-collections-in-edinburgh-newcastle-and-birmingham/ [accessed 17 September 2025].
[177] Birmingham Museums. 'Annual Report and Consolidated Financial Statements for the Year Ended 31 March 2024', 9. Available to download at: https://www.birminghammuseums.org.uk/about/policies-plans-and-reports [accessed 17 September 2025].
[178] Ibid., 3.

Curators employed by BMT have oversight across all the sites owned by the Trust. Given the disciplinary focus of their collections' remits, the two curators that I interviewed were primarily based at Thinktank (along with the Museum Collection Centre). However, they also mentioned undertaking projects and activities at BMAG, especially in relation to its recent redevelopment.[179] I interviewed these curators to gather information and insight on their approaches to developing the *Our Changing Planet* gallery at Thinktank. Along with the Science Museum's *Energy Revolution*, *Our Changing Planet* supplies the focus of Chapter 2. I also interviewed a former Finds Liaison Officer who was employed by the British Museum's Portable Antiquities Scheme. Although he was not a curator for Birmingham Museums, he provided archaeological support for the organisation, especially when it lacked a dedicated Curator of Archaeology. I arranged a discussion with him on the recommendation of the two curators I interviewed, so that I could gather his perspectives and experiences of interpreting archaeology for a science museum gallery. What follows is a brief introduction to these interviewees.

- **Dr Lukas Large**, who is the Curator of Natural Sciences. Before Birmingham Museums, he had worked at Royal Botanic Gardens, Kew.
- **Dr Felicity McWilliams**, who was the Curator of Science and Industry (being in this role for the duration of my research). Prior to this curatorial position, she had been a Research Assistant for the Science and Industry collection. And before joining BMT, her first formal job in the museum sector was at the Museum of English Rural Life (Reading).
- **Peter Reavill**, who was a Finds Liaison Officer for the Portable Antiquities Scheme and operated from Birmingham Museums. Finds Liaison Officers are responsible for dealing with members of the public (often detectorists) who discover artefacts, treasures and hoards of archaeological significance. He is now a Historic Environment Records Officer with Herefordshire Council.

Museums for Climate Action

As I established above, Museums for Climate Action is not an organisation per se, but a temporary project team dedicated to developing the *Reimagining Museums for Climate Action* exhibition at Glasgow Science Centre in 2021. I treat this team as an 'organisation' that is separate to Glasgow Science Centre, however, to distinguish them as meso contexts

[179] See Rebecca Atkinson, 'Birmingham Museum & Art Gallery Reopens History Galleries', *Museums Journal*, 2 May 2025. Available at: https://www.museumsassociation.org/museums-journal/news/2025/05/birmingham-museum-art-gallery-reopens-history-galleries/ [accessed 17 September 2025].

for the individuals involved in the project team. The project was officially launched in May 2020 as an international design and ideas competition for exhibits that reimagined museums to meet the present and future needs of the changing planet. Assembling the 'concepts' together in an exhibition functioned as a contribution from the arts, heritage and museums sector to the Green Zone of COP26 (2021), which was hosted by the UK Government in Glasgow. The Museums for Climate Action project team included Rodney Harrison, Colin Sterling, Henry McGhie, Rowan Gard, Janna oud Ammerveld, Robin Hoyle, Jenny Templeman, Graham Rose and Emma Woodham. The individuals that I interviewed were:

- **Prof Rodney Harrison**, who is Professor of Heritage Studies at the UCL Institute of Archaeology. From 2015 to 2019, he was Principal Investigator of the Heritage Futures Research Programme, funded by the Arts and Humanities Research Council (AHRC). And in 2017 to 2021, he led the AHRC's Heritage Priority Area Leadership Fellowship project.
- **Dr Robin Hoyle**, who was Director of Science at Glasgow Science Centre (at the time of interview). Hoyle had worked at Glasgow Science Centre in various roles since its opening in 2001. In order, they were: Outreach Coordinator, Staff Scientist, Science Programme Manager, Head of Science Learning and finally Director of Science.
- **Graham Rose**, who is the Creative Director at Glasgow Science Centre. His background was in architecture.

National Museums Scotland

While I am fascinated by the work being carried out by curators at National Museums Scotland (NMS) to document and interpret the changing planet through their collections, I nevertheless grant much less attention to the organisation compared to others in this thesis. For that reason, I will not provide an extensive overview of its history and present modes of operating. Rather, I briefly introduce NMS as a Scottish Charity and non-departmental public body supported by the Scottish Government. As its name implies, it manages the national museums of Scotland. They are the National Museum of Scotland, the National Museum of Flight, the National Museum of Rural Life and the National War Museum.

The context in which I consider curatorial practice at NMS is Chapter 1, on activities of collecting around the changing planet. Science Museum acquisitions supply the overriding focal point of this chapter, but I bring some objects into comparative analysis with case-study objects from the NMS Technology collection, overseen by Ellie Swinbank. The purpose of

this brief comparison is to spotlight a mode of science curatorship in the context of an interdisciplinary national collection. I am interested to contemplate how a curator navigates collecting the changing planet under the overarching, meso-level mission to preserve and interpret 'the past and present of Scotland'.[180] As such, through the case-study objects, I draw attention to how they are harnessed to speak to national culture, history and heritage—to the identity of Scotland. I lend a relatively brief analysis to NMS collecting activities because they are better documented in published articles and online blogs than those at the Science Museum. That being so, I did not collect any interview data from the Curator of Technology, Ellie Swinbank. Instead, I refer to her practice through her published works, along with the published works of her colleagues and Sam Alberti, the Director of Collections.

Glasgow Science Centre

Glasgow Science Centre is a charitable organisation that seeks to engage visitors with science in playful and interactive ways. It opened in 2001 and is located in the Pacific Quay development alongside BBC Scotland and STV. This site was developed as part of a project to 'regenerate' the Clyde Waterfront following the decline of industry in the area.[181] In this context, the mission of Glasgow Science Centre is 'to inspire everyone to explore and understand the world around them and to discover and enjoy science.'[182]

In my analysis of the *Reimagining Museums* exhibition, I treat Glasgow Science Centre on separate terms to the Museums for Climate Action project team because I intend to foreground how the organisation's permanent displays and ways of working stand in contrast to the exhibition. The Science Centre provides a meso-level context for its employees—Robin Hoyle and Graham Rose—that is distinct from the meso-level context of the Museums for Climate Action project. In my case-study analysis of *Reimagining Museums* in Chapter 3, I explore how Hoyle and Rose negotiated these separate meso-level environments in developing the exhibition; how they liaised their practice between the priorities of the project

[180] National Museums Scotland, 'National Museums Scotland Strategic Plan 2022-27', 3. Available to download at: https://www.nms.ac.uk/about-us/strategy/strategic-plan [accessed 17 September 2025].
[181] Glasgow Science Centre, 'What Was Here Before the Science Centre?', 5 July 2022. Available at: https://www.glasgowsciencecentre.org/our-blog/what-was-here-before-the-science-centre [accessed 17 September 2025].
[182] Glasgow Science Centre, 'Vision, Mission & Values'. Available at: https://www.glasgowsciencecentre.org/about-glasgow-science-centre/vision-mission-values [accessed 17 September 2025].

team and the priorities of the Science Centre. As I already introduced Robin Hoyle and Graham Rose above, I will not do so again here.

Sainsbury Centre (University of East Anglia)

My final case study is the Sainsbury Centre in Norwich, which I bring into dialogue with the Science Museum and Museums for Climate Action/Glasgow Science Centre in Chapter 3, concerning temporary exhibitions. This art museum is located on the campus of the University of East Anglia (UEA). It is managed by the Sainsbury Centre Board, which is a sub-committee of the UEA's overall governing body. This case study, therefore, is unique as the only organisation that is structurally (and geographically) connected to a university. In 2023, under the Directorship of Jago Cooper, it became the first museum in the world to officially recognise art as 'alive'.[183]

I examine the Sainsbury Centre as a tertiary case study because, strictly speaking, it is not a space in which science curatorship is enacted. Nevertheless, what draws me to this organisation is that it conceived an unprecedented role for a Curator of Art and Climate Change in partnership with the UEA's Tyndall Centre for Climate Change Research. At its root, the curatorial position was intended as an art-science collaboration, aiming to cultivate interdisciplinary perspectives and initiate dialogue between the disciplines in the space of the art museum.[184] This role is held by John Kenneth Paranada, who joined the Sainsbury Centre in 2022.

- **John Kenneth (Ken) Paranada** is the Curator of Art and Climate Change. Prior to this, he has fulfilled many curatorial roles across the globe. He also has an extensive, interdisciplinary educational background that traverses the study of art, curatorship, museum studies and the philosophy of nature.

By carrying out an interview with Paranada in early 2024, I hoped to gain insight into how he was navigating the newly established role as well as his reflections on developing his first exhibition for the Sainsbury Centre, *Sediment Spirit: The Activation of Art in the Anthropocene*. Through an exploration of his work and the interdisciplinary ambitions that

[183] Sainsbury Centre, 'About Us'. Available at: https://sainsburycentre.ac.uk/about-us/ [accessed 17 September 2025].
[184] John Kenneth Paranada, 'A Path Forward: Curating Art & Climate Change at the Sainsbury Centre, University of East Anglia', *Museum International*, Special Issue: 'Museum Sustainabilities', Vol.75(1-4), (2023), 58.

underpin it, in the Conclusion, I deliberate how it functions as an expansive mode of science curatorship, and I speculate future directions for interdisciplinary practice.

1 | Collecting Objects and Stories of the Changing Planet

> '*[…] what survives in both documentary and material history starts to define that history. So, [collecting is] quite a big responsibility. […] It's like we're creating an archaeology for the future. I think that's one of the big challenges of being a curator, whether [the work] relates to climate change or not: trying to ensure that what you collect remains significant for generations to come*.'[185]

Overview

In this chapter, I examine how science curators have harnessed collecting practices to materially document and relay stories of the changing planet. Taking the Science Museum as my primary case study, and lending a brief comparison with National Museums Scotland, I analyse curators' motivations and decision-making in collecting around climate change. In doing so, I assess what meanings, significances and resonances they draw from these objects. Addressing my research objective to contextualise curatorial practice, I delve into the diverse agencies that shape curators' collecting activities and anatomise them according to different spheres of influence: their microsphere, mesosphere, exosphere, macrosphere and chronosphere. Using case-study acquisitions, I propose new taxonomies for science collections in their documentation and categorisation of objects that speak to the changing planet: the 'Changing Earth', 'Energy Transition', 'Restoring Environmental Balance' and 'Environmental Activism and Justice'.

I discern that through their practice of acquiring objects to function as material records of the changing planet, curators are activating anticipatory modes of thinking. They are anticipating future histories on the changing planet, predicting and preparing the stories and material culture that future audiences will find meaningful. I argue that practices of collecting and categorising 'science' will have significant ramifications on shaping current and future conceptions of science, in particular, its roles and agencies in mitigating climate change, sustaining life on Earth and nurturing equitable societies. In this way, I argue that curators play a unique and important role in future-making on a changing planet.

[185] Interview with Rupert Cole (Science Museum). 7 December 2022.

Introduction to Collecting

Collecting, in a museum context, is a formal arrangement to obtain and safeguard an object or a group of objects.[186] Museums acquire objects to perform and enact particular roles and values in the 'spaces' of the museum, both physical and intellectual, public and private. Objects constitute and represent 'fragments of the world', providing opportunities for research; promoting learning and engagement; constructing history, memory and identity; inspiring creativity; creating enjoyable experiences that generate income; and aligning with people's values and worldviews.[187]

Fundamental to the rationale of museums is that they *preserve*: they acquire objects on the assumption that they will remain in their possession 'in perpetuity' and will be protected (as far as possible) from decay and obscurity. One way of designating the metamorphic process that objects undergo on entering a museum is *museumisation,* or *musealisation*. This describes how, to prevent natural processes of deterioration, objects must transcend their functional reality—the role that they fulfilled prior to the museum. In their new, preserved state they serve as a *representation* of the original context(s) in which they were created and used.[188]

Collecting, therefore, is a process of *conceptual* transformation as much as *physical* translation of objects. It 'not only produces knowledge about objects but also configures particular ways of knowing and perceiving'.[189] Knowledge, meanings and significances are conferred upon objects in the process of collecting. These are not only imparted explicitly in the official rationale for collecting (in the Science Museum, this is known as the 'acquisition proposal'), but also implicitly in the designation of an object to a particular collection, thus establishing disciplinary parameters around that object. At the Science Museum, curators are advised to contemplate 'how a contemporary object might speak to our historic collections.'[190] The collected object is not situated on its own terms, in a vacuum, but is brought into a disciplinary context wherein it is situated in relation to other objects of that intellectual remit. Both in terms of the macro disciplinary remit—in the Science Museum's case, science and technology—and micro disciplinary remits—the sub-disciplines that define

[186] Rhiannon Mason, Alistair Robinson and Emma Coffield, *Museum and Gallery Studies: The Basics*, 71.
[187] Suzanne Keene, *Fragments of the World: Uses of Museum Collections* (Elsevier Butterworth-Heinemann, 2005).
[188] See Lynn Maranda, *Museology: Back to the Basics: Musealisation*. *ICOFOM Study Series*, No.38, (2009), 251-258.
[189] Sharon Macdonald, 'Collecting Practices', in Sharon Macdonald (ed.), *Companion to Museum Studies* (Blackwell Publishing, 2006), 94-95.
[190] Science Museum Group, 'Intranet Resources: Contemporary Collecting FAQs' [unpublished], 2.

the Museum's individual collections. Working in these disciplinary frameworks means that many curators justify collecting on the grounds of filling 'gaps' in their collection.

> '[…] that's my job—to make sure the collections that *I care for* are updated. And tell the stories that we wanted to tell with objects that we otherwise couldn't tell because they weren't in our collections.'[191]

The 'gaps' in collections can be conceptualised in a number of ways. As the Science Museum curator, Oliver Carpenter, demonstrates in the above quote, he rationalises 'updating' the collections as inserting new objects that tell new 'stories' and offer new perspectives. In recent years, there has been a growing social-responsibility-oriented priority within the Science Museum's collecting activities to highlight 'diverse voices' that are not yet represented in the collections, [192] and to diversify perspectives of science and technology: 'capturing people's different experiences of gender, disability, sexuality and representing diverse social, economic and ethnic backgrounds'.[193]

The conceptual processes that take place in acquisition, however, are embedded in the practicalities of collecting and the legal transferral of ownership and management. Acquiring objects for a museum collection involves much more than just receiving or purchasing those objects. The SMG's collecting activities—much like those of other museums—must conform to the principles, standards and legal requirements of the National Heritage Act 1983.[194] One such requirement is that objects are stored appropriately to prevent deterioration and protected against external risks. Appropriately caring for and preserving objects also means that they must be recorded to a high standard so that the museum is able to account, locate and provide information about them. Lastly, objects must be made 'accessible' to audiences—for example, through public display, information services and loans—as well as made available to researchers who seek to study them.

As I repeatedly found in my interviews, curators value objects as powerful vehicles for storytelling. Objects are stories in tangible form, and curators fundamentally situate themselves as responsible for identifying, critiquing and conveying those stories to 'audiences': present and future, real and abstract. Collecting museum objects is not only

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[191] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[192] Science Museum Group, 'Contemporary Collecting FAQs', 2.
[193] Science Museum Group, 'Science Museum Group Collection Development Policy 2021', 7. Available to download at: https://www.sciencemuseumgroup.org.uk/about-us/policies-and-reports.
[194] Ibid., 5.

about constructing stories of transformation from the *past* to the *present*, but it is about assessing and pre-empting future conceptions of 'significance'. It is about anticipating the ways that future audiences will connect the objects of our present to their narratives of history. In a time of climatic and ecological upheaval—and under a looming prospect of environmental and social collapse—anticipating and constructing positive 'future histories' is a powerful form of action to which museum curators make a unique contribution. Constructing a material record of *historic change*—assembling stories of transformation, and of finding and implementing solutions to the changing planet[195]—is a compelling way to inspire hopeful futures thinking in audiences, present and future.

This is important to practices of collecting because it helps to justify *why* the institution dedicates time, labour, energy, finances and resources to acquire objects and preserve them 'in perpetuity'. Objects hold stories—current and potential—that pertain to broader narratives of historical change and social belonging. Acquisition, in this way, lends itself to the overarching rationale of the Science Museum. Sustaining and supplementing its 'preeminent' collections is a crucial mechanism through which it understands, constructs and conveys to audiences 'the value of science, technology, engineering, transport, medicine and media in the past, present and future.'[196] Collecting in this context, curators are assembling future histories wherein science and technology have effected positive, meaningful change to address the existential challenges being posed by the changing planet.

In a time of immense transformation and disruption, museum objects represent a sense of permanence. The preservation of objects 'deliberately interrupts time's natural order' and 'natural decay'.[197] They provide material remnants that defy the processes of destruction and degradation that many people are experiencing, or are in fear of experiencing, in the climate-changing world. Following Newell, Robin and Wehner's conception of museums as 'slow media',[198] collecting objects—being an activity that requires considerable time, thought and effort—allows for slower and more thoughtful reflection on climate change than 'fast media'. I thus consider the practice an antidote to consumerism and throwaway culture.[199] It is a way of looking at objects that is mindful of their longevity, as well as critical of their 'value' and 'significance' to be preserved into the future—not just satisfying present desires. Compared

[195] See Science Museum Group, 'Collection Development Policy 2021', 10-11.
[196] Ibid., 2.
[197] Susan A. Crane, 'The Conundrum of Time and Ephemerality: Time, Memory and Museums', in Sharon Macdonald, *Companion to Museum Studies*, 99-100.
[198] Jennifer Newell, Libby Robin and Kirsten Wehner, 'Introduction: Curating Connections in a Climate-Changed World', 5.
[199] See Russell Belk, 'Collectors and Collecting', in Christopher Tilley et al. (eds.), *Handbook of Material Culture* (SAGE Publications, 2006), 534.

to exhibitions and galleries, collecting is the most *long-term* and *permanent* museum activity in terms of focus, aims, rationale and products.[200] Through collecting, museums are selecting and preserving a material record—a memory—of a point in time: 'the very act of collecting, of preserving objects and stories from a moment, shapes and indeed creates public memory.'[201]

However, a challenge is that collecting poses major issues of sustainability. Museums have finite space for collections and finite resources for collections management. At what point does collecting the changing planet and sustainable transitions actually become counter-intuitive and unsustainable? The Curator of Chemistry, Rupert Cole, reflected on this issue.

> '[…] where will the Science Museum be in terms of collections storage in a hundred or two hundred years? It's a difficult question to grapple with, particularly as we're running out of space now. […] storing objects has a carbon cost associated with it. It's quite a big decision: to decide that we're going to preserve this for posterity's sake.'[202]

Museum theorists and practitioners have also pointed to the unsustainable aspects of collecting. Nick Merriman, who at that time was the Director of Manchester Museum, denounced the museum sector as 'continuing to collect far more material than they dispose of, which means that their collections continue to grow inexorably.'[203] Engaging in processes of disposal and deaccessioning—and engaging with academic discourse on 'forgetting'—could bestow one pathway to sustainability, foregrounding the role of curators within the 'active stewardship' of history and heritage.[204] Perceptions of the past and its role in shaping the present, he and many academics contend, are predicated on socio-cultural processes of active 'remembering': processes which necessarily require active 'forgetting'. As history-making institutions, therefore, is it the responsibility of museums to remove some objects from their care, or at least slow down processes of collecting, to fully embrace their function as stewards of memory?

This is an important line of debate in museological practice and scholarship, but not one which I delve into in this chapter. Instead, I recognise that the unsustainable aspects and

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[200] Interview with Rupert Cole (Science Museum). 7 December 2022.
[201] James B. Gardner, 'Preserving/Shaping/Creating: Museums and Public Memory in a Time of Loss', in Andrea Witcomb and Kylie Message (eds.), *Museum Theory*, 516.
[202] Interview with Rupert Cole (Science Museum). 7 December 2022.
[203] Nick Merriman, 'Museum Collections and Sustainability', *Cultural Trends*, Vol.17(1), (2008), 17.
[204] Ibid., 17.

carbon costs of collecting for posterity is one of the many challenges that curators must navigate in acquisition activities. As Rupert Cole intimated above, this challenge is one of the reasons why curators exert so much care and thought to their acquisition proposals. To justify preserving an object into the future, they must have grounds to anticipate that the object will remain significant, meaningful, compelling and relatable to future audiences and future histories.

By highlighting practices of collecting—as opposed to denouncing them as fundamentally unsustainable—I am addressing a gap in the literature around curatorial engagements with climate change. This literature is much more skewed towards displays and exhibitions than it is towards acquisition. For example, there are no contributions in the major volumes edited by Cameron and Neilson (2015); Newell, Robin and Wehner (2017); and Merriman (2024) that thoroughly investigate museum collecting as a mode of critically engaging with the changing planet. This is surprising, not only given that acquiring and preserving objects constitutes a defining aspect of museological and curatorial practice—underpinning what museums and curators do[205]—but also because collecting has an enduring effect on the museum.

This is not to overlook the work which does explore how the changing planet has impacted collecting practices. In particular, these works have taken shape as practical reflections and recommendations.[206] Curators from National Museums Scotland have been particularly active in reflecting on acquisitions that speak to climate and environmental change and people's responses to these changes.[207] These studies demonstrate how curators across a range of disciplines have been acquiring objects that tell different stories, and provide different perspectives, on the changing planet. From artworks created by Oceanic artists using repurposed plastic;[208] to a portable, flat-pack solar energy collector developed by an

[205] Sharon Macdonald, 'Collecting Practices', 81; Rhiannon Mason, Alistair Robinson and Emma Coffield, *Museum and Gallery Studies: The Basics*, 54.
[206] For example, see Guy Atkins, Georgina Young and Mark Teh, 'Save Our Placards!', in Owain Rhys and Zelda Baveystock (eds.), *Collecting the Contemporary: A Handbook for Social History Museums* (MuseumsEtc,, 2014), 556-587; Ellie Miles and Laura Boon, 'Theme 3: Climate Emergency', in Ellie Miles, Susanna Cordner and Jen Kavanagh (eds.), *Contemporary Collecting: An Ethical Toolkit for Museum Practitioners* (London Transport Museum, 2020), 16-21.
[207] See National Museums Scotland, 'Contemporary Collecting'. Available at: https://www.nms.ac.uk/collections/contemporary-collecting [accessed 17 September 2025].
[208] Ali Clark, 'Reduce, Reuse, Recycle: Repurposing Plastic Waste', National Museums Scotland, 10 November 2021. Available at: https://www.nms.ac.uk/discover-catalogue/reduce-reuse-recycle [accessed 17 September 2025].

engineer at Edinburgh's Heriot-Watt University;[209] to a laser distance finder that was used to measure snow patches on Scottish mountains, recording the size and rate of melt as the climate changes;[210] to posters and branded clothing that were created to promote Edinburgh's Cargo Bike Movement—a charity seeking to decarbonise the city's delivery services.[211]

Bringing together a variety of museum and curatorial staff to share insight into collecting the changing planet, the National Museum of Scotland has so far hosted three symposiums: two on the subject of 'Collecting Sustainable Technologies', convened in December 2023 and November 2024 by Ellie Swinbank (Senior Curator of Technology), and one on 'Collecting Environmental Change', convened in March 2025. These symposiums spoke to the huge variety of objects that have been collected—by various institutions—to document the changing planet in their own unique ways. Moreover, the discussions drew attention to the working realities of curators engaged in collecting, balancing the intellectual discussion with consideration for the pragmatic and tangential aspects of the activity.

I have selected the Science Museum as the focus of this chapter as, in recent years, the changing planet has constituted a substantial focus—and backdrop—for the collecting practices of its curators. This has given rise to a vast number of objects being acquired that convey different issues, understandings, framings and stories of climate change in different ways. Climate change has been firmly integrated by curators into the Museum's existing paradigms, remits and taxonomies for collecting. A large portion of the objects that speak to the changing planet have been assumed into Environmental Science and Technology, which was one of the collections that fell under Alexandra Rose's scope as Curator of Climate and Earth Sciences (previously called Earth Sciences and Astronomy). But others have entered collections within Oliver Carpenter's remit of Infrastructure and the Built Environment, such as Electricity Supply and Heating, Cooling and Ventilation.

[209] Ellie Swinbank, 'An Elegantly Simple Solar Energy Solution', National Museums Scotland, 25 February 2020. Available at: https://www.nms.ac.uk/discover-catalogue/an-elegantly-simple-solar-solution [accessed 17 September 2025].
[210] Sarah Laurenson and Iain Cameron, 'Snow Hunter: Collecting Scotland's Vanishing Ice', National Museums Scotland, 2 February 2022. Available at: https://www.nms.ac.uk/discover-catalogue/snow-hunter-collecting-scotlands-vanishing-ice [accessed 17 September 2025].
[211] Meredith Greiling, 'Smart and Sustainable: Collecting Urban Transport and Mobility Innovation in the 2020s', *Science Museum Group Journal*, Spring 2022, Issue 17. Available at: https://journal.sciencemuseum.ac.uk/article/smart-and-sustainable-collecting-urban-transport-and-mobility-innovation-in-the-2020s/ [accessed 17 September 2025].

There is also a focus on environmental subjects in the Art collection overseen by Anna Ferrari, the Science Museum's Curator of Art and Visual Culture. However, given my focus on science curatorship—and the ways that curators engage with histories and concepts of science—I do not draw attention to the work of the Art Curator. Instead, I examine how *visual culture* has been assimilated into a *science* collection—specifically, the Environmental Science and Technology collection—and explore the connotations of this on constructions of agency in and over science. Going beyond these 'traditional' taxonomies and addressing my research objective to speculate future directions in science curatorship, I organise the sections of this chapter according to my own proposals for taxonomising objects that relate to the changing planet.

While I am sympathetic to Indigenous, new materialist and posthumanist conceptions of objects as possessing 'energy', 'agency' and 'liveliness',[212] I centre the human agents—the curators—in practices of collecting. I do not attempt to construct 'biographies' of objects. '[To] attribute too much power to the things themselves […] would be to diminish the agency of humans in the story'.[213] Focusing purely on the objects themselves—the *products* of collecting—would obscure the fact that collecting is a *process*. It would overlook the labour of the curator in their acts of learning, interpreting, liaising and exchanging. Therefore, I consider how collecting is a mode of expression for the individual collector; an outlet of the curator's thoughts, perspectives, critiques, hopes and experiences. Oliver Carpenter stressed how collections provide a window onto the microcosm of the individual curator, reflecting their interests, worldviews and individual conceptualisations of 'historical significance'.

> 'We have been collecting since 1857, and, sometimes, you can really get to know the people who are collecting—the curators of the past. You can see their personalities and their motivations by what is in the collection. You understand that it is not objective. That it's entirely subjective.[214]

Nevertheless, when there is evidence to do so, I draw attention to the influence of curators' material encounters with objects over their decision-making. I also examine nonhuman agencies in the form of the nonhuman components that comprise the curators' 'environment'. These include the intellectual, disciplinary and subject frameworks within

[212] For example, see Vine Deloria, *The Metaphysics of Modern Existence* (Harper and Row, 1979); Jane Bennett, *Vibrant Matter: A Political Ecology of Things*.
[213] Samuel J.M.M. Alberti, 'Objects and the Museum', *Isis*, Vol.96(4), (2005), 561.
[214] Interview with Oliver Carpenter (Science Museum). 9 January 2025.

which the curator and their organisation operate (which fall within the curator's mesosphere and exosphere), as well as the events and phenomena that shape their conception of their 'present' moment in time (which fall across the curator's macrosphere and chronosphere).

I analyse the thoughts, decisions, actions and agencies of curators in collecting practices as relational, situated in ecologies of interacting forces and influences. I locate and differentiate the agencies that impact their thoughts and actions as emerging from their microsphere, mesosphere, exosphere, macrosphere and chronosphere. In doing so, I demonstrate how Science Museum curators do not work in a vacuum, nor are they given free rein in their collecting activities. Rather, acquisition is shaped by a vast array of agents spread across multiple layers of agency.

A crucial influence in curators' collecting practices is the institution in which they work, comprising their mesosphere. The thoughts and actions of Science Museum curators are highly embedded in their institution's aims and capacities. This corroborates with literature that explores the entangled relationship between collecting and the museum *in* and *for* which it takes place. Such literature analyses collecting as inherently intertwined with the idea and rationale of the museum. In many cases, the history of museums is charted in symbiosis with the history of collecting.[215] Regarding the Science Museum, the Emiritus Keeper, Robert Bud, draws attention to this symbiotic relationship between collecting and the institution:

> 'The collections expose not just the presuppositions of the Science Museum as an institution but also those of the cultures which sustained the Museum, and express the values and aspirations of the funders, audiences and staff within the institution who were recreating it on the ground. […] Above all, we can tell how the collections reflect layer upon layer of discourse on modern times.'[216]

Just as Bud discerned, I find that collecting activities speak to the wider environments in which they take place.[217] In my interviews, I found significant evidence of curators' decisions

[215] For example, see Susan M. Pearce, *Museums, Objects, and Collections: A Cultural Study*. (Leicester University Press, 1992), 89-117; John E. Simmons, *Museums: A History* (Rowman & Littlefield, 2016); Andrea M. Gáldy and Florian Dobmeier (eds.), *Collecting and Museology* (Cambridge Scholars Publishing, 2020); Owen Hopkins, *The Museum: From its Origins to the 21st Century* (Frances Lincoln, 2021).
[216] Robert Bud, 'Collecting for the Science Museum: Constructing the Collections, the Culture and the Institution', in Peter J.T. Morris (ed.), *Science for the Nation: Perspectives on the History of the Science Museum*, 251.
[217] For studies that examine collecting practices as a lens onto macro histories, such as histories of gender and imperialism, see, for example, Dianne Sachko Macleod, *Enchanted lives, Enchanted Objects: American Women Collectors and the Making of Culture, 1800-1940* (University of California Press, 2008); Maia Wellington Gahtan and Eva-Maria Troelenberg (eds.), *Collecting and Empires: An Historical and Global Perspective* (Harvey Miller Publishers, 2019).

around acquisition being impacted by factors beyond their individual (micro-level) and institutional (meso-level) contexts. I designate these factors as exo-, macro- and chrono-level agencies. The objects being acquired are entangled in the intellectual, social, cultural, economic and political environments of a moment in time. I argue that contextualising Science Museum curatorship within the ecological systems through which it takes place both helps to make sense of collecting activities but also lays the groundwork for speculating future directions for acquisition in the institution.

I realise that curators, such as those at the Science Museum, work in highly specific and highly localised contexts relating to their workplace, their wider society and their lived experience of historical change. Recognising that collecting takes place through interacting, ecological agencies, I argue, is crucial to conceptualising future directions and effecting change in the practice. Within this chapter, the main way that I speculate future acquisition in the Science Museum is through my proposals for new collection taxonomies that speak to different issues of the changing planet.

Collecting Practices at the Science Museum

The Science Museum takes great pride in its objects, forming one of the world's most significant collections of science.[218] They lie at the core of the institution's identity, providing the basis for its branding itself 'the home of human ingenuity'.[219] Throughout its history, collecting activities have taken a variety of different forms and have been guided by a variety of priorities and circumstances. Following the inception of the Museum in 1909, the role of collections was set forth by the Bell Report: 'so far as is possible by means of exhibited scientific instruments and apparatus, machines and other objects, the Collections in the Science Museum ought to afford illustration and exposition of the various branches of Science within its field and of their applications in the Arts and Industries.' On the other hand, the Report proposed that the Museum should fulfil a second role: to collect, house and preserve 'appliances which hold honoured place in the progress of Science or in the history of invention'.[220]

To the former Keeper of Science Collections, Alison Boyle, the two-pronged focus on the *history* of science and *current practice* in science set out by the Bell Committee has been

[218] Science Museum, 'Collections Team Handbook' [unpublished], 6.
[219] Science Museum, 'Visit the Home of Human Ingenuity'. Available at: https://www.sciencemuseum.org.uk/see-and-do/visit-home-human-ingenuity [accessed 17 September 2025].
[220] Quoted in Alison Boyle, '"Not for Their Beauty"', 40.

hugely influential on collecting practices, becoming the 'defining dichotomy of the Science Museum throughout its existence.'[221] However, rather than a dichotomy as such, I argue that collecting for *historical significance* and collecting to demonstrate *contemporary practice* as two sides of the same coin. The historical significance of an object cannot be judged without examining its influence on the contemporary; and the contemporary significance of an object cannot be discerned without relating it to the historical or anticipating its future significance as historical artefact.

Contemporary collecting is a unique and important role that collections curators perform at the Science Museum,[222] contributing to the SMG's broader strategic priority to 'sustain our collection' so that it will be 'the best in the world for our fields.'[223] Providing a key framework within which collecting takes place, and a crucial reference point for acquisitions, is the Science Museum Group's Collections Development Policy, the most recent of which has been in place since 2021. It is a document that curators refer to when making the case for acquisitions. So much so, the exercise is 'a little bit tick-box-y': if curators can reference the stipulations of the collecting policy, they will do so to strengthen their practical and intellectual justification for an object.[224]

One of the fundamental aims of acquisition is to 'reflect significant changes in the advancement of knowledge, the development of processes, and innovation in products, services and experiences.'[225] Collecting within such a framework—wherein objects are situated in an overarching narrative of development through time—harks back to the origins of the institution: to the Bell Report's stipulation that the Science Museum should acquire and care for objects that speak to the *progress* of science or the *history* of invention. Its curators continue to approach collecting within an overarching framework that constructs narratives of transformation, linking the past, present and future.

While the Science Museum centres around issues and stories of *science*, it is through the lens of the *historian* that curators are collecting. Curators select objects by ascribing historical value onto them, anticipating their significance to future conceptions of history, heritage and identity: 'what survives in both documentary and material history starts to define that history. […] It's like we're creating an archaeology for the future.'[226] Oliver Carpenter

[221] Alison Boyle, '"Not for Their Beauty"', 40.
[222] Science Museum, 'Collections Team Handbook', 7.
[223] Science Museum Group, 'Inspiring Futures: Strategic Priorities 2022-2030', 30-35.
[224] Interview with Rupert Cole (Science Museum). 7 December 2022.
[225] Science Museum Group, 'Collection Development Policy 2021', 2.
[226] Interview with Rupert Cole (Science Museum). 7 December 2022.

spoke passionately on this feeling that, as a Science Museum curator, he has an enormous responsibility to serve future audiences and future histories through his work in collecting. He recognises the huge implications in acquiring an object to remain in the collections 'in perpetuity'.

> 'I think about that almost daily—that responsibility [to anticipate future histories]. I'm here as a curator for a very short amount of time in the context of the collection. […]
>
> 'Wow, that's really powerful—to have that potential to impact future historical analysis and understanding of the past by what you choose or do not choose, or what you are able or are unable to acquire for the collection today. […]
>
> 'This is your watch, Oliver. What you choose, or do not choose, to acquire today—people in the future will look back on you and say, 'I'm so glad that Oliver managed to do this!' Or, 'this happened on Oliver's watch, and he did *nothing*? What the hell!' So, I'm feeling that weight from people that might not even be born yet.'[227]

One of the difficulties, however, in collecting the history of science is the occasional inscrutability of science objects. This challenge is well known to curators of science across the museum field. It is the challenge of the 'black box'—objects that, while important to the practice of contemporary science, may be visually 'uninteresting', 'incomprehensible' and 'featureless' in display contexts, lacking in 'presence' and 'material charisma'.[228] One curator stressed that contemporary objects are 'often not very exciting to look at' compared to historical objects. A lack of aesthetic appeal poses difficulties to the curator in their acquisition case, since they anticipate that 'it might not be engaging for audiences.'[229]

So, for Science Museum curators, the practice of selecting objects relies on a mix of head, heart and gut reactions to objects; on being able to anticipate how *intellectually*, *affectively* and *visually* stimulating they are to audiences.

[227] Interview with Oliver Carpenter. 9 January 2025.
[228] Alan Morton, 'Curatorial Challenges: Contexts, Controversies and Things', in Graham Farmelo and Janet Carding (eds.), *Here and Now: Contemporary Science and Technology in Museums and Science Centres* (Science Museum, 1997), 149; Samuel J.M.M. Alberti et al., 'Collecting Contemporary Science, Technology and Medicine', *Museum Management and Curatorship*, Vol.33(5), (2018), 406; Samuel J.M.M. Alberti, *Curious Devices and Mighty Machines*, 86.
[229] Interview with anonymous participant (Science Museum). 31 January 2023.

> ‘[As a curator,] you have this often instant and just completely visceral reaction as to whether something is going to make a good display object or not.’[230]

> ‘I think we’re at a point where the curatorial team are quite trusted in their judgement in their own areas. […] I guess it’s just an instinct you develop for what’s interesting.’[231]

It is one thing that an object has ‘historical value’: being judged by the curator as significant in narratives of change and worthy of preserving as a record of a moment in time. But it is another that the object possesses the material and visual qualities to render it ‘appealing’ and ‘engaging’ to the public on a sensorial level. Many of the collecting activities that I explore below were display-driven. These objects were acquired in and for a context of display in the *Our Future Planet* exhibition (2021-2022), which showcased technologies and practices in carbon removal and storage; and the *Energy Revolution* gallery (2024-), which explores the role of low-carbon technologies and energy transitions to avoid the worst impacts of climate change. While in the long term, the collected objects are fulfilling a purpose within historical frameworks, it is important to recognise that they have fulfilled, and currently fulfil, specific display functions in the immediate term.

On a final note, beyond the work of curators in selecting and advocating for object acquisitions, the formal accession of objects into the Science Museum involves numerous steps and multiple members of staff. While collecting is ‘couched in the intellectual arguments’—something that is highly important to curatorial work in general—it would be short-sighted to overlook the fact that it is enabled and influenced by non-curatorial colleagues and ‘a load of pragmatic stuff that’s happening alongside’ the work of the curator.[232] Curators’ decisions on what to acquire are dependent on how feasible those acquisitions are judged to be by personnel in other departments, such as Conservation and Registration.

Collecting the Changing Planet at the Science Museum

A thematic focus on climatic and environmental change—and responses to these changes—are now embedded in the priorities of the current SMG Collection Development Policy. So, it is worth drawing attention to the efforts of Alexandra Rose (née Johnson)—when she was an

[230] Interview with Alexandra Rose (Science Museum). 7 December 2022.
[231] Interview with Rupert Cole (Science Museum). 7 December 2022.
[232] Interview with Alexandra Rose (Science Museum). 7 December 2022.

Associate Curator of Science—in galvanising climate- and environment-focused acquisition and proposing actionable steps to guide collections development in these areas. In 2015, she produced a plan of action called 'Collecting Climate: A Strategy for Representing Climate Change in the Science Museum's Collections'. While the Science Museum—along with other museums—had been integrating climate change into its programming since the early 2000s, these outputs were largely focused on communication and engagement, 'with few curators considering how this vast topic can and should be captured within permanent collections.'[233]

To address this, Rose's collecting strategy put forward areas of focus around which the Museum could begin to document a material culture of climate change. The themes she recommended for targeting were: science of the earth, climate and environment; living with weather and climate; fossil fuel society; technological responses to climate change; and behavioural responses and political engagement.[234] From its early stages, therefore, the scope of Science Museum curators in collecting climate change has been wide-ranging, seeking to capture not just the scientific research and technological response to the changing planet, but also their broader social and political impacts. In the wake of Rose's endeavours in the mid-2010s, diverse issues of the changing planet have been firmly embedded in the Collection Development Policy and have been fully integrated into curators' collecting practices. As she reflects, a considerable number of collecting activities—carried out by diverse curators—now interface with the changing planet. It is no longer siloed as the exclusive niche of the Environmental Science and Technology collection, over which she presides. [235]

Section 4.5.1 of the current Collection Development Policy (2021), concerning the collecting targets of the Science Museum, draws significant attention to sustainability and climatic and environmental change as foci for acquisition activities. Such is the high priority of these issues that they appear first in the collecting targets and occupy nearly half of the total word count for this section. Essentially, the recommendations centre around *study* and *response*. How science has shown that climate change is happening, and the responses that have emerged not just from science and engineering, but also politics, industry, society and culture across multiple scales. The order in which these recommendations appear—stating *study* first, and *response* second—suggests a historicising narrative framing of objects. A narrative that begins by constructing a 'past'—the scientific evidence for climate change—

[233] Alexandra Johnson, 'Collecting Climate: A Strategy for Representing Climate Change in the Science Museum's Collections' [unpublished] (2015), 1.
[234] Ibid., 1.
[235] Interview with Alexandra Rose (Science Museum). 7 December 2022.

which provides the basis upon which 'present' and 'future' realities of transformation are taking place. The recommendations for collecting *responses* stress the enormous changes taking place in the present and developing into the future. In particular, it spotlights large-scale shifts that are taking place across industrial and technological landscapes, responding to needs for mitigation of, or adaptation to, climate change.

Besides the 'big tech' approach, collecting targets also cite agriculture as an area of focus in narratives of change, particularly regarding transformations in farming practice and food production, and the changing relationship between agriculture and biodiversity. Opening up biodiversity to narratives of change, moreover, signals a shift towards widening the disciplinary concerns of the museum, recognising that scientific practice, impact and histories are inseparable from the 'natural world' in which they operate. In a similar vein are recommendations to collect around the socio-cultural history of climate change—to collect narratives of transformation that are taking place on the micro level of individuals and communities. Such suggestions echo the Policy's broader vision to ensure that collected objects will not only speak to scientific and technological change but will also show how such changes 'link to people's lives and interests', capturing a diversity of experiences and stories.[236]

All the Science Museum curators that I interviewed emphasised this people-centred approach to collecting as central to their practice and outlook, conceptualising objects as embodiments of diverse human stories and perspectives. This was neatly encapsulated by Alexandra Rose:

> 'I think, in general, the way that we collect now is very focused on people. In the broadest possible sense, I think whenever we collect something, we try to make sure there is as much story and as much humanity—a human story—in the object as possible.
>
> […] We don't obviously just reflect the stories of people who do science or are practising science, but also those who are users or beneficiaries or sometimes victims of science and technology and medicine.'[237]

[236] Science Museum Group, 'Collection Development Policy 2021', 7.
[237] Interview with Alexandra Rose (Science Museum). 14 December 2023.

The people-centred approach has done much to expand how curators conceptualise scientific agency in future-making in a time of planetary change. By and large—and unsurprisingly—through collecting, Science Museum curators anticipate futures that centre science and technology as agents of historic change. However, given that science and technology are implicated in environmentally and ecologically destructive practices, there are critics of the Science Museum's focus on science and technology as providing the 'solutions' to climate change. For example, the posthumanist museum scholar, Fiona Cameron, condemns the Science Museum for positioning 'big Science as the saviour of a now-threatened human race and as the discipline that can secure the future sustainability of the planet.'[238] However, as I found in my interviews, Science Museum curators are now wary of propounding the 'big Science' narrative in their work. Through their people-centred mode of practice, they are conscious to disrupt the status quo and decentre 'elite' conceptions of science.

New Taxonomies of the Changing Planet

In my analysis of Science Museum acquisitions, I put forward some taxonomies for categorising the objects in terms of what they constitute regarding the changing planet. I realise that these taxonomies are not exhaustive and do not encompass the full spectrum of objects that pertain to the changing planet.[239] They are the 'Changing Earth', 'Energy Transition', 'Restoring Environmental Balance' and 'Environmental Activism and Justice'. I contend that new approaches to taxonomising objects that relate to climate change is warranted by the fact that the changing planet is having such an enormous impact over all aspects of science and technology that siloing it into 'traditional' disciplines and classifications does not do justice to the scale and paradigm-shifting nature of these changes.

Reflecting on how it has impacted her own practice as well as that of her curatorial colleagues at the Science Museum, Alexandra Rose emphasised that the changing planet and the sustainable transition is 'on everybody's radar. Every single curator, pretty much regardless of what collections responsibility they have, is collecting around climate change

[238] Fiona R. Cameron, 'We Are on Nature's Side? Experimental Work in Rewriting Narratives of Climate Change for Museum Exhibitions', in Fiona R. Cameron and Brett Neilson (eds.), *Climate Change and Museum Futures*, 56.
[239] For an area of collecting that I exclude in this chapter (as it has been documented by Science Museum curators in a published text), see Rupert Cole et al., 'Curating Plastics', in Genevieve Godin et al. (eds.), *The Routledge Handbook of Archaeology and Plastics* (Routledge, 2024), 99-122.

and sustainability and environmental stuff.'[240] I believe that it is important to maintain this sense of the multidisciplinarity of the changing planet and the sustainable transition, so with my proposed taxonomies, I suggest that they should be overseen by a collective of curators rather than a sole curator—as a shared record and resource for the history of the changing planet. In addition to this, I would also propose that these taxonomies should be seen as fluid, overlapping and mutable. As Rose herself warned, it would be wrong to think of the categorisation of collections as 'monolithic' and 'unchanging' because she and her colleagues 'negotiate the boundaries of them all the time'. They are aware that these boundaries are shifting in response to the challenges and demands of the changing planet.[241]

I propose the 'Changing Earth' to encompass a focus on the methodologies of science and the stories of scientists who have studied, documented and evidenced the changing planet. In this way, it would embrace objects from the current 'Environmental Science and Technology' collection which represent disciplines such as Climate Science and Earth Sciences. However, I argue that it in the taxonomisation of these objects, it is important to underscore the context in which this scientific research is taking place: the context of a human-induced changing planet. For that reason, I submit the 'Changing Earth' as a categorisation that unites the different actors, methodologies and bases of evidence that document and study the physical changes taking place on the planet. While it is very similar to the phrase 'changing planet'—which I use to encompass the broad environmental, social, cultural, infrastructural, economic and political changes taking place—I propose a semantic difference with the 'Changing Earth' by taking the latter to explicitly denote physical changes across planetary systems: changes in the Earth's climates, atmosphere, ice, oceans, rivers, rocks, soils and ecosystems. Of course, these environmental changes are entangled with human lives. However, I distinguish them from the *human responses* to the changing planet that include the 'Energy Transition', 'Restoring Environmental Balance' and 'Environmental Activism and Justice'.

With 'Energy Transition', I not only denote the changes taking place in energy infrastructure and the physical generation of energy—the transition from fossil fuels to sustainable and renewable sources of energy—but also the changes taking place across the social, cultural, economic and political dimensions of energy. In particular, the energy transition demands a reduction in the *consumption* of energy, and this will have enormous impacts on the lives of

[240] Interview with Alexandra Rose (Science Museum). 7 December 2022.
[241] Interview with Alexandra Rose (Science Museum). 14 December 2023.

individuals and whole societies, which could include the stagnation or decline of economies.[242] So, besides speaking to the technological aspects of energy transition, I envisage an 'Energy Transition' taxonomisation to encompass the wider impacts of this and the reduced consumption of energy on human societies.

I admit that 'Restoring Environmental Balance' at first glance seems a vague taxonomy. Under this descriptor, I examine objects that speak to processes and technologies of 'carbon capture'. However, as a taxonomisation, I would suggest avoiding the terms 'carbon capture' or 'geoengineering' because of their connotations with 'techno-solutions': the engineered approaches to restoring the balance of greenhouse gases on Earth. As I examine in more detail in Chapter 3, the Science Museum is expanding its intellectual remit beyond human technologies, foregrounding the role of nature (nonhuman beings) and healthy ecosystems in efforts to mitigate and adapt to climate change. The Collection Development Policy reflects this shift to embrace biological and ecological perspectives, advocating for soil and biodiversity as collecting themes.[243] While the term 'carbon capture' can also encompass nature—as 'carbon sinks'—the focus on *carbon* distracts from the other greenhouse gases that are causing climate change as well as the other benefits of nature beyond their role in capturing and storing carbon. I propose 'Restoring Environmental Balance', therefore, as a taxonomy that comprises multiple approaches to restoring balance across planetary systems and biogeochemical cycles, and aligns with the Museum's burgeoning focus on the agencies of nature, biodiversity and ecosystems in tackling the changing planet.

Lastly, I examine objects which I categorise as 'Environmental Activism and Justice'. My aim with this taxonomy is to go beyond the literal 'science' and 'technology' pertaining to the changing planet and focus on the 'behavioural responses and political engagement' that Alexandra Rose recommended in her strategy for collecting around climate change.[244] In this way, objects speak to the socio-political aspects of science and technology, particularly the agencies of grassroots changemakers and non-scientists in influencing practice and policy in science and engineering. I also incorporate 'Justice' into this taxonomy not only because it is an important social dimension of the changing planet in the wider world, but also because the Science Museum curators themselves spoke to how they are addressing issues of justice and equity through their practices of curating climate change. I anticipate that, as time goes on, matters of justice and equity will play an increasingly prominent role in science,

[242] See Vincent Petit, *The Energy Transition: An Overview of the True Challenge of the 21st Century* (Springer, 2017).
[243] Science Museum Group, 'Collection Development Policy 2021', 11.
[244] Alexandra Johnson, 'Collecting Climate', 1.

engineering, economics, politics and legislation on the changing planet.[245] Therefore, I argue that it warrants significant and sustained attention in the Science Museum's collecting activities. In any case, it would align with the strategic priority for Equity: to 'promote greater inclusion and diversity in science, in culture and in wider society.'[246]

Collecting the Changing Earth

As a case study for collecting the Changing Earth, I have selected the Keeling air-sampling flask [Fig. 1.1],[247] although another object that would be suitable for this subject is the ocean indicator for microplastics research.[248] The Keeling flask has been on display in the Science Museum in two galleries: *Atmosphere* (2010-22) and *Energy Revolution* (2024-). From the moment it entered the Museum, it has remained almost continuously on show. However, the object represents a recent acquisition because, until 2021, it was on long-term loan. The initial purpose in loaning the flask was so that it could be displayed as one of the few, standalone objects in *Atmosphere*. In this predominantly interactive setting, objects were intended to provide 'a tangible link to the gallery concepts, helping visitors relate to an otherwise remote topic' (climate change).[249] Specifically, the flask featured in a section on the carbon cycle, exploring the scientific evidence for rising carbon dioxide in the atmosphere.

In 1958, after being appointed to lead a programme of research at the Scripps Institution of Oceanography (California), Keeling started to collect air samples using round-bottom flasks—such as this one—from an observatory on the Mauna Loa volcano in Hawaii. This data is charted on the iconic 'Keeling Curve' graph. In the initial request to loan the flask, the aim was to spotlight the work of Keeling and the Scripps Institution in gathering crucial evidence that carbon dioxide levels are increasing, revealing how this work has been instrumental to understanding contemporary climate change. So, a curatorial member of the *Atmosphere* project team contacted the organisation to ask that they loan one of their air-sampling flasks to the Museum.

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[245] See Esther Turnhout, 'A Better Knowledge is Possible: Transforming Environmental Science for Justice and Pluralism', *Environmental Science & Policy*, Vol.155, (2024), 1-7.
[246] Science Museum Group, 'Inspiring Futures: Strategic Priorities 2022-2030', 22.
[247] Science Museum Group, 'Air-sampling Flask and Base Used for Observations of Atmospheric Carbon Dioxide, 1980s'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8211044 [accessed 17 September 2025].
[248] Science Museum Group, 'Ocean Indicator for Microplastics Research'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8863088/ocean-indicator-for-microplastics-research [accessed 17 September 2025]. Also see Rupert Cole et al. 'Curating Plastics', 115-117.
[249] Hannah Clipson and Marie Hobson, '*Atmosphere … Exploring Climate Science* Gallery Summative Evaluation Report' [unpublished], (2011), 3.

Having been on loan to the Museum for over ten years, the opportunity arose for Alexandra Rose to consider acquiring the object for the Environmental Science and Technology collection under her remit. On receiving an email from a registrar to confirm the legal status of the loan, Rose decided that now was the opportunity to finally acquire the flask. As she realised at the time: 'I don't know why we keep renewing this. We don't have anything like this in the collection.'[250] While the initial entry of the flask into the Museum was actively driven by a display context, the acquisition was led by favourable circumstances. Rose was confident that the Scripps Institution would agree because they have no shortage of these flasks, and 'they obviously haven't missed this one since 2010.' This prompted her to reflect on the fact that, although the intellectual arguments of curators are really vital in collecting activities, just as important are the circumstances that make an object feasible to collect.[251] In this case, the exo-level circumstance that the object donor—the Scripps Institution—was deemed very likely to agree to the request for acquisition.

While this context facilitated the acquisition process, that is not to overlook Rose's work in demonstrating the intellectual value of the object to the Museum: as significant to the history of climatic research, but also to the history of science and the history of humankind more broadly.

> 'The multi-decadal data series reveal the inexorable rise of carbon dioxide in the atmosphere and is one of the cornerstones of our present understanding of anthropogenic climate change.'[252]

> 'It reflects a really important graph—a very important cornerstone of our understanding of climate change. It absolutely belongs in the collection.'[253]

To the curator, the flask functions on multiple levels with multiple points of entry into its storytelling capacities. Firstly, it encapsulates the substantial, long-term research that has been conducted by scientists in measuring atmospheric carbon dioxide concentrations. Second, it offers a reference point to the Keeling Curve, which is one of the most influential and recognisable visualisations of rising carbon dioxide. Indeed, 'one of the most famous

[250] Interview with Alexandra Rose (Science Museum). 7 December 2022.
[251] Ibid.
[252] Science Museum, 'Acquisition Proposal ACQ0000645: Original Air-sampling Flask Used by Charles David Keeling as Part of His Pioneering CO_2 Measuring Experiments' [unpublished], (2020), 1.
[253] Interview with Alexandra Rose (Science Museum). 7 December 2022.

diagrams in modern scientific history',[254] and one of the first instances where abstract evidence of climate change was made visible.[255] Thirdly, and building on its connection to the Keeling Curve, Rose interprets the flask as pivotal to 'our present understanding of anthropogenic climate change'. The meaning that Rose embeds in this object is that carbon dioxide levels are rising as a result of human activities, and scientists such as Keeling have been pivotal to collecting evidence of this phenomenon and instilling it in scientific knowledge and public understanding.

Possessing these multiple representational functions reinforced the flask's appeal to Rose. In these different ways, it symbolises an 'important cornerstone' in the narrative of climate change, embodying the realisation—particularly in the latter half of the twentieth century—that carbon dioxide is a key actor in climate change, and thus a key focus for intervention. By extension, the flask contributes to a metanarrative of scientific and technological transformation—the transition towards sustainability to achieve low-carbon futures. 'It absolutely belongs in the collection' both in the sense that it reflects a significant body of work in the environmental sciences, but also in the wider sense of the Museum collection, where objects, broadly, are schematised in a chronological 'advancement of knowledge' and 'development of processes'.[256]

This is exemplified by the next display context in which the flask plays a part. In *Energy Revolution* (see Chapter 2) it features in the 'Future Planet' section, which draws attention to the importance of climate models to simulate climatic and environmental scenarios, and thus are crucial to guiding the energy transition.[257] Through its association with climate modelling, the flask offers a narrative starting point to a gallery that explores 'how we can journey to a more sustainable future'.[258] Specifically, for the curator, it offers a means to ground the energy transition in the context of the substantial scientific data that evidences the changing planet. 'It's about showcasing the scientific labour that's gone into our understanding of climate change.'[259]

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[254] David E. Newton, *Chemistry of the Environment* (Facts on File, 2007), 86.
[255] Birgit Schneider and Thomas Nocke, 'Image Politics of Climate Change: Introduction', in Birgit Schneider and Thomas Nocke (eds.), *Image Politics of Climate Change: Visualisations, Imaginations, Documentations* (Transcript Verlag, 2014), 13.
[256] Science Museum Group, 'Collection Development Policy 2021', 2.
[257] 'Future Planet' panel, *Energy Revolution: The Adani Green Energy Gallery*.
[258] Science Museum, 'Energy Revolution: The Adani Green Energy Gallery'. Available at: https://www.sciencemuseum.org.uk/see-and-do/energy-revolution-adani-green-energy-gallery [accessed 17 September 2025].
[259] Interview with Alexandra Rose (Science Museum). 7 December 2022.

Energy Revolution is premised on the knowledge that carbon dioxide levels are increasing, which in turn is spurring the transition towards lower-carbon sources and uses of energy.[260] The Keeling flask helps to supply this premise, offering—alongside other instruments—an origin story to the changes taking place across industrial and energy infrastructures, as well as society, politics, culture and in individual human lives. Being a scientific instrument that is harnessed to signify the processes and findings of science, it helps to embed these large-scale transformations in scientific authority. In a gallery that is 'all about looking to the future',[261] it posits the quantitative data of climate science as a pivotal agent in defining the future—in shaping the ways that human societies are transforming themselves.

Besides its narrative value—possessing a historical significance to present and future realities on the changing planet—the acquisition of the flask was also predicated on its materiality. It was an object that had a purpose in scientific research. It had a biography of use. It provides a tangible connection to the work of scientists. The curator's desire to collect objects that had had a 'working life' corresponds to the intellectual approaches to objects that emerged from the 'material turn' in late twentieth-century scholarship.[262]

> 'I think it's usually the case that something that's got a bit of a history of use feels more compelling to us these days. It wasn't always the way that people collected in the past in the Museum. But the fact that it's been out there, it's had a life in the field, is really nice.'[263]

This perspective was echoed by another Science Museum curator, who emphasised that they try not to collect 'an off-the-shelf scientific instrument just to represent it'. Rather, it is more important to them that the object can demonstrate points of connection to the people and environments it was used in.[264] Having a connection to the 'real' work of scientists strengthens the instrument's symbolic capacity to stand in for this research. From an Actor-Network perspective, scientific 'facts'—in this case, rising carbon dioxide levels—can only be discerned through the particular interaction of actors: the scientist and the instrument.[265] Collecting a scientific instrument on the grounds that it had been *used* in the process of research thereby invokes the un-collectable presence of the scientist. Rose spoke of her

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[260] Introduction panel, *Energy Revolution: The Adani Green Energy Gallery*.
[261] Interview with Alexandra Rose (Science Museum). 7 December 2022.
[262] Liba Taub, 'Reengaging with Instruments', *Isis*, Vol.102(4), (2011), 690.
[263] Interview with Alexandra Rose (Science Museum). 7 December 2022.
[264] Interview with Rupert Cole (Science Museum). 7 December 2022.
[265] Bas de Boer, *How Scientific Instruments Speak: Postphenomenology and Technological Mediations in Neuroscientific Practice* (Lexington Books, 2020), 13.

intention to conjure the presence of the scientist in both her acquisition case and in our discussion on the flask. In the acquisition case, she gave space to describe the specific protocol for taking air samples with the flask, supplying such details including how the observer would hold the flask towards the incoming ocean breeze, and then hold their breath to avoid contaminating the sample.[266] She was captivated by these personal details and stories of use.

> 'All of that lovely *how do you hold it?* and *what do you do with your body when you're using it?* sort of stuff, all of that just feels so much more authentic when the object has been used. If it had just come out of the factory, sometimes if feels like that [authenticity] is not there.'[267]

Her motivations here also speak to her meso context: the ambition of the collecting policy to represent the 'people and practices' of science, conveying the lived experiences and activities of *real* scientists.[268] Having a context of use reinforces the authenticity of the scientific instrument. 'Authenticity'—however defined in theory and practice—is often an imperative in acquisition. Certainly, the Science Museum believes its prerogative is to provide extraordinary learning encounters with the 'real' objects of scientific research and technological innovation. It enables the object to speak on behalf of the people who interacted with it—to embody the human experience. In the context of climate change, the 'authenticity' of objects takes on a significance of its own, which Oliver Carpenter, Lead Curator on *Energy Revolution*, alluded to. To him, one of the unique assets of curators is providing 'encounter[s] with the *real thing*' to make the 'potentially abstract story' of climate change and the energy transition more *real* and *tangible*.[269]

Key to Rose's intellectual case for the Keeling flask is its power to materially encapsulate the complex reality of climate change. Possessing this 'authentic' connection to the work of climate scientists since the mid-twentieth century—and their evidence for rising atmospheric carbon dioxide—allows the curator to situate the flask as an agential force in history. Possessing this capacity to stand in for a *moment in time*—the 'origins' of contemporary understanding of climate change—bestows on the object a capacity to be employed in a broader historical narrative of transformation—technological and social. This is how the flask functions in *Energy Revolution*, providing the narrative context to the energy transition. But

[266] Science Museum, 'Acquisition Proposal ACQ0000645: Original Air-sampling Flask', 3.
[267] Interview with Alexandra Rose (Science Museum). 7 December 2022.
[268] Science Museum Group, 'Collection Development Policy 2021', 7.
[269] Interview with Oliver Carpenter (Science Museum). 9 January 2025.

beyond this gallery—looking further into the future—Rose anticipates that the Keeling flask will continue to fulfil an important narrative function. It is a ‘great and enduring story’ of the work of scientists in evidencing anthropogenic climate change which will remain ‘relevant’ to the histories being preserved and presented in the Museum for years to come.[270] She predicts that it will be used and interpreted again and again in histories of science and technology, conveying the long history of scientific labour that has shaped our knowledge of anthropogenic climate change.

As I have demonstrated through this case study, the process of collecting takes place in an ecosystem of interacting agencies. While the acquisition speaks, on a micro level, to the training, experiences and outlook of the curator—Alexandra Rose—as a historian of science, I recognise that there are other actors, influences and circumstances at work in the process of collecting. Certainly, as Rose herself acknowledged, the intellectual case for objects is only one part in the processes of collecting. Acquisition ultimately depends on a myriad of factors and actors. These ecological agencies are summarised in Table 1.1.

[270] Interview with Alexandra Rose (Science Museum). 7 December 2022.

Table 1.1 Summary of the Ecological Agencies in Collecting the 'Changing Earth' in the Science Museum

Agencies Supporting and Shaping Acquisition				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
Rose is a historian of science. This supports her intellectual case for the flask, underpinning her conceptualisation of it as historically significant.	The Science Museum's collecting policy stipulates a focus on the study of climate change through observation and modelling techniques.	The donor—the Scripps Institution of Oceanography—were deemed likely to agree to the acquisition given that the flask had already been on long-term loan to the Science Museum.	The curator interprets the flask as an agent in '*our* present understanding of climate change'. She connects it to research that has had a profound impact on society and therefore stresses its significance to shaping societal understanding and responses.	The curator situates herself in a 'present' and anticipates a 'future' in which carbon-induced climate change has had a significant impact. She interprets the flask as an agent in 'our *present* understanding of climate change', thus contextualising the wholescale transitions taking place to engender sustainable futures.
Rose is drawn to the fact that the flask had a 'biography' of use in the field. She is personally intrigued by the object and considers it to possess an 'authenticity'.	The flask would be serving an immediate purpose in the *Energy Revolution* gallery.			
	The Science Museum endorses 'people-centred' collecting. This includes a focus on the 'people and practices of science'.			

Collecting the Energy Transition

Collecting the *study* of the Changing Earth frames the objects as already historically significant: as 'important cornerstones of our *present* knowledge of climate change' [emphasis added].[271] Collecting the contemporary *response*, however, frames objects as significant in an *anticipated history*. The future ability of these objects to act as signifiers of change, or to be recognised as agents of change, can only be anticipated at present. One of the key narratives that the Science Museum—and other museums—are constructing through the acquisition of objects is that of the energy transition. Object acquisitions at the Science Museum help to reveal its framing and interpretation of the energy transition as an epochal shift, shaping the future of the Earth and humankind. Collecting offers the Museum an opportunity to document a material record of these transformations. Objects, large and small, evince both the macro-scale changes taking place on infrastructural and socio-political levels, as well the meso- and micro-scale changes taking place in workplaces, households and personal transportation.

Collecting the Energy Transition is an exercise in marking out a narrative shift from fossil-fuel intensive technologies to low-carbon technologies. Through acquisition, curators at both the Science Museum and National Museums Scotland are anticipating and constructing future histories that centre low-carbon technologies and energy systems as agents of broader historical change. In doing so, they are imagining optimistic futures wherein technological innovation and adaptation—however that is defined—are key agents in mitigating climate change.

Collecting the Energy Transition on a Macro Scale

I begin with the Science Museum's acquisition of a unit control desk from Cottam Power Station[272] to exemplify how climate change and the sustainable transition have fed curators' interpretation of fossil fuel energy systems. I bring it into comparison with an acquisition at the National Museum of Scotland of a flare tip from a decommissioned oil platform, which was also collected to speak to 'the end of a technical endeavour' that has been necessitated by the changing planet. Collecting this object was 'a way of looking back at the recent past and also of representing the beginning of a new and significant chapter.' [273] Along with the

[271] Science Museum, 'Acquisition Proposal ACQ0000645: Original Air-sampling Flask', 2.
[272] Science Museum Group, 'Cottam Power Station Control Desk and Equipment'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8794308 [accessed 17 September 2025].
[273] Ellie Swinbank, 'Collecting and Displaying the Decommissioning of North Sea Oil and Gas at the National Museums Scotland', *Architectus*, Vol.61(1), (2020), 25.

Science Museum's tidal turbine blade[274] and National Museums Scotland's dry-mate connector from the MeyGen tidal array, the case-study objects help to chart a journey of the energy transition as it is occurring on a macro infrastructural level.

First, the Science Museum's acquisition of Cottam Power Station's unit control desk signifies an 'end of an era'—the phasing out of fossil fuel energy generation. This desk was one of four at the coal-fired power station in Nottinghamshire, from which an operator could control a 500MV power generation unit. Cottam was part of an immense building programme undertaken in the 1960s and 1970s to develop a national electric power system. However, it is the context of the power station's decommissioning that provided the opportunity for the Curator of Mechanical Engineering & Manufactures—Ben Russell—to acquire it for the Electricity Supply collection (over which Oliver Carpenter currently presides). Here, it represents an 'epoch-making moment' that 'marks the end of three centuries of power generation based upon coal.'[275]

This rationale builds on long-standing methodologies of 'rescue' or 'salvage' collecting: collecting to document something that is 'disappearing' or 'in decline'. Many museum collections have been constructed or enriched through this practice, particularly ethnographic or folk museums, or museums of 'disappearing' or 'lost' industries and practices.[276] In this context, 'rescuing' the control desk from a decommissioned power station serves to underscore its narrative power in relation to the energy transition. The very act of rescuing an object from a closing-down power station, before it is lost forever, is symbolic of the decline of coal-powered electricity. Retiring from its working life, and entering the Science Museum collection, resigns the object to history. 'A historic cycle that began with Thomas Newcomen in 1709, and developed through the work of Watt, Trevithick and Parsons, is coming to an end.'[277] To Russell, the object thus encapsulates the macro decline of the age of fossil fuels.

One of the main challenges in collecting the remnants of decommissioned technologies and industries is salvaging those remains before they are repurposed or sold as 'scrap metal'. Like Russell, Oliver Carpenter—the Science Museum's Curator of Infrastructure and the

[274] Science Museum Group, 'Tidal Turbine Blade from Orbital Marine Power's SR2000 Turbine'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8928417 [accessed 17 September 2025].
[275] Science Museum, 'Acquisition Proposal ACQ0000202: Control Desk Unit for Coal Mill and Oil Burners' [unpublished], (2019), 2.
[276] See Sharon Macdonald and Jennie Morgan, 'What Not to Collect? Post-Connoisseurial Dystopia and the Profusion of Things', in Philipp Schorch and Conal McCarthy (eds.), *Curatopia: Museums and the Future of Curatorship* (Manchester University Press, 2019), 33-34.
[277] 'Science Museum, 'Acquisition Proposal ACQ0000202: Control Desk Unit', 2.

Built Environment—also carries out targeted salvage collecting to document the historic decline of fossil power in the UK. In his interview, he spotlighted his work in reclaiming objects from Ratcliffe Power Station—the UK's last coal-fired power station—to constitute the 'end of an era' of the fossil-fuelled Industrial Revolution.[278] However, his actions are not only spurred by the narrative potential of such objects. Carpenter also drew attention to the fact that it is a *practical imperative* to undertake acquisition into decommissioned fossil fuel industries now, before it is too late. Being the curator of collections that represent fossil fuel industries, he realises that enriching and filling gaps in them is a 'now or never' opportunity before the industries have completely disappeared in the UK. He must act deftly, and cannot delay the acquisition request, because there is a high likelihood that the industrial donors would otherwise repurpose, sell off or dispose of their technologies.[279]

Returning to the Cottam control unit, the fact that the object is just one (comparatively) small part of the power station—and the only object collected from this site—further strengthens its symbolic value. It is a fragment that has broken off from the disintegrating whole. This aspect of the materiality of the control desk is not employed by Russell as rationale in his acquisition proposal. It did, however, support a comparable acquisition at National Museums Scotland: the flare tip of the Murchison Oil Platform, which was dismantled in 2017. Reflecting on the object, Sam Alberti—the Director of Collections at National Museums Scotland—characterised the flare tip as a 'synecdoche': a part that represents the whole.[280] On the oil platform, the flare tip functioned to burn off unusable or waste gas. It comprised only a small fraction of the total site but nevertheless is a huge object for the Museum to collect, standing almost four metres high and weighing around 800 kilograms.

To Alberti, the substantial size of the object—and the knowledge that it was only a small fragment of the oil platform—provides a 'powerful way of illustrating the sheer scale of the North Sea oil industry and its decommissioning, and all that meant for the UK.'[281] Moreover, its 'smoky patina contrasts with the clean lines of the wind turbine blades stored nearby.'[282] The worn appearance of the object materially renders it as of a bygone age, and through the symbolic act of salvage collecting, the Murchison Oil Platform is situated firmly *in the past*:

[278] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[279] Ibid.
[280] Samuel J.M.M. Alberti, *Curious Devices and Mighty Machines*, 85.
[281] Ibid., 85.
[282] Ibid., 203.

> ‘One mantra of Extinction Rebellion protestors, when critiquing cultural organizations in partnership with big energy, is that fossil fuel extraction should only be in museums as historic relics: this one is.’[283]

Functioning as a ‘historic relic’ of the fossil fuel industry—in line with the overarching agenda of the Museum to speak to Scottish histories at home and abroad—by extension, the object evokes a new era for Scotland. As Ellie Swinbank, Senior Curator of Technology, reflected: ‘Oil and gas have been, and continue to be, central to our economy and politics and have provided employment to an enormous workforce both off and on shore.’ As such, the Murchison flare tip enhances ‘our ability to tell the story of twentieth- and twenty-first-century Scotland.’[284] She situates the phasing out of fossil fuels—an industry that is intertwined with the history, politics, economy and culture of Scotland—as marking a new age for the country, carving out a new identity for it. By underscoring its significance to the history of Scotland, Swinbank is responding to her meso, institutional context: the aspect of the mission of National Museums Scotland ‘to preserve, interpret and make accessible for all, the past and present of Scotland’.[285] To reinforce her case for the flare tip, she noted how it builds on the organisation’s existing collections relating to the history of energy in Scotland. Furthermore, she cited the institution’s Collections Development Strategy and its emphasis on the transition to sustainable forms of energy: a transition that is shaping the future of the country and its place in the world.[286]

Returning to the Science Museum and its intellectual agenda to document the history of science—rather than the history of a nation—I now spotlight an acquisition that constitutes the start of a *new era* following the end of the fossil fuel epoch. This is a tidal turbine blade which had been part of Orbital Marine Power’s SR2000 floating tidal turbine in Orkney [Fig. 1.2]. At the time of its launch in 2016, it was the most powerful tidal stream turbine in the world, producing over three Gigawatt-hours (GWh) of electricity over its initial twelve-month test programme. This single turbine generated more power than that which had been generated cumulatively by the whole wave and tidal sector in Scotland in the preceding twelve years. The turbine therefore represents a ‘significant step forward’ for tidal power—

[283] Ibid., 203.
[284] Ellie Swinbank, ‘Collecting and Displaying the Decommissioning of North Sea Oil and Gas at the National Museums Scotland’, 26.
[285] National Museums Scotland, ‘Collections Development Strategy 2022-27’, 2. Available to download at: https://www.nms.ac.uk/about-us/policies-and-reports/collections-policies [accessed 17 September 2025].
[286] National Museums Scotland, ‘Murchison Flare Tip’ [unpublished acquisition proposal], (2017). Shared by Ellie Swinbank, 19 August 2025 (personal communication).

speaking to the scaling-up its operations to deliver a greater proportion of the UK's electricity.[287]

This facet of its being representative of the *scaling-up* of tidal power in the energy transition is emphasised by the materiality of the object. The blade is a substantial acquisition, being 7.2 metres long and approximately 3000 kilograms in weight. Collecting such a large object was a complicated endeavour for the Museum, requiring substantial effort to secure its safe transport from Orkney to London.[288] However, the curators of *Energy Revolution*—where the blade is currently on display—succeeded in arguing the case that these practical difficulties were worth facing to acquire an object that could suitably reference the huge scale—both physical and emblematic—of decarbonising the energy sector. '[W]e want people to stand in front of this and go: 'wow, look at the scale of this—it's ginormous!'. To have a sense of that scale, I think, shows the scale of the challenge.'[289]

This curator's emphasis on how audiences would engage with the physicality of the object relates to its display context in the *Energy Revolution* gallery. The turbine blade was collected with this specific display space—and its narrative framing of the energy transition—in mind. A major priority of the curators in developing this gallery was representing the enormity of energy infrastructure and thus the enormity of their macro-scale transformation towards sustainable practice.[290] In a historical narrative framework, collecting the turbine thereby functions to represent the magnitude of efforts taking place 'to provide clean energy as we urgently transition to a low-carbon future.'[291] It provides a material and figurative synecdoche to the macro-scale, era-defining changes taking place within the energy sector.

But again, to draw attention to the practical dimensions of collecting, the curators' capacity to acquire 'big tech'—such as the tidal turbine blade—to supplement and 'update' the collections was supported by the meso context of display. The fact that a large-scale object would serve an immediate, narrative role in a major gallery project for the Science Museum—*Energy Revolution*—lent weight to the case for acquisition. Moreover, Carpenter specifically—as Lead Curator on the gallery—could 'kill two birds with one stone', both in terms of developing content for the gallery but also updating collections. And working with a

[287] Science Museum, 'Acquisition Proposal ACQ0001446: Tidal Turbine Blade from Orbital Marine Power's SR2000 Turbine' [unpublished], (2023), 2.
[288] It is fortuitous that the turbine blade made it into *Energy Revolution* at all. The only means of bringing the object into the gallery was to lift it by crane, and this was a long and arduous process that was nearly deemed impossible by the installers.
[289] Interview with anonymous participant (Science Museum). 31 January 2023.
[290] Ibid.; Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[291] Science Museum, 'Acquisition Proposal ACQ0001446: Tidal Turbine Blade', 2.

team of curators took the pressure off the individual, enabling them to share and delegate responsibilities in acquisition.[292]

Another meso-level factor that provided crucial support for the acquisition was, again, the Collection Development Policy. This was also emphasised by Carpenter, whose collecting activities around macro-scale, infrastructural energy transitions were carried out in specific reference to institutional priorities and aims for collecting. He and his colleagues 'could tick so many boxes' in collecting the 'big tech' of the energy transition because the Policy itself emphasises how these infrastructural changes are a very important and very current issue to represent in the Museum.[293] And the meso-level context of a gallery project, in turn, provided impetus for object donors to cooperate in the acquisition process. 'It makes it a lot more appealing for [potential donors] if they know they're going to get that immediate public exhibit of their thing.'[294] Thus, acquisition takes place through the fortuitous alignment of various factors that shape and support those processes, which are summarised in the table below.

As a brief comparison, I consider National Museums Scotland's acquisition of a dry-mate connector from the MeyGen tidal energy array. Like the Science Museum's tidal turbine from Orbital Marine Power, Orkney, the dry-mate connector also derived from a tidal farm in the waters off Orkney, in the Pentland Firth. However, in contrast to the Science Museum's tidal turbine, the acquisition case for National Museums Scotland's dry-mate connector was underpinned by a rationale of its significance to the history of Scotland. This *Scottish* national history aspect was absent from the Science Museum's acquisition case, which instead designated the tidal turbine as 'an innovative *British* technology' [emphasis added].[295] Meanwhile, National Museums Scotland's acquisition signifies 'innovation and improvement within an emerging part of Scotland's renewable energy sector',[296] and will help to 'show future generations who we are', as Scots.[297] The meso-level agenda of National Museums Scotland, therefore, is crucial to situating the practice of collecting the Energy Transition—and the changing planet more broadly—within a narrative schema centred around the history and identity of Scotland. Rather than pertaining to the history of

[292] Interview with Oliver Carpenter. 9 January 2025.
[293] Ibid.
[294] Ibid.
[295] Science Museum, 'Acquisition Proposal ACQ0001446: Tidal Turbine Blade', 2.
[296] National Museums Scotland, 'MeyGen Dry-Mate Connector' [unpublished acquisition proposal], (2023). Shared by Ellie Swinbank, 19 August 2025 (personal communication).
[297] Ellie Swinbank, 'How Contemporary Collecting Will Show Future Generations Who We Are', *The Scotsman*, 16 March 2024. Available at: https://www.scotsman.com/whats-on/arts-and-entertainment/how-contemporary-collecting-will-show-future-generations-who-we-are-4557261 [accessed 17 September 2025].

science and technology in and of itself, acquisitions serve a meta function in nation-building.[298]

Collecting the Energy Transition on Meso and Micro Scales from a Global-South Perspective

Collecting the Energy Transition is not only taking place in a macro sense. Just as in the display context in which they are being acquired for—*Energy Revolution*—Science Museum curators are conscious to acquire material that speaks to meso- and micro-scale transitions: changes that are taking place across communities and within individual lives. Moreover, the gallery has provided opportunities for curators to deliberately disrupt UK- and Global North-focused, techno-centric paradigms of 'development' and broaden their collections' remits to embrace Global-South perspectives and approaches to energy transitions. This was supported by the fact that, from the outset, *Energy Revolution* was 'global' in scope.

Before gallery development could take place—and thus its display-driven acquisition—the Science Museum's executive team had to establish a primary sponsor. When Adani Green Energy—an Indian company that is majority-owned by the conglomerate, Adani Group—agreed to fund the gallery, it inspired the Museum executives to give the project an international focus.[299] Nevertheless, the curators already recognised the importance of a global perspective, given that climate change and the energy transition are a 'global story'.[300] Both for the gallery in the short term, and for the Science Museum collection in the long term, the curators deemed it pivotal to bring in 'objects and stories from parts of the world that are fundamental to the energy transition but have been neglected [in the Museum].'[301]

One of the objects that was acquired to represent contemporary science and technology in Africa is the Reeddi Capsule: a solar-powered portable battery that is used in Nigeria [Fig. 1.3].[302] Being available to rent to charge electronic devices, the battery provides a cost-effective and sustainable alternative to carbon-emitting diesel generators. In the acquisition proposal, the curator draws attention to the context that while energy *demand* is increasing in Nigeria, energy *accessibility* is nonetheless 'rooted in a historic and unjust imbalance of

[298] See Alima Bucciantini, *Exhibiting Scotland: Objects, Identity and the National Museum* (University of Massachusetts Press, 2018).
[299] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[300] Ibid.; Interview with Alexandra Rose (Science Museum). 14 December 2024; Interview with anonymous participant (Science Museum). 31 January 2023.
[301] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[302] Science Museum Group, 'Reeddi Capsule, Solar Powered Portable Battery'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8913538 [accessed 17 September 2025].

wealth,' pointing to the colonial histories that have inhibited equal access to energy.[303] The Reeddi Capsule thus presents a story of an energy transition that is taking place in the context of energy inequalities, caused and exacerbated by colonial legacies.[304] By providing a clean and affordable source of energy to households, communities and businesses in a developing country—where energy demand is increasing rapidly—the technology presents a solution to '['leapfrog'] the step of excessive fossil fuel use such as happened historically in the UK.'[305]

By way of comparison, National Museums Scotland also acquired an object that stands as an example of how energy demand and energy injustices can be addressed in the Global South in sustainable ways. This is the SolarisKit: a portable, flat-packable solar thermal collector for use within households and small businesses and communities. This technology was developed by Faisel Ghani of Heriot-Watt University (Edinburgh) as an affordable and easy to transport and install energy source that would help to 'empower some of the world's poorest people by providing access to low-cost, clean heat.'[306] While the SolarisKit demonstrates how the Energy Transition can be made accessible to the Global Majority, the emphasis of the acquisition is nevertheless on its origins in Scotland: '[showing] ways in which Scottish engineers and innovators are seeking to address climate change and global energy inequalities.'[307] Again, this underscores how National Museums Scotland's collecting work engages with a distinctly national agenda, which differs to the Science Museum's burgeoning focus on global practices of science that bear no relation or context to the UK.

I return to the Science Museum to highlight a sustainable solution from the Global South that serves to overturn Global-North notions of innovation. This is the 'CoolAnt' passive cooling façade [Fig. 1.4], assembled from rows of terracotta pots which are held in place within a stainless-steel frame.[308] It was developed by the New Delhi-based architect Monish Siripurapu and is designed to keep buildings cool. When in use, this structure is fixed to a wall or window to enhance ventilation of cool air in the building. It works by distributing water

[303] Science Museum, 'Acquisition Proposal ACQ0001278: Reeddi Capsule, Solar Powered Portable Battery' [unpublished], (2022), 2.
[304] See Emmanuel Iniobong Archibong and Abiodun Paul Afolabi, 'From Colonial Exploitation to Renewable Transition: A Critical Analysis of Africa's Energy Paradigm', *European Journal of Sustainable Development Research*, Vol.7(4), (2023), 1-9.
[305] Ibid., 2.
[306] National Museums Scotland, 'SolarisKit' [unpublished acquisition proposal], (2019). Shared by Ellie Swinbank, 19 August 2025 (personal communication).
[307] Ibid.
[308] Science Museum Group, 'Terracotta 'Leaflet' and Pot Elements for CoolANT Passive Cooling Façade'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8917513 [accessed 17 September 2025].

across the pots, which draws in warm air from outside the building and releases 'passively cooled' air into the building's interior.[309]

A central appeal to acquire the cooling façade, as the collector,[310] Alexandra Rose, emphasised, was the fact that it represented a 'powerful example of using low-tech techniques' in new and innovative ways.'[311]

> 'It's lovely because it uses traditional techniques of pottery. So, it has this sort of low-tech feel of using past, traditional techniques, but it's also developed by an innovative, contemporary architect. It's a melding of old and new in a way that we really liked.'[312]

In this way, the object disrupts the narrative paradigm of evolutionary development and techno-centric innovation: a paradigm that traditionally pervaded the collections and galleries of the Science Museum. Moreover, it foregrounds a form of climate action that is embedded in Indian knowledge and heritage: a perspective on science, technology and the Energy Transition that was previously neglected in the Museum.

Being a sustainable technology from India helps to satisfy the global remit of the *Energy Revolution* gallery, but also address the meso-level objective of the Science Museum Group to enhance its representation and engagement with global science and technology.[313] As such, the acquisition received backing from the Science Museum's Global Engagement and Strategy Team, who facilitate connections with international institutions and help to establish international relationships. In helping to demonstrate the Museum's global outreach, the acquisition roused much attention within the institution. The SMG Director, Ian Blatchford, even got involved in the acquisition process, while the architect was invited to the Museum to collaborate on a *Late* event.[314]

On an interpretive level, furthermore, the façade helps to broaden perspectives on climate change, signifying the impacts and experiences of climate change in India. In making her case for the façade, Rose was aware of her macro context: of media reporting on the

[309] Science Museum, 'Acquisition Proposal ACQ0001316: Terracotta 'Leaflet' and Pot Elements for CoolANT Passive Cooling Façade' [unpublished], (2022), 2.
[310] While Alexandra Rose composed and submitted the Acquisition Proposal for the cooling façade, it actually entered the Heating, Cooling and Ventilation collection, overseen by Oliver Carpenter.
[311] Science Museum, 'Acquisition Proposal ACQ0001316: CoolANT Passive Cooling Façade', 2.
[312] Interview. Alexandra Rose (Science Museum). 7 December 2022.
[313] Science Museum, 'Acquisition Proposal ACQ0001316: CoolANT Passive Cooling Façade', 2.
[314] Interview with Alexandra Rose (Science Museum). 7 December 2022.

devastating heat waves that have taken place in South Asia. ‘Reading about Indian heatwaves and just how terrifyingly deadly they can be’ was in the back of her mind when making the acquisition case. In that way, an important motivation in collecting the façade was to demonstrate how ‘technology’ was being harnessed as means of *adapting* to the impacts of climate change.[315] Having this focus on *adaptation* made the object unique to the curator, demonstrating our contemporary reality of climate change; a reality that cannot be addressed through *mitigation* alone.[316]

The CoolANT cooling façade is significant in the ways that it disrupts a Global-North-focused, techno-centric acquisition narrative based on ‘innovation’ and ‘adaptation’, turning these concepts—as they are traditionally propounded in the Science Museum—on their head. I speak more to this in Chapter 2, in my analysis of *Energy Revolution* and the ways in which the curators who worked on this gallery project were consciously challenging and questioning paradigms of ‘innovation’. However, I will allude to this analysis by foregrounding the micro-level agency of the curator, Alexandra Rose, in seeking out an object that deliberately disrupts this paradigm, constituting ‘a melding of old and new’: blurring the boundaries between ‘traditional’ and ‘innovative’, ‘past’ and ‘future’.[317] As a historian of science, Rose is conscious of the ‘colonial legacies’ that underpin Global-North conceptualisations and practices of science and technology, and therefore purposely used the gallery—and its display-driven acquisitions—to draw attention to Global-South perspectives and approaches.[318] In this way, acquisitions such as the cooling façade provided an outlet of her historical critique.

But this global remit was also facilitated by the meso- and exo-level contexts of the Science Museum’s objectives to be an institution with a *global* outlook and influence, as well as the *Energy Revolution* gallery having an international corporation as an external stakeholder. These circumstances supported curators to acquire a substantial amount of material from all over the world, giving them scope to address the Globa-North-centredness of objects and narratives in the Science Museum. Nevertheless, as I examine further in Chapter 2, I do not situate acquisitions such as the cooling façade as explicitly taking place through a decolonial or postcolonial agenda.

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[315] Ibid.
[316] See European Environment Agency, ‘What is the Difference Between Adaptation and Mitigation?’. Available at: https://www.eea.europa.eu/en/about/contact-us/faqs/what-is-the-difference-between-adaptation-and-mitigation [accessed 17 September 2025].
[317] Interview with Alexandra Rose (Science Museum). 7 December 2022.
[318] Ibid.

In the gallery's display-driven acquisition proposals, there is no outright critique of the colonial legacies and contexts in which climate change and the sustainable transition are taking place, nor an explicit condemnation of their resulting social injustices—such as the neocolonial abuses in countries like the Democratic Republic of Congo, which are being exploited for their precious minerals to make the electric batteries that power the energy transition.[319] Taking a literal postcolonial or decolonial critique—dismantling climate injustice and climate colonialism—is, as one my interviewees revealed, their 'hope' and 'ambition' for future collecting practice in the Museum, but not necessarily a present reality. [320]

As I have demonstrated in this chapter, collecting the Energy Transition has taken place through the alignment of multiple agencies across the curators' microsphere, mesosphere, exosphere, macrosphere and chronosphere. These are summarised in Table 1.2 below.

[319] See Alberto Boretti, 'Green Façades, Enduring Dependencies: European Union's Battery and Hydrogen Strategies as Modern Neocolonialism', *International Journal of Hydrogen Energy*, Vol.129, (2025), 193-198.
[320] Interview with anonymous participant (Science Museum). 31 January 2023.

Table 1.2 Summary of Ecological Agencies in Collecting the 'Energy Transition' in the Science Museum

Agencies Supporting and Shaping Acquisition				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
The curators are historians. They interpret the energy transition as a historical shift taking place across social, cultural, economic and political worlds. To them, it does not just entail technological and infrastructural change.	The objects were serving an immediate role in the *Energy Revolution* gallery.	Museum Executives secured funding for *Energy Revolution* from Adani Green Energy. They provided the financial means for display-driven collecting activities.	During her acquisition of the cooling façade, the curator noted the poignancy of media reports on the intense heatwaves in India.	The curators situate the energy transition as one of *the* defining transformations taking place in their 'present' moment. Acquiring objects that speak to the end of the 'fossil fuel era'—is a 'now or never' opportunity.
Being historians—and exercising historical critique—curators are aware of histories and voices that have been 'neglected' in the Museum's historical record. Collecting is an opportunity to fill these 'gaps'.	The acquisitions directly spoke to the collecting policy's ambitions, specifically its focus on 'the evolving infrastructure of energy supply'.	The closure and decommissioning of fossil fuel industries is providing opportunities for curators to acquire material from them. But this relies on the industries having not already sold, discarded or recycled these materials.		The curators anticipate futures wherein the present energy transition is remembered as a history-defining process. Specifically, they speculate positive futures in which energy transitions have successfully mitigated climate change.
Curators have visceral reactions to the objects they are collecting. This includes their sense of awe for large-scale objects, and their sense of wonder at 'surprising' objects like the cooling façade.	Museum Executives commissioned *Energy Revolution* to be 'global' in scope. The international remit of collecting was also supported by the Museum's Global Engagement and Strategy Team.	Potential donors are more persuaded to grant their objects to the Museum if those objects will be put on public display immediately.		

Collecting Restoring Environmental Balance

The current reality of climate change—as something that human societies have failed, so far, to sufficiently mitigate—has recently led the science and policy sectors to call for an upscaling of geoengineering technologies to avoid the worst-case scenarios of a climate-changed planet. Many experts—scientists, engineers and policymakers—are advocating for the removal and sequestration of carbon dioxide from the atmosphere as necessary to achieving the Paris Agreement: where signatories pledged to limit global heating to well below 2°C—ideally below 1.5°C—to avoid some of the most devastating consequences of climate change.[321] Significantly for global policy, the IPCC's *Special Report on the Impacts of Global Warming of 1.5°C* (2018) urged that, while cutting carbon dioxide emissions is essential, on its own, it is no longer viable in limiting temperature increase to 1.5ºC. All its target pathways rely on large-scale programmes of removing carbon dioxide from the atmosphere over this century.[322] This is a position that it upheld in the most recent Assessment Report.[323]

The following objects were all display-driven acquisitions for the *Our Future Planet* exhibition (see Chapter 3) or resulted from a loan-to-gift during or following the exhibition run. Much like the other case studies in this chapter, the ability of these objects to perform a role in a context of display—to be both visually engaging and constructive to the overarching exhibition narrative—was central to the curators' rationale. But beyond their role in the exhibition, the acquisitions signify the impact of the shifting landscape of climate action and policy on the Science Museum's intellectual engagements with climate change. These objects demonstrate how the Museum and its curators align themselves with such approaches to climate action as those propounded by the IPCC, which, in turn, frames the development and upscaling of carbon capture technology as pivotal to arresting the worst impacts of the already climate-changing world. Acquiring carbon capture technologies for their future historical significance is an act of anticipating futures in which these technologies have helped to restore balance to the Earth's systems, thus avoiding the worst impacts of the inevitable climate change that is taking place.

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[321] For example, see Pushp Bajaj and Saurabh Thankur, 'Carbon Dioxide Capture and Sequestration to Achieve Paris Climate Targets', in Suhaib A. Bandh (ed.), *Climate Change: The Social and Scientific Construct* (Springer, 2022), 215-233.
[322] IPCC, 'Summary for Policymakers', (2018).
[323] IPCC, 'Summary for Policymakers', in Priyadarshi R. Shukla et al. (eds.), *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press, 2022).

Through the following object case studies, I demonstrate how curators were collecting within a framework that mirrored the narrative journey of *Our Future Planet*. Commencing this narrative is the 'Mechanical Tree' prototype [Fig. 1.5],[324] designed and constructed in 2017 by the engineer, Klaus Lackner, and his team at the Center for Negative Carbon Emissions, Arizona State University. It was developed as part of an investigation into the scientific and commercial viability of removing carbon dioxide from the atmosphere through direct air capture (often abbreviated to DAC). While I use the term 'carbon capture' as a catch-all for carbon removal activities, it is important to note the differences between terms on their technicalities and modes of operating. 'Direct air capture' extracts carbon dioxide *directly* from ambient air in any location. It differs to, 'carbon capture and storage' (often abbreviated to CCS), which traps carbon dioxide from a 'point source', such as an exhaust at a fossil-fuel power plant. The engineers' intention is that thousands of mechanical trees would work together on industrial-scale 'farms' to remove carbon dioxide from ambient air.[325]

The fact that the machine is a prototype for such technologies heightened its appeal to the curator who presides over the Environmental Science and Technology collection, Alexandra Rose, as well as the assistant curator, Margaret Campbell, with whom she jointly made the acquisition case. Looking to their mesosphere of influence, they observed that it satisfied the collecting policy's objective to collect around 'practices and processes of science'. They interpreted the mechanical tree, as a 'work in progress', to encapsulate early efforts in researching and testing carbon removal technologies. So much so, the curators spotlighted the researchers' nickname for the tree—'Cranky'—which derived from the mechanical, electronic and plumbing problems that 'plagued the team during tests'. [326] As such, the curators on *Our Future Planet* were keen to employ it as a starting point in a narrative of the development of engineered carbon removal.[327]

[324] Science Museum Group, 'Gantry from Mechanical Tree Prototype Designed by Klaus Lackner, 2017'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8718404 [accessed 17 September 2025]; 'Tank from Mechanical Tree Prototype Designed by Klaus Lackner, 2017'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8718401 [accessed 17 September 2025]; 'Fridge Used in Conjunction with Mechanical Tree Prototype, 2017'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8718701 [accessed 17 September 2025].
[325] See Eirwen Williams, ''Mechanical Tree' Farms Show Promise for Carbon Capture', *Sustainability Times*, 26 April 2022. Available at: https://www.sustainability-times.com/sustainable-business/mechanical-tree-farms-show-promise-for-carbon-capture/ [accessed 17 September 2025].
[326] Science Museum, 'Acquisition Proposal ACQ0000435: Mechanical Tree' [unpublished], (2020), 3.
[327] Interview with Rupert Cole (Science Museum). 7 December 2022.

Representing the next step in this developmental narrative is the Climeworks unit [Fig. 1.6],[328] which demonstrates the upscaling of carbon removal—marking the transition of these technologies from *inception* to *commercialisation*.[329] Climeworks is a Swiss company which, in 2017, opened the world's first commercial direct air capture project in Hinwil, Switzerland, and in the process launched the world's first commercially available direct air capture machine. Since then, Climeworks have established sixteen direct air capture plants across Europe, in the ambition that, by 2030, their technologies will be rolled out on a global scale, extracting carbon dioxide at multi-megaton capacity.[330]

While the curators gave the unit a prominent position in the exhibition, reflecting the commercialisation of carbon capture, it was not originally considered for acquisition. Instead, it was only after the show had closed that Rose and Cole, the two curators who led the acquisition case, considered upgrading its status from loan to permanent acquisition. One of the reasons for this initial hesitancy was that representing a large-scale carbon capture technology was already somewhat satisfied by the mechanical tree, acquired nearly two years prior. However, as time drew on, the curators reflected on the unique characteristics of the Climeworks unit, discerning how it spoke to—but represented something apart from—the mechanical tree: *what story could it tell that the mechanical tree could not?* The curators concluded that the Climeworks Unit was able to represent 'a really interesting juncture in the history of the scaling-up and commercialisation' of carbon capture.[331] 'Its [current] size is about a metre-and-a-half-tall and two- or three-meters-wide, but *what might that look like in the future?*', Cole wonders. Anticipating that the technologies will be scaled up, he reasoned that 'it would be an interesting moment to collect and represent the materiality of when they were first introduced.'[332]

Brought into relation with one another, the mechanical tree and the Climeworks unit 'tell quite a complete story of the development of [carbon capture] technology',[333] embodying a progression from *concept* to *practice*. Nevertheless, while conveying a narrative of 'scaling-up' was essential to its intellectual justification, it created practical difficulties for both the curatorial and logistical personnel involved in the acquisition process. Rose and Cole had to

[328] Science Museum Group, 'Climeworks Carbon Collector Unit'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8718402 [accessed 17 September 2025].
[329] Science Museum, 'Acquisition Proposal ACQ0001237: Climeworks Carbon Collector Unit' [unpublished], (2022), 1.
[330] See Climeworks, 'Mammoth: Our Newest Facility'. Available at https://climeworks.com/plant-mammoth [accessed 17 September 2025].
[331] Interview with Rupert Cole (Science Museum). 7 December 2022.
[332] Ibid.
[333] Ibid.

argue robustly for the Climeworks unit. Given the large size of the object, following Science Museum procedure,[334] the curators had to go to an extra level of committee to present their acquisition case. As Cole explained, this is because storage space is a 'premium' at the SMG's National Collections Centre (in Wroughton). Curators must make a very compelling case to justify large objects that require significantly more space and resources to ensure their safe transportation, storage and preservation.[335]

Despite these hurdles, the ability of large objects to provide striking focal points in display contexts is highly attractive to curators, who aim to select objects that draw the attention of onlookers. Cole pointed to the Science Museum's Audience Research, which consistently proves that visitors 'love big objects': 'they [provide] quite important moments in the science and technology museum.'[336] This demonstrates the influence of meso-level factors on the decision-making of the curator. Not only did the curators argue robustly for the object because of the narrative value of its size: being 'important to preserve to provide a record of what this technology was like at the moment it was first scaled up for commercial use in the 2010s.'[337] But they were also conscious of the audience appeal of large objects, which is empirically evidenced by the institution's Audience Research.

To represent the next stage in the narrative of carbon capture, I highlight the basalt 'carbon core'[338] [Fig. 1.7]—an object that is much smaller in scale to the preceding acquisitions.[339] By the 'next stage' in the story of the development of carbon capture, I refer to technologies of storing and utilising captured carbon. In *Our Future Planet*, there were many such objects, being selected to hark back to the Climeworks carbon collector and presenting viable pathways for storing and utilising the captured carbon. But for my analysis of collecting practice, I foreground the basalt carbon core as it constitutes a unique case wherein the curators—Alexandra Rose and Sophie Waring—had to justify the object on disciplinary grounds; they had to argue why the object was relevant to the 'Science' Museum as opposed to the 'Natural History' Museum.

[334] See Science Museum Group, 'Collection Development Policy 2021', 16-17.
[335] Interview with Rupert Cole (Science Museum). 7 December 2022.
[336] Ibid.
[337] Science Museum. 'Acquisition Proposal ACQ0001237: Climeworks', 2.
[338] See Science Museum Group, "Carbon Core' Containing Carbon Mineral Deposits Fixed in Basalt'. Available at: https://collection.sciencemuseumgroup.org.uk/objects/co8718403 [accessed 17 September 2025].
[339] While I take the basalt core sample to constitute the 'next stage' in the story of the development of carbon capture, it is important to note that these collecting activities were not undertaken in 'chronological' order. The acquisition case for the basalt core sample was made over a year before the case for the Climeworks unit.

The basalt carbon core works by first dissolving carbon dioxide in water and then injecting it into the rock strata, where it reacts with basalts and other minerals to create a carbon sink. This sample was acquired from the Icelandic company CarbFix, which has been collaborating with Climeworks at Iceland's Hellisheiði geothermal power station to capture emissions and store them underground. The acquisition case emphasises that injecting carbon dioxide permanently into rock is currently seen, scientifically and economically, as a realistic avenue in decarbonisation. It stresses the 'industrial scale' at which CarbFix are already operating and subsequently anticipates that the UK government (as of 2020) will upscale its investment in carbon capture and storage projects such as this one. In this context, the rock provides 'proof of concept for underground storage of carbon [as] highly significant for the future viability of carbon capture as a means of tackling climate change.'[340] It thus helps to complete a narrative of carbon capture: from the development of viable carbon capture to the development of viable carbon storage, locking away that captured carbon.

Beyond the narrative value that the curators bestow on the basalt carbon core, it provides an example of how curators negotiate disciplinary boundaries through processes of collecting. The acquisition proposal calls attention to the fact that rock specimens do not usually fall within the collecting remit of the Science Museum, 'since geological collections more properly belong within the Natural History Museum.'[341] Given that collections storage is a 'premium', the Science Museum—and other museums—have to be highly selective with the material they collect. This includes making sure that the material falls within the disciplinary constraints of 'science' and 'technology', however these concepts are defined. If an object could be construed to fall outside these disciplinary bounds, they must argue a case for why it *belongs* in the Science Museum as opposed to another institution with another subject remit. As Alexandra Rose stressed, working in such close proximity to the Natural History Museum adds further pressure to avoid any collections overlap between the neighbouring institutions.[342]

However, with the basalt carbon core, the curators defended its suitability for the Science Museum by accentuating its origins as 'the product of an industrial process': 'though geological in appearance, it might more properly be thought of as a man-made material.'[343]

[340] Science Museum, 'Acquisition Proposal ACQ0000650: 'Carbon Core' Containing Carbon Mineral Deposits Fixed in Basalt' [unpublished], (2021), 2.
[341] Ibid., 2.
[342] Interview with Alexandra Rose (Science Museum). 7 December 2022.
[343] Science Museum, 'Acquisition Proposal ACQ0000650: 'Carbon Core'', 2.

In this way, they distance the object from 'natural' geological specimens such as those preserved next-door. I situate the disciplinary boundaries within which curators operate as an exo-level influence over their decision-making and practice in collecting. This is because there is a degree of separation between the *institution* and the *disciplines* they represent. The disciplines of 'science', 'engineering', 'mathematics' and 'medicine' have a life of their own beyond the confines of the Science Museum. In the real world in which they operate, they do not function within the boundaries set by the institution. Nevertheless, regarding the disciplinary remits of collecting, I recognise that there is an overlap between exo-level and meso-level influences. After all, the mesosphere of curators—the institution—as Rose acknowledges, does have agency in the ways that it defines and demarcates its subject areas. And this, in turn, impacts curators' decisions over what to collect, as well as how they make their case that such material *belongs* in the Science Museum—and supplements its collections—as opposed to another institution.

Another exo-level factor that played a major role in the acquisition of all the objects in this section is the wider scientific environment in which carbon capture is playing an ever more prominent role. Specifically, the acquisitions were carried out in response to the growing advocacy for capture carbon technologies by scientific bodies, such as the IPCC, to avert the worst-case scenarios of climate change. Carbon capture had not always been met with widespread scientific endorsement. At the inception of *Our Future Planet*, Rupert Cole had himself been apprehensive of carbon capture as a 'greenwashing technology of big oil'—a scepticism that he believed to be shared by many in the scientific community. However, within the timeframe of the exhibition's development, opening and closure, carbon capture came to be formally endorsed by the IPCC, and he, too, became more persuaded that it was a realistic and viable approach to climate change mitigation.[344]

Formally collecting objects that had been employed in the exhibition, then, was carried out by the curators as a response to their exo-level scientific environment and macro-level political and economic environment. They were witness to a context in which carbon capture technologies were gaining increasing support and investment, and therefore considered it timely to preserve this 'moment' of endorsement. Looking to their chronosphere, they situated themselves in a point in time from which carbon capture was going to gain increasing prominence as a form of climate action. Through collecting these objects, they were anticipating future histories in which carbon capture had played a significant role in

[344] Interview with Rupert Cole (Science Museum). 7 December 2022.

mitigating climate change. I summarise the ecological agencies at play in collecting the objects that I taxonomise as ‘Restoring Environmental Balance’ in the Table 1.3.

As a conclusion to this section, however, I reflect again on why I designated my proposed collection taxonomy as ‘Restoring Environmental Balance’. Through the above objects, I demonstrated how and why Science Museum curators are integrating carbon removal and storage as a thematic focus in collecting activity. These three objects all constitute *engineered* approaches to restoring balance in the Earth’s distribution of carbon, being products of scientific and technological investigation. However, as I explore further in Chapter 3, the *Our Future Planet* exhibition also drew attention to ‘*natural*’ approaches to balancing the carbon cycle, spotlighting forests, among other ecosystems, as ‘carbon sinks’. Given the Museum’s burgeoning focus on the ecological sciences since the exhibition, I propose that an exciting avenue for future collecting would be one which foregrounds the restorative and regenerative agency of nonhuman life.[345] In this way, conceptions of ‘science’ would expand beyond the techno-solutions—and hence the economic-growth agenda of science—to nurture respect for the agential role of nonhumans in building sustainable futures, both for humankind and the Earth. It would open up science and scientific knowledge as key frameworks for decentring the anthropocentrism that has caused the changing planet, as well as achieving multi-species justice.[346]

[345] See Håkon Aspøy, ‘Forest Science Between Human and Nonhuman Agency’, *Trees, Forests and People*, Vol.15, (2024), 1-8.
[346] See Theo Stanley et al., ‘Just Nature Recovery: A Framework for Centring Multispecies and Multi-dimensional Justice in Land Management’, *Environmental Science & Policy*, Vol.164, (2025), 1-7.

Table 1.3 Summary of Ecological Agencies in Collecting 'Restoring Environmental Balance'

Agencies Supporting and Shaping Acquisition				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
The curators are historians. The framework in which they collect carbon capture, therefore, is one that centres on a narrative of change through time. They are constructing a history of carbon capture, from concept to practice, small-scale to large-scale.	The acquisitions accorded with the Science Museum's collecting policy. Specifically, its ambition to represent 'emerging technologies for geo-engineering, such as carbon capture, utilisation and storage.'	The scientific community—including the IPCC—were starting to endorse carbon capture technologies. They play a prominent role in pathways to limit global heating to Paris targets.	The UK government were starting to endorse carbon capture technologies, and were making plans to upscale activities in capturing, storing and utilising carbon.	The curators were responding to a present 'moment' in which carbon capture was beginning to play a prominent role in climate modelling, mitigation and policy. They saw themselves as situated in an opportune time to collect these burgeoning technologies.
The curators had to argue robustly for the large Climeworks unit. Collecting is an 'involved' process that requires a lot of work from the curator in making and defending their case.	Findings from the Science Museum's Audience Research confirm that visitors are drawn to large objects, which supported the case for the Climeworks unit.			The curators anticipate hopeful futures in which carbon capture has played a major role in mitigating climate change.
	Space and resources for collecting and storage are a 'premium' at the Science Museum. An extra level of committee had to be consulted to approve the Climeworks unit.			
	The curators had to justify their unusual acquisition of 'geological' material, given that it falls outside of the traditional disciplinary remit of the Science Museum.			

Collecting Environmental Activism and Justice

In the previous sections, I examined object acquisitions that directly pertain to the disciplines of 'science' and 'technology' and spotlighted how curators vested them with agency to bring about hopeful futures. In contrast, with the following objects—protest materials from the Global Youth Climate Strike[347]—the curator acquiring them, Alexandra Rose, specifically sought to highlight future-making agencies *beyond* the scientific and technological realms. These acquisitions embody forms of climate action that question and challenge the 'establishment': the powers that govern science, policy and society.

Integral to this acquisition case was the fact that 'these people aren't scientists',[348] providing a rare opportunity 'to reflect the voices of young people directly'[349] and thus diversify the stories and perspectives being represented in the collection (both on an institutional level and on the level of the Environmental Science and Technology collection). Acquiring protest materials also corresponds to the collecting policy's ambition to represent the 'increasing visibility of environmental activism across a variety of platforms'.[350] Arguably, moreover, they also relate to the institution's ambitions for collecting *art*, specifically works which express the 'lived human experience' of 'political and environmental uncertainty'.[351] However, this connection is tentative given that they were not acquired for the Science Museum's Art collection.

Another contrast between the present acquisitions and those in the preceding sections relates to the curator's methodology of collecting. Alexandra Rose took a deliberately participatory and experimental approach to collect protest materials 'on the ground'. In this case, by attending a climate protest in London—one of the Global Youth Climate Strike demonstrations taking place on 15 March 2019—and asking protesters directly if they would be interested in donating their materials to the Science Museum. To her, it was a 'pilot' to inform and inspire future collecting activities around protest for the Science Museum. In establishing her methodology, she consulted Georgina Young, who was then Head Curator

[347] SMG object numbers: 2020-173; 2020-174; 2020-223; 2020-286; 2020-376 – 2020-391. In this section, I refer to these objects collectively as 'climate protest materials'. Nevertheless, this catch-all designates three separate acquisitions containing numerous individual items. They are considered together since they all came from the Global Youth Climate Strike (London, 15 March 2019).
[348] Interview with Alexandra Rose (Science Museum). 14 December 2023.
[349] Ibid.
[350] Science Museum Group, 'Collection Development Policy 2021', 11.
[351] Ibid., 10.

at the SMG's Museum of Science and Industry (Manchester), but had previously worked for the Museum of London, for which she collected 'Occupy London' protest materials.[352]

Rose's participatory approach to collecting echoes the SMG collecting policy's broad aims around people-centred collecting: to acquire material that links to people's lives and captures people's experiences.[353] Collecting on the ground—gaining first-hand experience of a protest and interacting with protesters directly—was carried out in support of this broader ambition. As Rose recalled, it reflected how, at the Science Museum, 'the way that we collect now is very focused on people', wherein objects are deemed significant for the *human* stories they tell.[354] Her methodology provided a means to directly capture the stories, voices and perspectives of the protesters. And the materiality of the protest materials as forms of visual culture that the protesters created by hand reinforces the imperfect *humanity* of the objects while also signifying their agency. They are the literal *makers* of the material, which, by extension, symbolises their role in *making change*.

By attending the climate protest herself, Rose was hoping to underscore the historical significance of the protest: to foreground a zeitgeist wherein the youth climate movement was attracting significant and unprecedented attention. Looking to her macrosphere and chronosphere, she stressed that 'this was in the news all the time. It was such an important movement in the climate change landscape'.[355] To sufficiently record this historical moment, Rose's methodology stipulated the importance of capturing 'the context of the protest through photographs and voice recordings of our own impressions.'[356] This would enrich the interpretation of the protest as a historically significant event. And it provided a means for the curator to document the grassroots, youth-led responses to climate change that were taking place, at an unprecedented scale, in 2019. This youth-led environmental movement—sometimes referred to as 'Fridays for Future' or 'School Strike for Climate'—gained worldwide attention from the summer of 2018, when the Swedish teenager, Greta Thunberg, started to skip school on Fridays to protest outside Sweden's parliament and demand stronger action on climate change. Since then, waves of young people went on strikes and protests to demand that governments addressed the changing planet with the gravity it deserves—as a *climate emergency*.[357]

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[352] See Guy Atkins, Georgina Young and Mark Teh, 'Save Our Placards!'.
[353] Science Museum Group, 'Collection Development Policy 2021', 7.
[354] Interview with Alexandra Rose (Science Museum). 14 December 2023.
[355] Ibid.
[356] Alexandra Rose, 'Global Youth Climate Strike, 15 March 2019: Collecting Proposal' [unpublished], (2019), 1.
[357] See 'Letters: Climate Crisis', *The Guardian*, 1 March 2019. Available at: https://www.theguardian.com/environment/2019/mar/01/youth-climate-change-strikers-open-letter-to-world-leaders [accessed 17 September 2025].

The gathering momentum of the global youth movement caught the attention of Rose as something that warranted representation in the Environmental Science and Technology collection. In particular, she was drawn to the Global Youth Strike taking place on 15 March 2019 as an event of 'particular salience', helping to address her ambitions to collect protest material that she had laid out four years previously in the 'Collecting Climate' proposal.[358] To her, it signalled an extraordinary moment when climate change and the environment pervaded media, public and policy discourse. Uniquely, these discussions were led by, and centred on, young people; 'it was rare to reflect a moment when young people's voices are actually being instrumental in shaping policy.'[359]

Through her historian's gaze in the microsphere, but also looking to her conceptions of time in the chronosphere, she anticipated that acquiring a material record of youth-led activism would be 'historically significant' to future generations. They would look back on this 'pivotal moment' of grassroots climate action and celebrate 'the people who were part of that movement.'[360] Such was the salience that she experienced that Rose had to develop her collecting methodology within a short timescale, given the impending deadline of the Global Climate Strike.

> '[As curators], we're trying to put ourselves in the position of the historian in fifty years' time looking back on today. It's impossible to chronicle comprehensively what's happening as you're living through a moment. But it is about trying to take that step back and think, *does this feel like it's reflecting a shift that's genuine?* And I think, at that time, it did [referring to the youth-led environmental movement].'[361]

The Science Museum had not previously undertaken any targeted collecting around environmental protest materials, hence Rose's methodology was 'experimental'. Indeed, she was a pioneer of on-the-ground protest collecting for the Science Museum. To account for the lack institutional experience in this area, she composed a rationale, methodology and risk assessment. This served to justify and prepare for her participatory approach to acquisition. The methodology was thus. Rose and a colleague (Shaz Hussain, then an Assistant Curator) arrived at the starting point for the Youth Strike, Parliament Square, with

[358] Alexandra Rose, 'Global Youth Climate Strike, 15 March 2019: Collecting Proposal', 1; Alexandra Johnson, 'Collecting Climate', 7.
[359] Interview with Alexandra Rose. 14 December 2023.
[360] Ibid.
[361] Ibid.

equipment to record their experience. If they encountered protest materials that fit their requirements, they would approach the individuals and ask if they would consider donating their objects to the Museum. If they responded positively, Rose would provide them with her contact details. Finally, if people got in contact, she would proceed with the acquisition process and paperwork.

The Science Museum's Registration team advised from the start that it would be inappropriate to take materials that had been discarded on site. While that would have been an easy, practical way of collecting a substantial amount of protest material, there would have been issues of copyright and legal title as there was no way to trace the owner.[362] Due to the experimental nature of her activities, Rose believed it imperative that her strategy was as low-risk and small-scale as possible.[363] 'The reason that I had devised that methodology was so that we didn't have to do something weird in the process; to make it as easy as possible to follow our normal procedures.'[364]

Another priority for Rose was to establish criteria for protest materials. Keeping in mind her desire to make the process as uncomplicated as possible, she admits that she made some 'small-c conservative decisions' regarding what she was looking to collect. Given that they would be entering the *Science* Museum, she deliberately targeted materials that spoke to the climate, the environment and the planet. She was conscious not to acquire anything overtly 'political', avoiding the abundant 'anti-Tory' material.[365] As Rose reasoned, it is not in the Science Museum's remit and interest to reflect political critique, anti-government rhetoric or party-political messaging on their own terms; 'there are other museums for this kind of stuff'. She concluded that the Science Museum's responsibility, instead, is to represent 'how images and language of the Earth and the environment and the planet are being mobilised by young people'.[366] With the placards and signs that were acquired from the protest, their slogans include: 'NO pollution is our solution! No global warming'; 'Less beef more leaf'; 'Fossil fools'; 'We're doing our GCSE's: Green Certificates of Saving the Earth!'; 'Love the earth, not yourself'; 'Climate change sucks'; 'Grown ups grow up and help save Earth'; 'Keep it Cool'; and 'I'm with Her [the earth]' (these latter three being illustrated in Fig. 1.8).

[362] Ibid.
[363] Alexandra Rose, 'Global Youth Climate Strike, 15 March 2019: Collecting Proposal', 1.
[364] Interview with Alexandra Rose (Science Museum). 14 December 2023.
[365] Ibid.
[366] Ibid.

It is difficult to disentangle politics from science; science and technology are inherently political entities employed towards inherently political ends and uses.[367] The Science Museum curators that I spoke to were all conscious of the impossibility of total 'neutrality'. But, as far as possible, they seek to ensure that in all their activities—collecting or otherwise—they are telling stories with 'science' at the centre. Whether that is practices of science, or the social impact of science. The curator acquired the protest materials for a 'science' collection—specifically, the Environmental Science and Technology collection—because they embodied the 'social ramifications' of a scientific issue. As such, it was important to Rose that the objects were grounded in this scientific context and did not stray too far into the 'political'.[368]

Moreover, being a national museum—sponsored by the UK Government's Department for Digital, Culture, Media and Sport (DCMS)—it is not in the Museum's interest to dis-align from the establishment: to pit itself in opposition with the government. This stance of objectivity informed by science is embedded within practices of collecting, and curatorship more broadly, at the Science Museum, wherein curators view themselves as being guided by the 'science' (as opposed to 'politics'). Another curator expressed that it is important to them that the Museum serves the public as a 'trusted voice': 'I think because it's a public building—it's paid for by the public—it needs to serve the public. It would be a huge misstep if it wasn't guided by the science'.[369] As Rose alluded, there are other museums that assign themselves to overtly political debate and discussion. For example, the People's History Museum (Manchester), which posits the responsibility of its collections as telling the 'story of democracy in Britain'.[370] Activism pervades the outlook, mission, programming and functioning of the institution, so much so that it designates its charitable supporters as 'Radical Friends'.[371] The Museum's collections remit, therefore, lends itself to exploring political histories.

Nevertheless, in the end, some of the protest materials that were acquired at the Global Youth Strike *did* become embroiled in politics. Specifically, the politics around the Science Museum's partnerships with the fossil fuel industry. In this case, its acceptance of sponsorship from the oil and gas company, Shell. The problematic politics that this situation

[367] See Sharon Macdonald (ed.), *The Politics of Display: Museums, Science, Culture* (Routledge, 1998).
[368] Interview with Alexandra Rose (Science Museum). 14 December 2023.
[369] Interview with anonymous participant (Science Museum). 31 January 2023.
[370] People's History Museum, 'Collection | Ideas Worth Collecting'. Available at: https://phm.org.uk/collection/ [accessed 17 September 2025].
[371] People's History Museum, 'Support Us | Ideas Worth Supporting'. Available at: https://phm.org.uk/support-us/ [accessed 17 September 2025].

caused highlights a crucial exo-level context to curating activities: the relationship between the institution and the object donor. An amicable relationship with donors is pivotal to securing the long-term ownership of objects.

When *Our Future Planet* opened in May 2021, a selection of the climate protest materials—'Green Up Your Act', 'Keep it Cool' and 'Grown Ups Grow Up and Help Save Earth' [Fig. 1.8]—had featured at the beginning of the exhibition to introduce the increasing public awareness and demand for climate action: as an 'opener to set up the premise of the show and the need for technologies like carbon capture.'[372] However, the donors of these placards did not support the fact that the Museum's Executives and Board of Trustees had agreed to Shell's sponsoring the exhibition, which they interpreted as an endorsement of the fossil fuel industry. An open letter from the UK Student Climate Network (UKSCN) made the call to withdraw the objects from display.[373]

Among the activists making this call was Bella May, who had donated the 'Keep it Cool' and 'I'm with Her' placards. In the open letter, she requested that the objects were returned to her as soon as possible. The UKSCN, in addition, urged the Museum to never again put one of the youth climate strike protest signs on display in a fossil fuel-sponsored exhibition.[374] The political lives of objects, as this demonstrates, remain ever active, even after they have been transferred to the Museum. The executive decisions around fossil fuel sponsorship have continued to affect curators' work in collecting. As one curator suggested in relation to this challenge, it has created 'instances where donors haven't wanted to work with the Science Museum because they don't want their work to be seeming to be endorsed by a fossil fuel funder.'[375]

As this underscores, acquisition is contingent on the exo-level agency of the donor's cooperation, and this can be impacted significantly by their political and ethical judgement of the meso context—the institution—with which they are negotiating, particularly if it does not align with their own views and perspectives. In Table 1.4, I summarise this and the other ecological agencies that impact curators' work in collecting Environmental Activism and Justice.

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[372] Interview with Alexandra Rose (Science Museum). 14 December 2023.
[373] Rebecca Atkinson, 'Science Museum Removes Protester's Climate Strike Placard from Display', *Museums Journal*, 14 September 2021. Available at: https://www.museumsassociation.org/museums-journal/news/2021/09/science-museum-to-return-protesters-climate-strike-placard/ [accessed 17 September 2025].
[374] Ibid.
[375] Interview with anonymous participant (Science Museum). 31 January 2023.

Table 1.4 Summary of Ecological Agencies in Collecting 'Environmental Activism and Justice'

Agencies Supporting and Shaping Acquisition				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
The curator is a historian. Rose was conscious to reflect in her collecting activities how social history interfaces with scientific and technological history.	The collecting policy specified an aim to represent the 'increasing visibility of environmental activism across a variety of platforms'.	The donors that Rose approached at the protest had to respond positively to her proposal, and in the long term, had to be willing to see through the acquisition process in its entirety.	Youth climate activism pervaded the media and public and political discourse. It was having an enormous impact on public understanding and political engagement with climate change.	Rose 'hastily' compiled her methodology because she interpreted the Global Youth Climate Strike protest as a now-or-never opportunity to collect historically significant environmental protest material.
Rose's motivations to collect drew on her 'Collecting Climate' proposal. She realised the absence of climate protest material from her collection and set out to address this.	The Science Museum endorses 'people-centred' collecting. This includes a focus on non-scientists—grassroots actors whose lives are impacted by science, but also who impact science from the outside.	The donors of some placards withdrew their consent for the Museum to display them and hold them in their collections. They did so in protest against Shell's sponsorship of *Our Future Planet*.		
The acquisitions help fill a 'gap' in her collections regarding the perspectives, experiences and agencies of young people.	Collecting was 'guided by the science'. The curator was conscious not to collect anything overtly 'political'. As There are other museums that are better placed to engage more directly with politics.	Some donors are put off by the controversial nature of the Science Museum's sponsorship by fossil fuel companies. This impacts their willingness to donate their objects to the institution.		
Rose pursued a methodology to collect 'on the ground' by gaining first-hand experience of attending a climate protest. Her individual actions and decisions on the day gave rise to subjectivities in her acquisition of protest materials.				

Conclusion

In this chapter, I have explored how curators at the Science Museum have engaged with the changing planet through practices of collecting, and I have analysed these practices in relation to micro, meso, exo, macro and chrono contexts and agencies. The intellectual and practical processes of acquisition offer a glimpse into the worlds of curators: as actors who are operating within, and negotiating between, a network of diverse agencies. The framework within which curators select and acquire objects is one that centres on their storytelling capacities and their contribution to anticipated histories. For the Science Museum, objects provide building blocks in the construction of narratives: narratives of change and development through time—from the past, to the present, and into the future. Through collecting, curators are given opportunities to enrich their anticipated future histories with additional, diverse stories and perspectives.

> '[… storytelling is] what we do. Pulling stories out of what could look like a mundane object—on the surface, it's a mundane object—but actually what it says about wider society—our hopes and fears, our dreams for the future—all of that could be wrapped up in this [object]. Even if it's a rusty teaspoon, or whatever. It can tell so many amazing stories despite not being awe-inspiring to look at.'[376]

In the act of collecting, curators are making a tangible, material impact on constructions of history and constructions of science. As Rupert Cole expressed evocatively, they are 'creating an archaeology for the future.'[377] Time can only tell whether the objects being collected for the Science Museum will be interpreted as 'historically significant' in years to come. In the meantime, they certainly signal the curators' anticipation for hopeful futures; futures in which people will look back to the past for stories of collective action, innovation, adaptation and resilience to the changing planet. For now, in our present world, the objects that curators collect for the Science Museum play a role in demarcating the institution's conceptualisations of 'science'. Expressing what 'science' and 'innovation' means on a changing planet, and what they can contribute towards building positive future worlds.

Through my proposed taxonomies for collecting work—the 'Changing Earth', 'Energy Transition', 'Restoring Environmental Balance' and 'Environmental Activism and Justice'—I have explored how curators interpret agency in science and future-making on a changing

[376] Interview with anonymous participant (Science Museum). 31 January 2023.
[377] Interview with Rupert Cole (Science Museum). 7 December 2022.

planet. In the ‘Changing Earth’, I demonstrated how the curator assesses the work of Earth scientists in collecting data and evidence of the changing planet as a pivotal actor in shaping our current understandings of the world and what is happening to it as a result of destructive human activities. In the ‘Energy Transition’, I revealed how curators are working with this concept across multiple scales of transformation—macro, meso and micro—emphasising the multiple levels of agency at which people are contributing to the mitigation of climate change and the building of a more sustainable future. In particular, I argued that the curators’ focus on meso- and micro-scale energy transitions in the Global South serves to reconceptualise notions of ‘innovation’ in the institution’s collections, introducing stories, perspectives, experiences and practices of science and engineering that were previously neglected.

In ‘Restoring Environmental Balance’, I drew attention to the work of curators in collecting around the processes and products of carbon removal and storage. I showed how these acquisitions relate to our contemporary context in which global heating is an ever-present reality, leading scientists and policymakers to advocate for carbon removal as a legitimate course of action to avoid the worst impacts of climate change. But I also contemplated how the taxonomy of ‘Restoring Environmental Balance’—instead of just ‘Carbon Capture’—would free curators to continue to pursue collecting around the ecological sciences, as well as collecting that would emphasise the restorative agency of nature in building sustainable and regenerative futures. Lastly, in ‘Environmental Activism and Justice’, I demonstrated how the curator’s work in collecting protest materials highlighted the agencies of non-scientist, civic populations—specifically, young people—as having a significant impact on shaping future directions in science and climate policy. This work, I argue, compellingly expands conceptions of what science is and who has power in guiding its impact on the world.

I constructed these four taxonomies on the basis of my investigation into the interacting, ecological agencies that shape curatorial practice. They are the products of my collating together the diverse evidence that I found regarding the influences on curators’ practice. I propose that they could be useful categories for curators in their future collecting activities that pertain to the changing planet, making manifest how practices and conceptualisations of science and scientific agency are shifting in response to demands for more sustainable and equitable futures.

2 | Interpreting History and the Changing Planet in Permanent Galleries

> '*Just the idea of this gallery, it messes with your head. The idea of time. I was obsessed with time in this gallery […] and all these different kinds of ideas about your role today, and looking forward from the past, looking back from the future*.'[378]

Overview

In this chapter, I explore curators' approaches to developing 'permanent' galleries that engage with the changing planet. I foreground two science museum galleries to assess the unique challenges and opportunities that these spaces pose to curators. Hence, in this thesis, I treat these spaces on their own terms, separate to temporary exhibitions. I examine how curators managed and negotiated these challenges in their approaches to interpreting the changing planet and people's responses to it.

I discern that the principal challenge in developing permanent galleries is precisely their *permanency*, leading curators to make conservative decisions that ensure the continued relevance of the gallery to an anticipated future audience. Yet despite this challenge, I draw on the evidence of the two case studies to argue that bringing 'new' and 'experimental' practices and perspectives to permanent galleries is rewarding for science curatorship in its engagement with the changing planet. Specifically, they provide a compelling and lasting medium through which curators can anticipate futures in ways that are challenging and subversive of 'traditional' paradigms in science curatorship. In doing so, they can (re)frame science and technology as agents in making sustainable and equitable futures. I build and develop this argument on my findings from interviews with curators. Namely, that a diverse range of agencies—across their microsphere, mesosphere, exosphere, macrosphere and chronosphere—shape and support their work to shift, expand and subvert histories, conceptualisations and paradigms of science.

The case studies in this chapter are two major gallery redevelopments in UK science museums: *Energy Revolution* at the Science Museum, which opened in March 2024, and *Our Changing Planet* at Thinktank Birmingham Science Museum, which opened in May 2021 (not to be confused with the *Our **Future** Planet* exhibition at the Science Museum,

[378] Interview with Oliver Carpenter (Science Museum). 9 January 2025.

discussed in Chapter 3). My analysis of these case studies centres around the decisions—creative, intellectual and pragmatic—that curators made in selecting and interpreting objects and constructing overarching narratives that relate to climate change. I study the nuances of the two galleries by contextualising the curators' differing approaches to interpreting the changing planet in their respective galleries. Specifically, I compare and analyse the 'Energy Revolution' and the 'Anthropocene' as conceptual framings in climate change curatorship.

Introduction to Permanent Galleries

Permanent galleries are integral to the ways in which museums conceptualise not only their public offer, but also their identity. In contrast to museum collections, galleries are underpinned by the practice of *exhibiting*: of literally showcasing objects to audiences in a designated physical space, where they are interpreted in alignment with an overarching narrative schema for that space.[379] As declared in the SMG's Strategic Priorities: 'At the heart of our museums are the galleries which we regularly refresh and redevelop.'[380] However, as this statement also attests, the 'permanency' of galleries should not be taken literally, since they are subject to alteration and replacement.

While I focus primarily on curatorial activities in *developing* galleries, I recognise that the curators' responsibilities for these spaces do not end here. After a gallery is open, curators (along with estates teams) possess a unique role in overseeing its lifespan. Other members of the gallery project team retreat in their responsibilities after the formal opening, leaving curators as the 'public face' of the gallery: involved in promoting it, speaking to the press, leading tours, and defending the gallery and its content, among other activities.[381] Typically, museums develop permanent galleries to last five, ten or twenty years, though sometimes they remain open for even longer. Intertwined with their long lifespan—as both a cause and effect of it—is the fact that permanent galleries are time-, resource- and labour-intensive to develop. To be cost-effective, the gallery must be both physically and intellectually robust.[382]

First—on the practical side—a gallery must physically endure years of display on the gallery floor. A gallery's physical media—which could include, for example, objects, display cases, interpretative panels, signage, audiovisual equipment and interactive exhibits—must be strong enough to withstand years of use, while also safe enough to prevent damage or harm

[379] See François Mairesse (ed.), *Dictionary of Museology*, 204-207.
[380] Science Museum Group, 'Inspiring Futures: Strategic Priorities 2022-2030', 12.
[381] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[382] See Katherine Molineux, 'Permanent Collection Exhibitions', in Maria Piacente (ed.), *Manual of Museum Exhibitions* (Rowman & Littlefield, 2022), 62-63.

befalling the objects, exhibits and indeed visitors. My interviewees pointed to issues of longevity regarding interactive technologies: exhibits that are a staple in many science museums, as well as the core attraction of science centres. Developing a permanent gallery that is led by interactive media—especially digital interactive media—involves high upfront costs to commission and develop the interactives, and then the long term is fraught with problems of damage, upkeep and obsolescence.

In science centres, audiences *expect* to engage with interactives, sometimes very vigorously, leading to high maintenance costs. However, as Robin Hoyle and Graham Rose of Glasgow Science Centre intimated, there is currently no alternative than to try to ensure that interactives are physically robust; interactivity is at the heart of the very function and philosophy of science centres.[383] In contrast, science museums can be more flexible in their approaches to permanent galleries. Certainly, many science museum curators—including those that I interviewed—would situate the objects and collections, rather than interactives, at the core of their museum's identity, activities and objectives.[384] It is noteworthy that both *Energy Revolution* and *Our Changing Planet* are object-led galleries that replaced interactive-led galleries. I explain the causes and consequences of these interpretive shifts in more detail in the case-study analyses. But for the purposes of this introduction, I emphasise that curators were influential in the transformation of the spaces to spotlight museum collections.

With both galleries, the curators had an empirical backing to their advocacy for collections. They had observed how—in their respective institutions—interactives would not lend themselves to a permanent gallery on the changing planet. The labour and costs of maintaining interactives were deemed unsustainable, and in the case of *Our Changing Planet*, the then-ongoing Covid-19 pandemic imposed restrictions on using interactives at all. Not having to worry about the *physical* challenges posed by interactives, in our interviews the curators expressed more concern for the *intellectual* robustness of their object-centred galleries.

A gallery's intellectual content—the knowledge, ideas, themes and stories it shares—must be based on rigorous, well-established evidence and careful thought as to their longevity, relevance and meaningfulness to audiences now and in the future. Anticipating the ideas

[383] Interview with Robin Hoyle (Glasgow Science Centre). 28 February 2023; Interview with Graham Rose (Glasgow Science Centre). 28 February 2023.
[384] On the nature of this 'conflict' between object-focused and interactive-focused approaches in science museums, see Susan Pearce (ed.), *Exploring Science in Museums* (The Athlone Press, 1996).

and dialogue that future visitors will continue to find engaging and relevant is a formidable task that requires the curator (among others involved in gallery projects) to exercise both empirical backing and anticipatory thinking.

At the Science Museum, the temporal dimension of permanent galleries—their long lifespan—was particularly pertinent to curators' decision-making regarding how they framed, mediated, thematised and narrativized the changing planet. Science Museum curators are conscious to avoid themes, ideas and information that could become 'outdated' within the lifespan of a gallery. They compare working on gallery projects to working on temporary exhibitions, characterising the latter as providing much more scope to engage with 'topicality' and the 'contemporary'.[385] The curator Alexandra Rose, moreover, drew attention to the fact that the longevity of permanent galleries poses particular challenges in dealing with information, stories and issues of the changing planet, given that it is *changing* rapidly—both in terms of its real impacts on the world, but also in terms of the ways in which people understand, engage with, and respond to it.[386]

Furthermore, another crucial aspect of this chapter is to explore the role of the science museum curator as a historian. In Chapter 1, I framed the responsibility of the curator in collecting activities as one of *anticipating future histories*: constructing the future historical significance of 'contemporary' objects for future audiences. In this chapter, I also analyse curators' exercising anticipatory modes of futures thinking. I situate permanent galleries as media through which curators explore and exhibit the entanglements between past, present and future worlds. In judging and conveying the significances of objects—historical and contemporary—in a time of climate change, the curators intend to stimulate audiences to think critically about the future. Specifically, they seek to inspire hopeful futures thinking and action.

Therefore, in this chapter, I foreground the role of the museum curator in processes of *interpreting history*. I argue that museums are crucial forums through which history is interpreted and narrativized to public audiences, and curators are crucial agents in shaping these interpretations and narratives. Practices of narrativizing and drawing meaning from the past to understand the present, in turn, are central to practices of anticipating future worlds.

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[385] Interview with Oliver Carpenter (Science Museum). 9 January 2025; Interview with Rupert Cole (Science Museum). 29 May 2025.

[386] Alexandra Rose, '*Atmosphere* to *Energy Revolution*: Approaches to Climate Displays at the Science Museum, 2010-2024'. Paper for *Contemporary Collecting and Sustainable Technologies* symposium [online], National Museums Scotland, 26 November 2024.

Through objects, museums present material 'documents' of past and present worlds—providing visceral encounters through time—to explore who we are, why we are that way, and, importantly, where we are going as a society (whether on local or global scales).[387] As the historian Marek Tamm contends, 'historical understanding is not formed in the aftermath of past experiences, but even more so, in the foremath of new modalities of the presentist future.'[388] Constructing historical narratives of events that have defined the present is carried out in tandem with anticipating future worlds; the past provides evidence-based lessons and inspiration for acting on the future.

By constructing and conveying meaningful historical narratives, museum galleries have a powerful capacity to inspire positive visions of the future, as well as galvanise anticipatory action in future-making.[389] Developing galleries that engage with the changing planet involves actively selecting which issues to draw attention to and making conscious choices around language and their wider connotations. Approaches to framing the changing planet—deciding which stories to tell, and the terminologies used to convey those stories—has strong implications on its perceived 'causes' and 'solutions'.[390] I selected my case studies—*Energy Revolution* and *Our Changing Planet*—precisely to speak to how different framings of climate change impacts the ways in which curators mobilise objects. Curators' interpretation of objects, history and the changing planet are intricately bound together in processes of anticipating future worlds.

Not only do I situate permanent galleries as media through which curators *interpret* history, but I also analyse the curators' approached *Our Changing Planet* and *Energy Revolution* by incorporating practices of *reinterpreting* history. I locate these reinterpretations of history as being carried out by curators through their engagement with objects. I also examine these galleries in terms of the ways in which they were an outlet for curators to reflect on—and *reinterpret*—their own practices. In the development of the galleries, the curators were deliberately challenging and subverting 'previous' ways of working in their institution. Lastly, I argue that reinterpretation also took place through the physical transformation of space and interpretive media. Significantly, both galleries are products of an interpretive shift from *interactives* to *objects*. These objects supply the primary medium through which the curators

[387] See Viviane Gosselin and Phaedra Livingstone (eds.), *Museums and the Past: Constructing Historical Consciousness* (UBC Press, 2016).
[388] Marek Tamm, 'Future-oriented History', in Zoltán Boldizsár Simon and Lars Deile (eds.), *Historical Understanding: Past, Present and Future* (Bloomsbury Academic, 2022), 138.
[389] See Kristin Alford (ed.), *Cultivating Futures Thinking in Museums*.
[390] See Thomas A. Morton et al., 'The Future That May (Or May Not) Come: How Framing Changes Climate Responses to Uncertainty in Climate Change Communications'. *Global Environmental Change*, Vol.21(1), (2011), 103-109.

examine and convey their conceptual framings of the changing planet; they (re)interpret the objects according to what they signify in relation to the Energy Revolution (in the Science Museum) and the Anthropocene (in Thinktank).

However, I realise that it would be misguided to characterise these galleries as solely concerned with reinterpreting objects—of redisplaying historical collections and ascribing 'new' meanings to them. Although the curators did engage in such practices, they did not constitute the primary aim and focus for the galleries. For one, a significant number of objects in *Energy Revolution* were recent display-driven acquisitions, therefore could not be 'reinterpreted' in the sense that they had already been interpreted by the Science Museum before. And for *Our Changing Planet*, many of the objects had not yet been on public display, and as such, were being interpreted and exhibited to Birmingham Museums' audiences for the first time. There was no precedent of their interpretation to visitors to be reevaluated.

I organise this chapter into three sections: 'Gallery Contexts', 'Gallery Temporalities' and 'Gallery Legacies'. In the first, I foreground the contexts that galvanised and subsequently shaped the development of the new galleries, drawing particular attention to the institutional, meso-level agencies that drove these projects. In 'Gallery Temporalities', I analyse and cross-examine the unique ways in which the two galleries conceptualise time through the periodisations of the 'Energy Revolution' and the 'Anthropocene'. In turn, I demonstrate how these temporal concepts impact the ways in which curators employ objects in the galleries; how they interpret and draw meaning from them in relation to the 'Energy Revolution' or the 'Anthropocene' respectively. And in 'Gallery Legacies', I spotlight the curators' agencies (and the factors that influenced them) to adopt new perspectives and practices in the process of developing their respective galleries. I argue that, while permanent galleries pose difficulties in relation to their 'longevity', these spaces nevertheless provide a powerful medium through which science curators can expand and reinterpret concepts of 'science' in ways that embrace ethics of sustainability and equity.

Gallery Contexts: Agencies that Initiated and Shaped the Galleries

From *Atmosphere* to *Energy Revolution* at the Science Museum

At the Science Museum, *Energy Revolution* (March 2024-present) currently constitutes its flagship gallery that engages with the changing planet. In this role, it replaces the *Atmosphere* gallery, which closed in March 2022 after being on public display for over eleven

years. Having been designed to last only five years,[391] there was a strong feeling amongst Museum staff that *Atmosphere* was 'beyond the end of its lifespan': 'it was getting a bit decrepit and needed replacing.'[392] *Energy Revolution* thus replaces *Atmosphere* on a physical level, occupying the space of its predecessor, located on Level 2 of the Wellcome Wing. But in many ways, *Energy Revolution* also marks a conceptual transformation of *Atmosphere*.

Uniquely, Alexandra Rose had direct experience of working on *Atmosphere*: a perspective that informed her contributions to *Energy Revolution*. For *Atmosphere*, she did not work in a formal curatorial capacity, but rather as a 'content developer'. The responsibility to ensure that the information being presented was 'rigorous' and 'robust'—a responsibility that is usually assumed by collections curators in gallery projects[393]—instead fell to content developers (from the Exhibitions team). In contrast to *Energy Revolution*, *Atmosphere* was led by digital interactives. They functioned 'to facilitate active engagement with 'basic' climate science'.[394]

This pedagogical approach—outlining the principles of climate science and demonstrating the concrete evidence of climate change—was informed by the wider context of the gallery's development. In the years leading up to *Atmosphere*'s opening—2008, 2009 and 2010—climate scepticism and denialism were still on the public agenda in the UK. The arguments of climate sceptics and denialists were still being platformed in polarised public 'debate', which undermined the majority scientific consensus that climate change was real.[395] In particular, the 'Climategate' controversy of 2009—which resulted from a breach of data from the UEA's Climatic Research Unit—led to increased uncertainty and confusion around the climate change 'debate'.[396] This contemporary context was 'ossified' in *Atmosphere*, especially its mission to demonstrate the 'established science' of climate change and to generate public trust in climate science.[397]

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[391] Hannah Clipson and Marie Hobson, '*Atmosphere … Exploring Climate Science* Gallery Summative Evaluation Report', 6.
[392] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[393] Ibid.
[394] Hannah Clipson and Marie Hobson, '*Atmosphere … Exploring Climate Science* Gallery Summative Evaluation Report', 7.
[395] See Andrew C. Revkin, 'Climate Change as News: Challenges in Communicating Environmental Science', in Joseph F.C. DiMento and Pamela Doughman (eds.), *Climate Change: What it Means For Us, Our Children, and Our Grandchildren* (The MIT Press, 2014), 239-242.
[396] Wouter Poortinga et al., 'Uncertain Climate: An Investigation into Public Scepticism About Anthropogenic Climate Change', *Global Environmental Change*, Vol.21(3), (2011), 1015-1024.
[397] Alexandra Rose, '*Atmosphere* to *Energy Revolution*'.

Pedagogically-oriented digital interactives, as such, offered the means through which *Atmosphere* set out to address public confusion, fatigue, scepticism and mistrust in climate science.[398] The interactives were harnessed to teach 'basic climate science' and demonstrate the 'robust' evidence of climate change. Throughout *Atmosphere*, its interpretive content and its interactives ran a tone of voice that emphasised 'Science' (with a capital 'S') as a universally benevolent and all-powerful endeavour, abstracted from socio-cultural context.[399] Given the longevity priorities of permanent galleries, Rose recalled that focusing on introductory communication around the 'established science' was a pragmatic decision to ensure the gallery felt 'timeless' and relevant in the long term.[400] However, what Rose and her colleagues had not anticipated—which subsequently led to their feeling that the gallery needed to be replaced—was how this detached, empirical approach would start to appear outdated and hubristic by the mid to late 2010s. Lacking much consideration for the social and emotional dimensions of climate change seemed out of step with their macrosphere: the landscape of public action and dialogue, particularly the growing prominence of environmental activism and social justice movements.[401]

Looking to her macrosphere and chronosphere at shifts in public attitudes towards museums, Rose observed how the curatorial team are now more conscious of the 'museum voice', and more critical of how they exercise that voice. 'The whole 'museums are not neutral'—we all know and understand that to a much greater extent than we did in the *Atmosphere* days.'[402] She granted that the authoritative, detached tone in *Atmosphere* that centred around 'big Science' as saviour[403] was 'the product of a very specific set of choices that were responding to what was happening in the wider landscape'.[404] Specifically, the widespread disinformation and scepticism around climate change. But *Energy Revolution* was developed in a different context of widespread trust in climate science and widespread support for sustainable transitions. This was confirmed by the front-end audience research for the gallery, which found that visitors engaged most with the 'global story' of climate change and the Energy Transition when it had personal resonance, rather than divorced from social contexts.[405]

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[398] TWResearch, 'A Climate Change Gallery at the Science Museum' [unpublished], (2008); TWResearch, 'Developing the Climate Change Exhibition' [unpublished], (2009).
[399] Alexandra Rose, '*Atmosphere* to *Energy Revolution*'.
[400] Ibid.
[401] Ibid.
[402] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[403] See Fiona R. Cameron, 'We Are on Nature's Side?', 51-77.
[404] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[405] Science Museum, '*Energy Revolution* Interpretation Plan' [unpublished], (2022), 6-7. Shared by Alexandra Rose, 30 September 2024 (personal communication).

Responding to these meso- and macro-level circumstances, the *Energy Revolution* team sought to exercise a different tone of voice and authority to *Atmosphere*.[406] As an example, Rose pointed to a film that explores how climate modelling is being tailored to better understand the African climate system as well as support communities in southern Africa to build resilience to extreme weather events.[407] The purpose of the film is to spotlight a method of climate modelling that is localised and 'built with the needs and the priorities of particular places and people in mind.'[408] To Rose, this is important in demonstrating how climate modelling—and, by extension, 'Science'—is not an objective, universal language abstracted from human contexts. In a tonal shift from *Atmosphere*, the film challenges the Global North-centric view of 'Science' that purports to speak for the entire planet.[409]

Furthermore, unlike *Atmosphere*'s focus on 'timeless' content, for *Energy Revolution* the curators embraced the theme of change, taking a 'long view' of the energy transition.[410] Material culture—including loans, recent acquisitions and objects already in the Museum collections—supplied the means to explore this change. Providing visceral, material encounters, objects serve to *embody* the energy transition, and their contexts and materialities are the basis upon which the narrative of historical change is constructed. Oliver Carpenter—the Lead Curator on *Energy Revolution*—explained that the historicising approach was informed by both conceptual and pragmatic reasoning. In the gallery, 'everything is treated as a historic case study in its own time, its own place'.[411] A future of low-carbon energy is situated, so the role of objects—whether 'historic' or 'contemporary'—is to demonstrate how they contribute to this established future. Engaging solely with the 'present', and leaving the future too open to *speculation*, would, he reasoned, have risked the gallery becoming out of date within its lifespan. This issue was particularly pressing given the meso-level factor of a lack of budget to accommodate updates.[412]

Nevertheless, the Science Museum's Executive and Masterplan teams had not always intended the gallery to be led by the collections. The long, historicising view of the energy

[406] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[407] See Science Museum, 'Weather Forecasting and Climate Modelling: A Short History', 19 June 2024. Available at: https://www.sciencemuseum.org.uk/objects-and-stories/weather-forecasting-and-climate-modelling-short-history [accessed 17 September 2025].
[408] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[409] Ibid.; Alexandra Rose, '*Atmosphere* to *Energy Revolution*'.
[410] Alexandra Rose, '*Atmosphere* to *Energy Revolution*'.
[411] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[412] Ibid.

transition was not 'baked into the project right from the beginning', but rather '*evolved*.'[413] In the very early stages of planning, rather than developing an energy transition gallery, the Executive and Masterplan teams had discussed updating *Atmosphere* with a focus on the Earthshot Prize.[414] When they realised that they had an opportunity to produce an entirely new gallery, they had some initial scepticism over whether it should be led by the collections.

First, it occupies a space that is difficult to transport large objects to—a challenge that came into sharp focus with the arrival and installation of the tidal turbine blade (see Chapter 1). The only way to bring large objects into the gallery is to use a crane to lift them in from the side. 'We're all hoping that none of us have to be involved in getting them back out again in ten or fifteen years' time because it's going to be a really tough job!'[415] Second, other recent galleries—*Science City* (2019-) and *Medicine* (2019-)—are rich in historical collections, and therefore senior management felt that *Energy Revolution* needed to be and do something different. And third, contemporary energy material was scarce in the Science Museum's collections, so an object-rich gallery would require a substantial number of acquisitions and loans.[416] Initially, the Masterplan team was hesitant to pursue a major collecting project. However, as Rose recalled, they were also ambivalent to the gallery being interactive, given how costly it is to maintain the technologies. That being so, 'we did spend a bit of time at the beginning thinking, well, if it's not that *and* it's not that, then what is it?[417]

During this very early phase of the project (from late 2020), Alexandra Rose was acting as Lead Curator. Presiding over the Environmental Science and Technology collection, and having an active and sustained focus on climate change across her work, naturally, she was approached by senior managers to produce a curatorial brief for a gallery that was dealing with climate change and sustainability.[418] As Roger Highfield (SMG Director of Science) recalled, when he and his Executive colleagues decided to pursue a new gallery project, 'the top-line pitch was just really easy': they believed that the time was opportune for the Science Museum to explore 'the fastest energy transition in history'.[419] He produced a '*let's get the sponsor excited* document' with Ian Blatchford (SMG Director), which provided a headline overview of the gallery.[420] Once Adani Green Energy agreed to provide financial support, the project was launched. As a factor that permitted the gallery's existence, the context of

[413] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[414] Interview with Roger Highfield (Science Museum). 10 June 2025.
[415] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[416] Ibid.
[417] Ibid.
[418] Ibid.
[419] Interview with Roger Highfield (Science Museum). 10 June 2025.
[420] Ibid.

sponsorship resides in the curators' exosphere. Responsibility for content development was passed on to the Lead Curator, who, at that point, was Alexandra Rose.

For many reasons, one of which being that Rose was studying for her PhD, in the summer of 2021 she passed on the role of Lead Curator to Oliver Carpenter. Together, they established the 'big idea' and 'narrative concept' of the gallery when compiling the Design Brief: the document through which the Museum procures a gallery designer. This original Brief, reflecting the 'coyness' around what the gallery would look like, was 'thin on objects'; the curators had not yet identified how many, and which, objects to include in the gallery.[421] But through 'more and more iterative conversations', the curators concluded that it was appropriate for a gallery on energy systems to have 'really big, striking objects' to 'convey that sense of scale' of the sustainable transition.[422]

The curators, therefore, led the way in developing *Energy Revolution* as an object-centred gallery. Oliver Carpenter remembers, in an almost epiphany-like moment, walking into the empty shell of *Atmosphere* and realising that he had the freedom to 'start from scratch'; 'we were starting from a blank sheet of paper', so 'let's fill it with our own stuff'.[423] Carpenter emphasised that objects are 'the reason for people to visit a museum'. Looking to his personal, micro-level agency over the gallery, he stressed that within his own practice, he pivots around objects 'as the initial point of interest and appeal' for audiences.[424] With his strong conviction that the gallery should take a historicising approach, uniting 'historic' and 'contemporary' objects, he recognised that 'you can see my stamp on this gallery'. He sees it as following in the wake of other Science Museum galleries that were shaped by 'strong personalities': with *Mathematics* being 'a 'David [Rooney] gallery', and *Information Age* 'a Tilly [Blyth] gallery'.'[425] Bringing a wealth of collections into *Energy Revolution* marks his stamp of ownership over the gallery—an Oliver Carpenter gallery.

As I have demonstrated in this section, a variety of agencies from across the curators' microsphere, mesosphere, exosphere, macrosphere and chronosphere played a part in shaping the transformation of *Atmosphere* to *Energy Revolution*. I summarise these in Table 2.1.

[421] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[422] Ibid.
[423] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[424] Ibid.
[425] Ibid.

Table 2.1 Summary of Ecological Agencies in Gallery Contexts: *Energy Revolution*

Agencies Supporting and Shaping the Curators' Transformation of the Gallery				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
Collections Curators played a major role in *Energy Revolution*, which was not the case with *Atmosphere*.	The physical media of *Atmosphere*, namely its interactives, were wearing down and showing their age.	Adani Green Energy agreed to financially support a new gallery on the energy transition.	The curators perceive their wider landscape to be more concerned with the social dimensions of climate change.	Curators are aware that climate change is not being 'debated' in the same ways that it was in the late 2000s.
During the Design Phase, the curators decided that the gallery should centre around objects and pushed for this approach.	There was no budget to accommodate updates and high maintenance costs, discouraging the development of a new interactive gallery.		The curators are conscious to bring in 'global' perspectives on climate and energy, rather than assume a Global North-centric position.	There has been a shift in public and curatorial attitudes from seeing museums as 'neutral' authorities, to critiquing their subjectivities.
The curators are historians, which fed into the gallery taking a long, historicising view of energy transition.	The Masterplan and Executive teams realised that a wholescale gallery replacement was feasible (and desirable).			
	Audience Research confirmed that audiences, broadly, understand that energy transition is necessary for society.			
	Audience Research found that visitors engage most with stories of climate and energy when they have personal relevance.			
	The long lifespan required of galleries means that intellectual content has to remain 'relevant'. Curators are disinclined to engage purely with the 'contemporary'.			

From *Kids' City* to *Our Changing Planet* at Thinktank

I now turn to *Our Changing Planet* as a point of comparison to *Energy Revolution*, examining the similarities and differences in the context of its transformation from a previous gallery. I argue that is crucial to situate and analyse these contexts in relation to the approaches that the curators took to interpreting the changing planet for a permanent gallery. Like *Energy Revolution*, *Our Changing Planet* engendered a complete overhaul of the space that it inhabits in Thinktank, located on the second floor of the building. Before the new gallery opened in May 2021—when the UK Government lifted the Covid-19 lockdown restrictions on museums—the area had been occupied by *Kids' City*: an interactive space where children could role-play as the governors, workers and residents of a city. Following the closure of *Kids' City*, the Museum's dedicated play gallery was relocated to the third floor and renamed *MiniBrum* (which opened in 2019).

When it was *Kids' City*, the gallery had a huge water feature that children could play in. *Kids' City*—with its water feature—had been in place at Thinktank since it opened in 2001. That being so, by the late 2010s, it was becoming clear to staff that the gallery was 'starting to show its age', with the water feature becoming increasingly liable to breaking down and needing maintenance. This provided some of the impetus to remove the water feature and carry out a wholescale redevelopment of the gallery.[426] Underpinning the transformation of the gallery space—both physically and conceptually—then, was this meso-level, tactical drive towards sustainability, both in terms of cutting expenses while also reducing the building's consumption of water and electricity.

Another meso-level factor relating to the financial sustainability of Thinktank—which spurred the development of a new gallery—was the incentive to attract new audiences to the Museum. When *Kids' City* was open, the second floor of Thinktank—where the gallery was located—used to provide the main entrance to the Museum. The entrance moved down to Level 0 during the pandemic, at the same time that *Kids' City* was dismantled, and it has remained there since. Although *Our Changing Planet* is not now positioned near the entrance, in the early stages of planning in the late 2010s, the fact of its location was nonetheless important to the conception of the gallery.

Felicity McWilliams (Curator of Science and Industry) was not employed by Birmingham Museums at this time, but she spoke to an awareness at Thinktank that older children and

[426] Interview with Lukas Large (Thinktank). 6 February 2023.

adult visitors who were arriving at the Museum felt discouraged from entering because the first gallery they were greeted by was *Kids' City*. There was an apprehension amongst staff that these visitors were thinking 'this isn't for me, or I might not be allowed in here if I don't have kids with me.' [427] McWilliams also noted that at the time, there had not been much programming, galleries and exhibitions that were tailored towards adults and young people.

So, by developing a gallery that engages with climate change, staff and stakeholders at Thinktank—including stakeholders from the Millennium Point Trust, which loans the building to the Museum and provides financial support for its activities—were aiming to attract young audiences of secondary level and above: 'kids thinking about what they might like to study for GCSE, A Level, university, and so on.'[428] Being an external organisation with a stake in Thinktank's activities, I locate the Millennium Point Trust in the curators' exosphere. The gallery is an offshoot of the Millennium Point Trust's charitable remit around developing learning and skills in STEM. Having ties with the University of Birmingham, they work to encourage young people into studying STEM subjects and pursuing STEM careers. As such, they were particularly concerned to support a gallery that was targeted towards young people.[429] *Our Changing Planet* was the first major gallery project at Thinktank that was developed with these aims in mind, and it has since been followed by a small gallery of graphic displays telling inspirational stories of working in STEM, called *Find Your Future* [Fig. 2.1].

Lastly, by relocating the children's interactive play gallery to Level 3 and inserting a new gallery with adult- and young person-friendly content, the Museum's management team were not only hoping to attract these new audiences. They were also seeking to engage the 'traditional audience' of the former Museum of Science and Industry (located on Newhall Street); 'there's still quite a lingering affection' in Birmingham for its old science museum, and 'we wanted to attract back some of that audience that were being put off'.[430] Part of this objective to draw in 'traditional audiences' was to create a gallery that employed 'traditional' museum methods. By 'traditional', I mean that objects from Birmingham Museums' collections provide the primary media through which the gallery conveys its intellectual content to visitors, being conceived as the primary source of attraction to audiences.

[427] Interview with Lukas Large and Felicity McWilliams (Thinktank). 12 December 2024.
[428] Felicity McWilliams in ibid.
[429] Interview with Felicity McWilliams (Thinktank). 6 February 2023.
[430] Felicity McWilliams, in interview with Lukas Large and Felicity McWilliams (Thinktank). 12 December 2024.

Similar to *Energy Revolution*, *Our Changing Planet* marked an interpretive shift from interactive- to object-based engagement. As McWilliams asserts, however, this is not part of a wholescale move away in the Museum from interactive- and play-based learning. Rather, the development of *Our Changing Planet* on Level 2 as an object-centred gallery was more the product of 'conscious thinking' around how, 'within the constraints of this slightly odd building', the Museum could make space for its diverse audiences across its four floors.[431] Moreover, there were practical impediments to developing a new interactive gallery at this time. Namely, the macro-level guidelines that the Museum had to follow to be Covid-secure upon reopening after lockdown, resulting in the cordoning off or removal of interactive exhibits that required visitors' physical touch.

But unlike the Science Museum's *Energy Revolution*, *Our Changing Planet* was not developed in a context of replacing a former climate change gallery. Therefore, the curators' framing and interpretation of the changing planet was not responding to a gallery precedent in the institution. The factors shaping their adoption of the Anthropocene as the defining concept for the gallery were influenced more by their personal, micro-level excitement to engage with its ideas through the medium of Birmingham Museums' collections, as opposed to building on the lessons learned from a previous engagement with climate change. In many ways, *Our Changing Planet* was experimental for its curators. This is both in the sense that they had not developed a climate change gallery before, but that they were working with a scientific concept that is still being studied, theorised and debated, and as such, their practical approaches to interpreting the issue were likewise unprecedented.

[431] Ibid.

Table 2.2 Summary of Ecological Agencies in Gallery Contexts: *Our Changing Planet*

Agencies Supporting and Shaping the Curators' Transformation of the Gallery				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
The curators were personally excited to work with the Anthropocene concept. They were not responding to a precedent for a climate change gallery in the institution.	The water feature in *Kids' City* was unsustainable to maintain. Removing it from the gallery permitted a wholescale redevelopment.	The Millennium Point Trust—which leases the building to Thinktank and provides financial support—was eager to back a new gallery targeted to older children.	Following guidelines to be Covid-secure meant that developing an interactive gallery would have been hazardous.	Museum staff redeveloped the gallery as a way to emulate Birmingham's old, 'traditional' science museum.
	Staff perceived that *Kids' City* was putting off adults and older children from entering the Museum. This provided impetus to develop a new gallery targeted to these audiences.	The Millennium Point Trust has an interest in supporting activities in Thinktank that broadly encourage young audiences to engage with key issues in STEM.	Museum staff sensed a nostalgia amongst Birmingham residents for the former science museum and its historic collections.	

Gallery Temporalities: Conceptualising Time and Interpreting Objects to Explore the Past, Present and Future of the Changing Planet

Interpreting Objects Through the Energy Revolution: A Historical Meta-Event

Energy Revolution conceives our past, present and future worlds as belonging to the 'Energy Revolution': a historical meta-event leading to an anticipated low-carbon future. Through the 'Energy Revolution', the gallery proposes a future-oriented historical period that centres on the agency of the energy transition to transform human lives and thus induce historical change. In this way, it frames the changing planet as the *context* to history-defining adaptations, transitions and innovations. It is a conceptualisation of time and future history based on the human responses and 'solutions' to their changing climate.

> 'To avert the worst impacts of climate change, we must urgently transition towards lower-carbon sources and uses of energy. […]
>
> 'There are many routes to a low-carbon energy future if we act now. Which will we choose?'[432]

Like its revolutionary predecessors—the 'Agricultural Revolution', 'Industrial Revolution' and 'French Revolution', to name a few—the Energy Revolution denotes both a process and an era. Designating the energy transition as a 'Revolution' is a somewhat Marxian view of history and historical processes (in a bare-bones sense of Marxian). The Energy Revolution event, in theory, entails the *struggle* between modes of energy production: deposing the economic and political dominance of the fossil fuel industry and replacing it with sustainable modes of energy.[433] Nevertheless, I am not arguing that the gallery itself adopts such a conceptualisation of the Energy Revolution, given that it does not overtly challenge the socio-political and economic power of fossil fuels. Rather, the 'Revolution' it examines is primarily technological; the removal of carbon-intensive practices from systems of energy production and consumption.

Given my focus on curatorial practice, however, I consider it misplaced to extend my critique of the 'Energy Revolution' as a historiographic concept in the gallery. Gallery and exhibition titles do not usually fall within the remit of the Science Museum's curatorial team. The

[432] Introduction panel, *Energy Revolution: The Adani Green Energy Gallery*.
[433] See Kolya Abramsky (ed.), *Sparking a Worldwide Energy Revolution: Social Struggles in the Transition to a Post-Petrol World* (AK Press, 2010).

Energy Revolution was not purposely selected by the curators as a periodisation of history and anticipation of the future. Instead, gallery and exhibition titles in the Science Museum are 'a whole different ball game' to curating. Located in curators' mesosphere, the work in selecting gallery titles is 'about PR [public relations]. It's about Communications. Unfortunately, it's not about us.'[434]

So, while in many ways the Science Museum curators functioned as historians on the gallery—bringing the past, present and future together to construct an overarching narrative—this historical agency does not extend to the selection of Energy Revolution as a periodisation. Nevertheless, Oliver Carpenter does extend his micro-level, historical agency to *critique* the title. He acknowledges that the periodisation suits the primary message of the gallery that we are living through a wholescale paradigm shift from carbon-intensive to low-carbon energy systems. But with his historian's training, he nonetheless considers 'Revolution' to describe this transition as problematic, given that it has connotations of massive regime changes and overhauling political and social worlds: dimensions that are not interrogated in the gallery.[435]

He also lent his historical critique to Blatchford and Highfield's characterisation of the gallery as being concerned with 'the fastest energy transition in history'. Taking a long view of change in energy systems leads him to deduce that the transition is *not* as fast as they claim. But he also questions whether the speed at which the energy transition is taking place is really the point of the gallery. Rather, the point is to understand *what*, *why* and *how* it is taking place.[436] Drawing on his chronosphere to conceptualise his lived experience of *historical change*, he reasons that emphasising the rapidity of such change would ascribe too much agency to 'contemporary' and 'future' techno-solutions, overlooking the agency of long-existing technologies and practices.

But he recognises that the 'the academic world and the museum world *are* different.'[437] One of the most notable distinctions being that the primary objective of museums' Public Relations teams is to promote and sell a gallery to diverse public audiences, attracting their attention and hooking their interest. They are less concerned with how gallery titles will come under nuanced academic scrutiny.[438] While Science Museum curators did not have the final

[434] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[435] Ibid.
[436] Ibid.
[437] Ibid.
[438] Ibid.

say in naming *Energy Revolution*, the 'curatorial sphere of influence and power' lies deeper, in the content and stories of the gallery. Through their personal, micro-level agency as historians, the curators exercise a historical critique through their selection and interpretation of objects to construct an anticipated history of a low-carbon future.

To the historians Gross and Needham, the role of historians—which I argue includes Science Museum curators, as interpreters of history—in facilitating the energy transition is twofold. First, they can provide a broader perspective on the political, economic and social dimensions of energy transitions as they have played out in the past. This knowledge of the entanglement of energy systems in human lives and societies transcends the often techno-centric discussions of policymakers, economists, engineers and scientists. Second, analysing *past* energy transitions can be inspirational—providing evidence of meaningful change—while also disputing perspectives that emphasise *future* technologies as solutions to the energy crisis and climate change, which delay action in the present.[439]

Energy Revolution provides such perspectives, and the curators deliberately took a long view to harness the past as evidence of large-scale energy transition as well as to stress that achieving sustainability cannot depend on future techno-fixes. 'There are no new ideas. There are *new applications* for *old ideas*. [*Energy Revolution* is] not about 'the new technology needed', 'the next technology', 'we need a breakthrough', or whatever. No, we don't need that.'[440] They situate low-carbon futures as relying on a blend of 'old' technologies with 'contemporary' innovations, applications and adaptations.

The three content zones of the gallery are 'Future Planet', 'Future Energy' and 'Our Future', further embedding the Energy Revolution as a future-oriented conceptualisation of time. While there is no strict wayfinding between the sections, 'Future Planet' and 'Our Future' serve as bookends to 'Future Energy', which has a considerably larger physical and intellectual footprint. Both ends provide introductions to *Energy Revolution* because they are situated at the two points of entry into the gallery; a meso-level facet of its physical layout that hinders the demarcation of a linear route.[441] Even so, the curators still identify an ideal narrative journey through the gallery.

[439] Stephen G. Gross and Andrew Needham, 'Introduction: Toward a New Energy History', in Stephen G. Gross and Andrew Needham (eds.), *New Energies: A History of Energy Transitions in Europe and North America* (University of Pittsburgh Press, 2023), 8.
[440] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[441] Science Museum, '*Energy Revolution* Interpretation Plan', 13.

This journey would proceed from ‘Future Planet’. Containing objects from her collections remit, and considering her expertise on climate science, Alexandra Rose led the content development for ‘Future Planet’. This zone contains the Keeling flask examined in Chapter 1, which features in a display case of twenty-two meteorological and oceanographic instruments [Fig. 2.2]. The purpose of this display is to contextualise the energy transition in the scientific evidence of climate change. These instruments do not only speak to the observation of past and present climates and evidencing how they have changed. They also communicate how observations of the atmosphere and oceans feed into models of potential future climates.

The objects here serve as the ‘incentive of urgent action’ through energy transition;[442] they signify how practices of climate science and climate modelling are spurring and shaping the massive changes taking place across energy systems. These objects—ranging from ‘historic’ to ‘contemporary’—include two nineteenth-century marine barometers; nineteenth- and twentieth-century rain gauges; a sunshine recorder (1959); a temperature and humidity sensor (2010); and a radiometer for measuring sea surface temperatures from space (1995). They provide a *tangible* connection to the agency of science and scientific research in driving the energy transition.

However, the remainder of ‘Future Planet’ interprets the context of the energy transition in *intangible* ways. Two digital exhibits provide more in-depth information on climate modelling than can be provided by objects and their interpretation. One of these is a film developed in collaboration with the Met Office about the Resilience and Preparedness to Tropical Cyclones across Southern Africa programme (REPRESA). I discussed this film earlier regarding how the curator conceived it as challenging the universalised representation of ‘Science’ in *Atmosphere*, which had abstracted it from social contexts.

As one of the scientists in the film attests, traditionally, climate models have been developed by scientists *in* and *for* the Global North. However, the REPRESA project seeks to address this imbalance in scientific agency and power to take climate action. It is working to tailor their climate models with the communities of southern Africa in mind, supporting them to adapt and build resilience to climate hazards.[443] The purpose of the film, as such, is to both emphasise the agency of scientific modelling in anticipating and acting on the future, but also to extend this future-making agency to scientists and communities in the Global South.

[442] Interview with Alexandra Rose (Science Museum). 7 December 2022.
[443] See Science Museum, ‘Weather Forecasting and Climate Modelling: A Short History’.

The next zone of the gallery, 'Future Energy', dominates the physical and intellectual space of *Energy Revolution*. Along with the case of meteorological instruments from 'Future Planet', the objects are displayed in a radial layout around a central artwork, a kinetic sculpture suspended from the ceiling: *Only Breath*, by Alexandra Carr and Colin Rennie. Featuring objects that fall under his collections remit—Infrastructure and the Built Environment—Oliver Carpenter led the development of 'Future Energy'. The objects that comprise this section are arranged into different themes, which, at an overview, supports one of the key messages of *Energy Revolution*: that a wholescale transition across multiple energy systems, utilising a mix of solutions, is necessary to ensure a low-carbon future.[444] These themes are: 'Transport and Mobility'; 'Buildings and Construction'; 'Demand and Supply'; 'Hydrogen, Wind and Tidal Energy'; 'Solar Energy'; and 'Nuclear Energy'.

Aside from 'Demand and Supply' (its primary exhibit being a touchscreen computer information point, 'How Much Energy Do People Need?'), each section is rich in material, uniting objects of various size, location and age. In 'Gallery Legacies', I explore in more depth the rationale behind the curators' bringing objects into dialogue across time and space and assess the extent to which these practices constitute a subversion of Global North-, techno-centric narratives of 'progress' and 'development'. But for now, I analyse how the curators conceptualised agencies in effecting change on present and future worlds.

The curators employed large-scale, industrial-sized objects in *Energy Revolution* to embody the 'staggering enormity of the endeavour':[445] the size of these objects provide a touchpoint to the macro scale at which energy systems and infrastructures operate, and in turn echo the huge scale at which they are adapting to reduce their carbon impact. Along with the tidal turbine blade (see Chapter 1), other objects that serve to invoke such feelings of awe, wonder and excitement in visitors include the parabolic trough solar mirrors [Fig. 2.3] and the section of the Zero Energy Thermonuclear Assembly (ZETA) fusion experiment [Fig. 2.4]. Also underpinning the curators' rationale to display the macro-scale materiality of energy transition was to foreground the macro-level agencies in engendering change and shaping future worlds. Speaking to Oliver Carpenter's personal, micro-level agency over the gallery, it was a deliberate decision to 'take the concern or the worry off' the individual:

[444] Science Museum, '*Energy Revolution* Interpretation Plan', 8.
[445] Interview with anonymous participant (Science Museum). 31 January 2023.

> ‘System change, not climate change, right? This is a big deal. You can't have a thousand-acre solar farm in your garden. An individual can't have a nuclear power station. This is not something, on this huge global scale, that any one individual can transform. The transformation is endemic—it goes across all kinds of boundaries.’[446]

The inspiration behind this foregrounding of the macro-level agencies of industry and ‘big tech’ in climate action arose, in large part, from the curators’ turning to the IPCC for information to guide content development for gallery. Being an external source of knowledge located in their exosphere, the curators drew on the IPCC’s target sectors for decarbonisation and mapped these onto *Energy Revolution* as an organising principle. Entrusting the IPCC as an ‘authoritative scientific body’ to inform the content, themes, messages and structure of the gallery was an ‘easy’ decision for the curators.[447] Building on the work of thousands of scientists, Carpenter spotlights the authority of the IPCC’s findings, knowledge and recommendations: ‘it’s really rigorous and evidence-based, and the opposite of speculation and lack of evidence. It’s really respected. […] It was an outside source that people understand.’[448]

Given the politicised nature of climate change, along with the Museum’s legacy in seeking to address public mistrust in climate science, it is no wonder that the curators were conscious to obtain knowledge and inspiration from a globally respected and influential body of big Science. It provided them with a safe, established base of evidence from which they could assert the politically-implicated message that endemic systems change is needed to mitigate and adapt to climate change. Indeed, the voice of the IPCC features as one of the inspirational quotes bookending the gallery: ‘The choices and actions implemented in this decade will have impacts now and for thousands of years.’[449]

Emphasising the authority of the IPCC goes hand-in-hand with emphasising the agency of industry and ‘big tech’ in tackling climate change and shaping future worlds. These exo-level agencies are central to the curators’ conceptualisation of evidence-based scientific integrity. Promoting ‘system change’, ‘endemic transformation’, ‘big investment’ and ‘big technology’ is grounded in the sources of information that they consulted for the gallery: stemming from the ‘influential people’ they spoke to, and the ‘influential writing’ they read.[450] However, I contend

[446] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[447] Ibid.
[448] Ibid.
[449] ‘Our Future’ panel, *Energy Revolution: The Adani Green Energy Gallery*. Citing the IPCC’s Sixth Assessment Report (2023).
[450] Interview with Oliver Carpenter (Science Museum). 9 January 2025.

that this macro view of the energy transition also relates to Carpenter's micro-level agency. With his collections being taxonomized as 'Infrastructure and the Built Environment', he views himself as a 'curator of technological systems': looking at 'how isolated artefacts that the Museum collects are connected.' In turn, '[having] that infrastructure view is necessarily a bit of a step back [to look] at things in a broader context.'[451] He analyses and interprets his collections in terms of their working together in macro-level 'technological systems'.[452]

Although it was important for Carpenter to stress macro-level agencies in the energy transition, the gallery does nevertheless draw attention to micro-level, individual stories of change. Highlighting individual people and their agency in the energy transition relates back to the 'people-centred' framework located in Science Museum curators' mesosphere. From their front-end evaluation, the Audience Research team recommended that the gallery interpreted the 'global story' of the energy transition in ways that were 'relevant to visitors' lives', ensuring that stories and messages had 'personal relevance'.[453]

One of the curators on *Energy Revolution* corroborated that a focus on 'people' is a unifying principle of curatorship in the institution; they discern that 'attitudes and behaviour are more important than the tech itself. More important than the science. And I think that's a cross-cutting theme across everything we do.'[454] I argue that this people-centred framework has initiated a substantial paradigm shift in science curatorship over the last few decades, both within the Science Museum and beyond. Science curators now orient themselves around the 'human stories' of their collections and consciously avoid abstracting science and technology from their social worlds.

While Carpenter laid greater emphasis on foregrounding macro-scale agencies in the gallery, the curator quoted above was concerned to spotlight 'grassroots change and how that intersects with energy'.[455] In their individual, micro-level agency over the gallery, they were eager to 'speak to that idea of innovation not needing to happen in a lab or in a specific, traditional site of science': to demonstrate that 'change [does not need] to be made by traditionally powerful change-makers like politicians or big research universities'.[456] They are personally drawn to individual stories of change and innovation from people all around the world; 'to show that one person's endeavour is to be celebrated, especially if it's worthy

[451] Ibid.
[452] Ibid.
[453] Science Museum, '*Energy Revolution* Interpretation Plan', 7.
[454] Interview with anonymous participant (Science Museum). 31 January 2023.
[455] Ibid.
[456] Ibid.

of going in a museum. […] Showing that each individual person is part of a collective endeavour, and that's where the strength lies—I think that's really nice.'[457]

Objects that were selected to convey micro- and meso-scale agencies—emphasising the role of individuals and communities in the energy transition—include the dwarfism bicycle, which was developed by Islabikes and the Dwarf Sports Association to make low-carbon travel more accessible to little people (accompanied by a photograph of the bicycle's donor, Steve Scott) [Fig. 2.5]; ephemera for the Solar Giraffe, a solar-powered mobile phone-charging bank in rural Mozambique (accompanied by a photograph and quote from Sónia Preciosa Langa, one of the managers of Solar Giraffe) [Fig. 2.6]; and printed material relating to the Dover Sun House (Massachusetts, USA), the first home heated entirely by solar power, built in 1948 by Maria Telkes and Eleanor Raymond (accompanied by a photograph of Telkes adjusting the controls of the house) [Fig. 2.7]. Images and quotes from individuals also enrich the interpretation of some of the 'big tech', giving a human face to the science, technologies and industries of energy. For example, there are personal stories from Eileen Linklater, who works for the European Marine Energy Centre on Orkney; Zineb Aghzou, who is an engineer in a solar power plant in Ouarzazate, Morocco; and Mark Henderson, who is one of the scientists working on the ITER nuclear fusion experiment in southern France.

As I have examined in this section, a number of interacting agencies from across the curators' microsphere, mesosphere, exosphere, macrosphere and chronosphere were influential in guiding their interpretation of history, anticipation of futures and designation of agency in future-making. These are summarised in Table 2.3.

[457] Ibid.

Table 2.3 Summary of Ecological Agencies in Gallery Temporalities: *Energy Revolution*

Agencies Supporting and Shaping the Interpretation of History and Future-Making				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
As historians, the curators were wary of techno-centric solutions. They took a 'long view' of the energy transition to stress that sustainable technologies exist and there is no need to delay action.	The Science Museum's Communications team selected the 'Energy Revolution' as a gallery title—thus a periodisation of our current era.	The findings and recommendations of the IPCC provided a key body of knowledge for the curators to draw upon. They deem it to be reliable and having scientific integrity.	The curators foreground the science and perspectives of the IPCC because they judge it to be a publicly recognised and respected source of information.	Carpenter is sceptical to conceptualise the Energy Revolution as 'the fastest transition in history'. This would grant too much agency to 'contemporary' and 'future' technologies.
Different sections of the gallery were led by different curators. Rose and Carpenter oversaw 'Future Planet' and 'Future Energy' respectively because these sections spoke to their collections and subject expertise.	The Executive team set out in the project brief that it would be a 'global' gallery. In particular, it should feature stories of the energy transition that speak to the Global South.	The IPCC provided organisational principles for the gallery, inspiring the demarcation of themes. These spoke to the IPCC's targets for decarbonisation.		
Carpenter's emphasis on macro-level change was inspired by his 'infrastructural' perspective and 'systems thinking' approach to his collections (taxonomized as Infrastructure and the Built Environment).	The Audience Research team's front-end evaluation stressed that certain content in the gallery should have 'personal relevance' and relate to people's lives.	In developing the gallery, curators consulted individuals, organisations and research that stressed the need for systems change—over individual change—in mitigating and adapting to climate change.		
One curator was eager to foreground micro-level change. They are personally drawn to stories of grassroots innovation and celebrating the endeavours of individuals.	Including stories of micro-level change conforms to the general trend in Science Museum curatorship (and science curatorship more broadly) towards 'people-centred' perspectives.			

Interpreting Objects Through the Anthropocene Meta-Epoch

While the Science Museum conceives our past, present and future on the changing planet as belonging to the solutions-oriented epoch of the 'Energy Revolution', Thinktank's *Our Changing Planet* unites the past, present and future into the 'Anthropocene' meta-epoch that entangles human and Earthly histories. I say 'meta-epoch' because in the gallery, it is used to encapsulate multiple eras of history: 'Prehistory' [Fig. 2.8], 'The Columbian Exchange' [Fig. 2.9], 'The Industrial Revolution' [Fig. 2.10], 'The Age of Plastics' [Fig. 2.11] and 'The Great Acceleration' [Fig. 2.12].

The Anthropocene denotes a planetary epoch in which humans have been the primary agent of change on Earth (see Introduction). Earth scientists have found compelling evidence for the Anthropocene, finding traces of dramatic human impact across all planetary systems: in the lithosphere (rocks), hydrosphere (water), cryosphere (ice), atmosphere (air) and the biosphere (living things).[458] Nevertheless, the concept has also had profound impact on arts and humanities scholars, who provide their own perspectives on the evidence and effects of the Anthropocene. Humanities perspectives foreground the Anthropocene as marking a rupture in the relationship between humans and the planet, and the transformation in human attitudes towards their environment.[459] As such, a diversity of perspectives—from across the sciences, humanities and arts—enrich the debate on when the Anthropocene 'began'. This interdisciplinarity of Anthropocene studies was a crucial exo-level influence over the content development for *Our Changing Planet*. The interdisciplinary debate of the Anthropocene's origins is precisely what Birmingham Museums' curators—Lukas Large and Felicity McWilliams—set out to explore.

Adopting an Anthropocene framing, as *Our Changing Planet* demonstrates, can have a phenomenal impact on the interpretation of history, including the ways that curators interpret the historical significance of objects. In particular, it demands an integration of concepts and methodologies from the sciences and humanities to study the entanglement between 'human history' and 'Earth history'.[460] Being inherently critical of the dualistic separation

[458] Wolfram Mauser, 'Global Change Research in the Anthropocene: Introductory Remarks', in Eckart Ehlers and Thomas Krafft (eds.), *Earth System Science in the Anthropocene: Emerging Issues and Problems* (Springer, 2006), 3-4.
[459] Clive Hamilton, Christophe Bonneuil and François Gemenne, 'Thinking the Anthropocene', in Clive Hamilton, Christophe Bonneuil and François Gemenne (eds.), *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch* (Routledge, 2015), 3. Also see Heather Davis and Zoe Todd, 'On the Importance of a Date, or, Decolonizing the Anthropocene', *ACME: An International Journal for Critical Geographies*, Vol.16(4), (2017), 761-780; Simon L. Lewis and Mark A. Maslin, *The Human Planet: How We Created the Anthropocene* (Yale University Press, 2022).
[460] Libby Robin and Will Steffen, 'History for the Anthropocene', *History Compass*, Vol.5(5), (2007), 1694-1719.

between humans and nonhumans, the Anthropocene provides grounds for museums to question ontologies and disciplinary boundaries: bringing 'science', 'technology', 'natural history', 'social history' and 'art history' into constructive dialogue. This is the case in *Our Changing Planet*, uniting diverse objects from the Birmingham Museums collections. The meso-level context of Birmingham Museums' multidisciplinary collections thus underpinned the curators' engagement with an interdisciplinary concept.

Lastly, by shifting perspectives of history, the Anthropocene provides a springboard to engage in futures thinking. Approaching the concept as a futures-oriented historian (a micro-level agency over the gallery), McWilliams emphasised that:

> 'From a historical perspective, I was less interested in *when did the Anthropocene begin?* And more, *why do we want people to think about that? What do we want them to do with that information?*'[461]

Framing the changing planet through the Anthropocene provided her with an avenue to activate critical, future-oriented historical thinking in audiences. By situating the past and present in a meta-epoch defined by humans' transformation of the Earth, the curators intended to stimulate audiences' thinking around the solutions to safeguard the future for humankind and the planet. This points to a fundamental difference between *Energy Revolution* and *Our Changing Planet* in the chrono-level agencies shaping the curators' engagement with temporality.

Energy Revolution presents a solutions-oriented conceptualisation of time. It defines the past, present and future in terms of humankind's transition towards low-carbon energy and situates the future of humanity in a world where climate change has been mitigated as a result of this transition. *Our Changing Planet*, on the other hand, presents a problem-oriented conceptualisation of time. First, the Anthropocene defines the past, present and (long distant) future in terms of the detrimental impact of humankind on the Earth; a problem that humans need to resolve if they are to maintain planetary habitability and safeguard their future. The 'solutions' to the changing planet are not stated explicitly in the 'Anthropocene', as they are in 'Energy Revolution'.

Second, *Our Changing Planet* presents the Anthropocene as problem-oriented in the sense that it poses questions, without certain answers, for the audiences to contemplate

[461] Interview with Felicity McWilliams (Thinktank). 6 February 2023.

themselves: ‘are we in the Anthropocene?’, ‘when did it begin?’, ‘what caused it to happen?’,[462] and thus ‘how can we all help protect our planet?’.[463] To the curators, the Anthropocene is a purposely ‘messy’ and ‘vague’ temporal frame.[464] The Anthropocene future is uncertain. The only certainty is that the Earth will bear the impact of humankind for millions, perhaps even billions of years to come. Acknowledging that it is a debated scientific concept, the gallery shrouds its interpretation of the past and present as belonging to the Anthropocene in uncertainty as to whether it exists at all.

The questions of ‘when did the Anthropocene begin?’ and ‘what caused it to happen?’ occupy the first zone of the gallery, ‘Making the Anthropocene’. And the epochal candidates for representing the ‘origins’ of the Anthropocene are ‘Prehistory’, ‘The Columbian Exchange’, ‘The Industrial Revolution’, ‘The Age of Plastics’ and ‘The Great Acceleration’. These periods were activated by the curators to provide evidence for the supposed rupture in time in which humans ceased to live in balance with their environment. The curator, Felicity McWilliams, was personally intrigued by the debate around the origins of the Anthropocene precisely because there is no definitive answer.

Exercising her personal agency—shaped by her microsphere—McWilliams was interested to explore how locating the start of the Anthropocene in different moments in time would impact the sense of empowerment that people felt to be able to act on it. Being a historian, she approached Anthropocene literature with a lens on its socio-cultural dimensions, being ‘less interested in the geological evidence’, and more inclined to harness it as a tool to shift perspectives on the past, present and future.[465] In our interview, she drew attention to an article that she had read which discussed how locating the origins of the Anthropocene impacts people’s sense of agency to take action.

Locating the start of the Anthropocene in Prehistory—with the development of farming, early deforestation, or the extinction of megafauna—has ‘potentially drastic consequences for the way people think about it.’ Specifically, it situates a detrimental relationship with the environment as ‘intrinsic to human nature’ and therefore implies that ‘there’s nothing we can do about it.’[466] In contrast, situating the Anthropocene’s origins in the more recent Great Acceleration—when fossil-fuel consumption skyrocketed, among other environmentally

[462] ‘Are we in the Anthropocene? When did it begin? What caused it to happen?’ panel, *Our Changing Planet*.
[463] ‘How can we all help protect our planet?’ panel, *Our Changing Planet*.
[464] Interview with Felicity McWilliams (Thinktank). 6 February 2023.
[465] Ibid.
[466] Ibid.

detrimental activities—suggests that it is more 'undoable'. People may feel 'more empowered that this is a conscious choice that we've made. [Realising that], yes, it's perfectly possible that humans used to live in harmony with the environment and not destroy the planet.'[467] The Anthropocene is a 'powerful concept' to bring to museum objects because it shows how 'historical collections can—depending on how we interpret them—actively shape how we perceive where we are now, and what we do about it.'[468]

McWilliams' eagerness to discuss the historical conundrums of the Anthropocene, again, points to how she and her colleague, Lukas Large, adopted the concept for its inherent ambiguities and complexities. The vagueness and messiness of the Anthropocene—and the posing of questions as to when, and whether, it 'began'—offered a means to empower their audiences as agents of interpretation, deliberation and debate. Activating audiences in this way—inviting them to ask questions of the evidence being presented to them in the Museum—is fundamental to McWilliams' personal perception of curatorship. This was crucial in shaping the investigative tone throughout the gallery.

McWilliams questions the public perception of museums as 'presenters of *truth'* and questions the role of the curator as 'experts' of their collections. Her mode of science curatorship is about looking at collections from different perspectives and asking different questions from them, which, in turn, is carried out with the purpose to 'challenge' and 'surprise' visitors. To leave visitors with more questions than answers. To complexify different issues to visitors. 'It's really important that we don't necessarily present [the content in *Our Changing Planet*] as the *truth*. We present a toolkit for people to navigate these kinds of ethical issues themselves.'[469] The Anthropocene, as such, provided a tool for the curators to problematise history in a time of planetary change, as well as complexify the changing planet as encompassing so many more issues—environmental, social, cultural, economic, political, and so on—beyond carbon-induced global heating.

A crucial part of this toolkit—facilitating audiences' navigation through the complex issues of the changing planet—are the objects employed in the gallery. Objects lead 'Making the Anthropocene' and 'Living in the Anthropocene': the first two zones of *Our Changing Planet*. The final section—which is not so clearly titled, but which I refer to as 'How Can We All Help Protect Our Planet?'—is led instead by infographic displays, containing a small number of

[467] Ibid.
[468] Ibid.
[469] Ibid.

objects. This is not surprising given that this third zone was developed under the leadership of the Learning Manager, while the preceding zones fell to the two science curators.

At the entrance to *Our Changing Planet*—which stands opposite to Thinktank's natural history displays, *Marine Worlds* and *Wild Life*—the visitor is greeted by a specimen of a green sea turtle (*Chelonia mydas*) [Fig. 2.13], which the curators situate as the 'hook' into the gallery. Set in an octagonal case, the viewer journeys around the haunting, empty shell of the turtle to read its story and understand how it encapsulates many of the interconnected issues and complexities of the human-induced changing planet: colonialism, extinction, plastic production and pollution,[470] and anthropogenic climate change.

Through presenting the complex, multifaceted story of the turtle, the gallery introduces the concept of the Anthropocene; 'Turtles show how humanity's impact on the natural world has intensified through time.'[471] To McWilliams, it is a demonstrable case study of the impact of the Anthropocene on object interpretation; 'of how you could you look at one object from these multiple perspectives' of humans transforming their world.[472] Located at the gallery's entrance, the turtle is not confined to any particular period in the history of the Anthropocene. Rather, it embodies a sense of timelessness: the long and enduring impact that humans have had on the Earth and its nonhuman beings.[473]

Like many of the objects in *Our Changing Planet*, the turtle has been 'reinterpreted' in the sense that the curators relocated it into this space and bestowed with 'new' resonances, in this case, pertaining to the Anthropocene. It used to hang from a wall in the kitchens at Aston Hall, one of Birmingham Museums' historic houses. Through the curators' bringing it into dialogue with the Anthropocene, the stories being told by the turtle have been transformed. Stories of human-induced biodiversity loss and extinction of species; the expansion of global networks and colonial regimes; the boom in industrial and manufacturing processes; the threat of chemical and plastic pollution on wildlife; and the impact of rising temperatures on the oceans.

Deploying a nonhuman animal as a resounding symbol of humans' environmental impact speaks to Felicity McWilliams' microsphere of influence. Specifically, her academic interest

[470] Turtles are key actors in the history of plastic production as the first plastics were developed as alternatives to tortoiseshell: a material which was becoming scarce due to over-hunting. See Science Museum, 'The Age of Plastic: From Parkesine to Pollution', 11 October 2019. Available at: https://www.sciencemuseum.org.uk/objects-and-stories/chemistry/age-plastic-parkesine-pollution [accessed 17 September 2025].
[471] 'Green Sea Turtle (*Chelonia mydas*)' object label, *Our Changing Planet*.
[472] Interview with Felicity McWilliams (Thinktank). 6 February 2023.
[473] Ibid.

and involvement in Animal History (being one of the co-founders of the research network, the Animal History Group). ‘Nonhuman animals provide a great perspective [on history] because it forces you to look more widely at the environment and nonhuman factors in [humans’] decision-making.’[474] In his initial thoughts for the gallery’s ‘hook’, however, Lukas Large was drawn to the story of the domesticated chicken, which he perceives as ‘*the* ubiquitous animal of modern times.’ This is both because chicken farming is a massive global enterprise, but also because human practices of breeding have completely transformed chickens from their ‘natural’ state. ‘Anyone looking at a fossil record would be able to instantly see that this is a very weird thing that’s happening right now. And obviously that it’s tied into the whole modern cultural system.’[475] However, there is no object in the gallery to provide a material basis to the symbol of the chicken. I wonder that either an object pertaining to chickens does not exist within Birmingham Museums’ collections, or such an object was not deemed to be so charismatic and visually engaging as the sea turtle.

By considering the presence of the sea turtle (and intended presence of the chicken) in *Our Changing Planet*, I emphasise that it is unusual for a science museum to have access to ‘natural history specimens’ within its collections remit and to subsequently employ those objects for display. Objects from Birmingham Museums’ collection of Natural Science—over which Lukas Large is the curator—pervade the gallery. They include woolly mammoth teeth; cases of butterflies and insects; preserved plants; and taxidermied specimens of a flying lemur, a woolly monkey, an eastern quoll, a platypus, Arctic terns, a woodpecker and a vulture. The fact that natural history objects are included in the display schema at Thinktank, in *Our Changing Planet*, *Marine Worlds* and *Wild Life*, is due to the Museum’s (and the curators’) working within a trust that presides over the collections as a whole, rather than silos them according to institution. This meso-level circumstance removed barriers for the curators to harness multidisciplinary collections in *Our Changing Planet*. In turn, this supported and spurred their engagement with the Anthropocene concept.

While early ideas for the gallery had centred around Large’s curatorial specialism—natural history—the more that he and his colleagues researched the Anthropocene, the more they realised that it would permit them the exciting and unusual opportunity to integrate many different objects. It was an opportunity to bring together and critically examine multiple strands of history: natural, social, cultural, scientific, technological, and otherwise. This interdisciplinary engagement with the Anthropocene through harnessing multiple objects

[474] Ibid.
[475] Interview with Lukas Large. 6 February 2023.

(which would otherwise be separated by arbitrary disciplinary boundaries), in turn, echoed the broader literature around the Anthropocene: dialogues which are enriched by many different disciplines, methodologies, perspectives and bases of evidence.

Taking an interdisciplinary approach—engaging multiple collections and subject areas—was also deemed by the curators to have the added meso-level benefit of attracting a broad range of audiences and sparking a variety of interests. As Large reflected: 'Visitors might be interested in the wildlife side of things, or they might be interested in the Industrial Revolution side of things. We were looking for different entry points for people to engage with it, covering as wide a variety of interests as possible.'[476] Similarly, McWilliams considered that challenging disciplinary boundaries—questioning notions of what traditionally 'belongs' in a science museum—created 'surprising' and 'unexpected' encounters that attract and engage the visitors' attention and critical thinking.[477]

One such object that was construed as providing a 'surprising' encounter was the Bronze-Age gold torc [Fig. 2.14]. I now turn to this object as another case in point to analyse the curators' motivations and practices in developing *Our Changing Planet*. This object—a twisted gold bracelet—belongs in the 'Prehistory' sub-section of 'Making the Anthropocene'. In this context, it supplies 'evidence' that the Anthropocene originated in prehistoric human practices. While Large and McWilliams *oversaw* the content for *Our Changing Planet*, the interpretation for this particular object was provided by Peter Reavill and Victoria Allnatt, who worked as Finds Liaison Officers for Birmingham Museums on behalf of the British Museum's Portable Antiquities Scheme. They worked closely with the curators at Birmingham Museums—supplying specialist knowledge and advice on archaeological collections—but they were nonetheless independent of the curatorial team. When the curators decided to analyse 'Prehistory' as a starting point for the Anthropocene, 'they hit a crisis point where they needed archaeological support.'[478]

At first, the curators had consulted archaeologists at Birmingham University to provide interpretive support. While their research was rich and extensive, it was nonetheless so 'academic', 'technical' and 'detailed' that Large and McWilliams were overwhelmed with information. As Reavill recalled, 'it wasn't fit for purpose for what they needed it for'—a publicly-accessible museum gallery. This was when he and Allnatt came to assist on *Our Changing Planet*—quite late in its development—supplying interpretation for the

[476] Interview with Lukas Large (Thinktank). 6 February 2023.
[477] Interview with Felicity McWilliams (Thinktank). 6 February 2023.
[478] Interview with Peter Reavill (former Finds Liaison Officer at Birmingham Museums). 28 November 2023.

archaeological objects in 'Prehistory'.[479] They interpreted the significance of the gold torc for the Anthropocene in relation to the fact that it had been, presumably ritualistically, buried in moorland. Being about 3,500 years old, it speaks to a climatic shift in Bronze-Age Britain when the weather turned colder and wetter. As such, archaeologists believe that it was buried in a wetland bog as an offering to encourage better weather conditions.[480] To Reavill, it speaks to how 'climate has always had a huge bearing on how we as a society interact with our landscapes.'[481] Archaeologists of Prehistory, like Reavill, have found that many objects of that time were buried in 'liminal zones'—environments 'between safe and unsafe, farmed and unfarmed, natural and controlled'. They theorise that these liminal zones fluctuated throughout Prehistory due to humans' impact on landscapes and ecosystems in their transitioning from hunter-gathering to agriculture, which subsequently increased practices of deforestation and land-clearing. As a result of altering their environment, human societies faced environmental consequences such as increased flooding.[482]

In the remainder of 'Making the Anthropocene', objects pertaining to 'The Columbian Exchange', 'The Industrial Revolution', 'The Age of Plastics' and 'The Great Acceleration' function as *symbols* of human agencies in transform their environment. Like the gold torc and the sea turtle, if one was to look at the objects out of context, they are not literal evidence for the Anthropocene. Rather, they work to *symbolise* the human practices that are implicated in causing the Anthropocene. They are symbols of human agencies in shaping future worlds, unlike the objects in *Energy Revolution*, which are literally employed by people in practices of future-making through the energy transition.

This links back to how the curators consciously approached *Our Changing Planet* as an opportunity to think about Birmingham Museums' collections in new ways, asking new questions of them that pertain to the 'vague' and 'messy' concept of the Anthropocene. They were not looking to the objects to provide definitive answers and 'truth' as to whether the Anthropocene exists and when it began. Rather, they were more interested in using the objects as starting points to reflect on bigger ideas, concepts and stories. Their approach to the collections was all about demonstrating how a lens on the Anthropocene can shift perspectives on the ways in which historical objects—and, by extension, human histories—are interpreted.

[479] Ibid.
[480] 'Gold torc found in north Shropshire or south Cheshire' object label, *Our Changing Planet*.
[481] Interview with Peter Reavill (former Finds Liaison Officer at Birmingham Museums). 28 November 2023.
[482] Ibid.

And finally, in contrast to *Energy Revolution*, the futures thinking aspect of the gallery is much more conceptual and much less explicit. Nevertheless, the two galleries are similar in the sense that they harness objects—past and present—as *evidence* for anticipating future worlds. In *Energy Revolution*, that future world is situated and certain. It is a future in which the energy transition has been successful—human societies have embraced sustainable ways of living, and in doing so have mitigated and adapted to the climate-changing world. In *Our Changing Planet*, however, it is less certain what the future world of the Anthropocene will look like. In this way, and unusually for a permanent gallery, the curators have employed aspects of *speculative* thinking (see Chapter 3). Thinking about the future in ways that are less sure of the outcomes.

In this analysis of *Our Changing Planet*, I have demonstrated that a range of ecological agencies have worked together in shaping the curators' engagement with the Anthropocene through the medium of Birmingham Museums' collections. I summarise these agencies in Table 2.4.

Table 2.4 Summary of Ecological Agencies in Gallery Temporalities: *Our Changing Planet*

Factors Supporting and Shaping the Curators' Interpretation of History and Future-Making				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
As a historian, McWilliams was motivated to explore how the Anthropocene impacts the interpretations of history and perceptions of agency.	Anthropocene debates are inherently multi-disciplinary. Birmingham Museums' diverse collections enabled the Curators to reflect this.	The diverse collections were seen to provide different 'entry points' for visitors, being anticipated to attract a broad public.	Together, objects convey a broad and collective history of 'humankind'. They are used to ask questions about what it means to be human.	The Curators were drawn to stories that entangled the past, present and future, rather than presenting time as a linear progression.
Central to McWilliams' outlook is to shift perspectives and rouse audiences' curiosity. She was attracted to the Anthropocene because it asks more questions than it answers.	At the time, Birmingham Museums employed Finds Liaison Officers who worked closely with Curators. They provided specialist knowledge and interpretation for the archaeological objects.	McWilliams deems that public audiences benefit from 'surprising' experiences in museum spaces, raising their intrigue and prompting them to ask questions.		
Both Large and McWilliams are drawn to nonhuman histories as perspectives on human histories: Large as a scientist, McWilliams as a historian.	The final, future-oriented zone was developed by the Learning team. This explains the interpretive shift from the previous sections.	The Curators drew knowledge, ideas, discussions and questions from a diversity of literature, spanning across the sciences and the humanities.		
		The final zone spotlights the actions and voices of 'local' changemakers.		
		Inherently, the Anthropocene is a problem-oriented temporality. As such, the Curators pose questions about 'solutions', rather than state them explicitly.		

Gallery Legacies: Shifting Curatorial Practices and Lessons Learned

Subverting Paradigms of Progress in *Energy Revolution*

In this section, I spotlight how the *Energy Revolution* gallery created opportunities for Science Museum curators to shift paradigms of science curatorship. Despite the inherent constraints of permanent galleries—namely, the meso-level demand that they should have long-term 'relevance', avoiding content that could go 'out of date'—I demonstrate how the curators worked around these challenges to work in challenging ways. I analyse and contextualise their agency in subverting the techno-centric framework of linear historical development: the traditional paradigm of Science Museum curatorship. In the Conclusion to this thesis, I talk more to my argument as to why this is an important contribution to promoting sustainable futures on a changing planet.

Through their blend of historic and contemporary objects from across the globe, the curators of *Energy Revolution* sought to challenge Global North-centric paradigm of linear 'progress' and 'development' through time: a paradigm that is exemplified by the evolutionary schema of the Science Museum's *Making the Modern World* gallery. As the Lead Curator, Oliver Carpenter, recalled: 'I was obsessed with time in this gallery […] and all these different kinds of ideas about your role today, and looking forward from the past, looking back from the future.'[483] 'Playing with time'—entangling the past, present and future of energy, rather constructing a linear narrative of technological development—was 'forefront in [Carpenter's] mind' in his approach to the gallery.[484] Specifically, the curators harnessed objects of the *past* as anticipatory evidence for a *future history* of low-carbon energy. The 'solutions' to the energy crisis and climate change do not reside in a techno-utopian future. Rather, 'they are already around us'; they have already been around us for tens, hundreds, even thousands of years.[485]

Harnessing past technologies as active participants in future-making—challenging the idea that each 'new' technology is necessarily an 'advance' on what came before—relates to the curators' academic backgrounds in historical analysis. Carpenter spoke to this point especially. Looking to his microsphere—to his academic background in History—he noted how it is second nature for him to question paradigms of historical 'development', 'progress'

[483] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[484] Ibid.
[485] Ibid.

and ‘advancement’, viewing them as ‘an old-school idea of Whig history’.[486] Referencing his doctoral thesis on the transition from sail to steam in shipping, he is sceptical that technological shifts constitute ‘progress’, particularly when observing them from a present context of carbon emissions-induced climate change. ‘With every technological change—with every quote, unquote advancement—you have to question whether this is actually progress at all [from the perspective of the environmental].’[487]

As he alludes here, Carpenter was reluctant to interpret objects in *Energy Revolution* in terms of their conforming to a narrative of technological ‘progress’ and ‘advancement’ because a techno-centric framing would obscure the relationships between technologies and the human and nonhuman worlds of which they are a part. It would overlook the human actors and agencies involved in the invention and adoption of technologies, and it would overlook how they are impacted by, and exert impact on, their physical environment. Principles of actor-network theory and the social construction of technology are fundamental to the way he interprets objects under his curatorial oversight.[488] Moreover, I argue that it is important for curators and historians of science and technology to reinterpret techno-centric, profit-driven, capitalistic ideologies of ‘progress’ and ‘development’ as implicated in the very processes that have degraded environments and damaged ecosystems.[489]

So, in *Energy Revolution*, the curators were cautious not to interpret sustainable technologies in techno-centric terms of evolutionary progress, situating the ‘latest’ technologies as the most ‘advanced’ and having the most power to impact future worlds. Exercising their historical critique, they instead judged technologies—whether a traditional Fijian canoe [Fig. 2.15], a late-nineteenth-century electric taxicab [Fig. 2.16] or a nuclear fusion experiment from the 1950s[490] [Fig. 2.4]—on the grounds of the extent to which they can inspire and contribute to low-carbon futures.[491] Hence the curators brought objects of diverse age into dialogue, situating them as equal actors in evidencing and effecting the energy transition.

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[486] Ibid.
[487] Ibid.
[488] Ibid.
[489] See Amanda Power, ‘The History and Deep Time of Climate Crisis’, *Worldviews*, Vol.26, (2022), 196-215.
[490] While the curators were cautious to promote concepts of ‘progress’ and ‘advancement’, the object label for this nuclear fusion experiment—developed by the Interpretation team—does nevertheless speak to these ideas. It states that while ‘much was learned from ZETA’, ‘*newer*, more *advanced* experiments’ have now taken up ‘the fusion challenge’ [emphasis added]. (‘Piece of the ZETA fusion experiment, 1957’ object label, *Energy Revolution: The Adani Green Energy Gallery*).
[491] Interview with Oliver Carpenter (Science Museum). 9 January 2025.

Carpenter spotlighted the Bersey electric taxicab (1897) in our discussion. By being an out-of-date technology in terms of its practical functionality, he sees the electric taxicab as able to remain 'relevant'. 'A Tesla from 2024 would look out of date in 2029 or 2035, whereas the 1890s electric car, it's already done that, and it's still relevant. It's as relevant today as it will be in the future.'[492] He situates this 'relevance' in conveying a story of how electric vehicles have long been promoted as alternative modes of transportation to fuel-powered vehicles (and horse-driven carriages), thus positioning contemporary audiences' concerns around transitioning to electric vehicles in a surprisingly long context. Including the object in the gallery was a way to reinforce the overarching message that '*there is no new idea*', and that macro- and micro-level actors in the energy transition would benefit from 'looking to the past to try to solve, or help, our problems of the future'.[493] In addition to that, it fulfils the meso-level objective for the gallery to remain 'relevant' and have 'longevity' across its ten-year-plus lifespan. The electric taxicab therefore kills two birds with one stone. Being an *historic* electric vehicle, it is both conceptually appealing to the curators for its subversion of progress narratives, but also pragmatically appealing for its not being *contemporary*, which would otherwise, he anticipates, go 'woefully out of date' over the gallery's lifespan.[494]

Another avenue through which the curators challenged paradigms of progress was the 'global' remit of the gallery, specifically their conscious embrace of experiences, practices and innovations from the Global South and concepts of just energy transitions.[495] 'One of the biggest challenges will be making our future energy system fair for everyone. This means meeting growing global demand and addressing unequal energy distribution.'[496] In Chapter 1, I examined how curators' acquisition of material for *Energy Revolution* provided a channel for them to redress the dominance of Global-North perspectives in the Science Museum's collections. I contextualised this work by explaining that the brief from the Executive and Masterplan teams had stipulated from the beginning that the gallery should be 'global' in scope. This international focus was eagerly embraced by the curators, who agreed that *Energy Revolution* should analyse the energy transition as a *global* issue. The gallery 'needs to be mindful of everybody's needs around the world.' But the curators were also conscious to not be 'coy', '[expressing] some of the complexities in this topic. It's not simple. If it was simple, we would have done it already.' Among the complexities of the energy transition that the curators sought to address was global poverty and inequality.[497]

[492] Ibid.
[493] Ibid.
[494] Ibid.
[495] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[496] 'Future Energy' panel, *Energy Revolution: The Adani Green Energy Gallery*.
[497] Interview with Alexandra Rose (Science Museum). 19 December 2024.

Objects like the Reeddi capsule rentable battery (2022) [Fig. 1.3]; the ephemera relating to the Solar Giraffe mobile phone-charging bank (2022) [Fig. 2.6]; the model of the solar-powered classroom (2023) [Fig. 2.17]; and the solar suitcase (2018) [Fig. 1.3] are harnessed as evidence of technological solutions to energy poverty in the Global South. The solar-powered Reeddi capsule provides affordable electricity for people in Lagos, Nigeria, to charge their electronic devices, reducing the need for diesel generators as energy demand increases. The Solar Giraffe provides free electricity for people in rural Mozambique to charge their mobile phones, and the ephemera being displayed in the gallery—a t-shirt and posters—provide illustrated instructions on how to use the Solar Giraffe, ensuring that it is accessible to people of all reading abilities. The model of the solar-powered classroom demonstrates how the Simbi Foundation and Unknown Works are repurposing shipping containers as classrooms in India and Uganda, especially for schools that serve rural and refugee communities. And the solar suitcase was designed by We Care Solar to generate solar power for healthcare facilities around that world that have little to no access to electricity.

Together, these objects embody 'grassroots' energy transitions that are tailored to the needs and capabilities of specific communities: 'objects where it's not cutting-edge science, not cutting-edge technology, but it's being used in innovative ways. […] And that can make a huge difference to climate change.'[498] And this relates back to the curators' mesosphere—the people-centred modes of curatorship at the Science Museum—but also the curators' microsphere—their personal motivations to draw out the social contexts and human stories from their collections. One curator carries out their people-oriented and socially-responsible practice with a view to empower their audiences, deconstructing the boundaries of 'science' and removing barriers to participate in it:

> 'I think that one message that that type of [grassroots] object is doing is that there's not one way of doing science. There shouldn't be one template of what a scientist looks like or does. And that you can make change regardless of where you come from and your education'.[499]

I do not, however, describe the curatorial approaches to *Energy Revolution* as 'decolonial'. Indeed, Rose herself acknowledged that decolonisation was not on the gallery team's

[498] Interview with anonymous participant (Science Museum). 31 January 2024.
[499] Ibid.

agenda in a literal sense.[500] The gallery does not overtly explore (neo)colonial practices of energy generation and resource extraction, nor critique the colonial legacies that underpin energy poverty and inequalities across the world. For example, it missed an opportunity to probe ethical questions around the energy transition—in particular, the shift towards electric vehicles and infrastructure—as giving rise to a growing, unsustainable dependency on finite precious minerals that are being extracted through the neocolonial exploitation of people and environments in the Global South.[501]

Lastly, I recognise that *Energy Revolution*'s sponsorship by Adani Green Energy, associated with the Adani Group, puts the Science Museum in an intellectually and morally problematic financial relationship. It raises ethical questions around their seeming endorsement—at least in name—of a corporate conglomerate that profits from the extraction of fossil fuels and the degradation of the environment. An endorsement that compromises the key principles and messages of *Energy Revolution*. Since the gallery's opening in spring 2024, numerous activists and campaign groups have protested the Science Museum's partnership with Adani Green Energy and, by extension, Adani. They call on the Museum to cut *all* ties with fossil fuel companies, which includes subsidiary corporations that generate renewable energy. For example, in April 2025, the National Education Union (NEU) passed a motion to signal its support for teachers and schools who boycott the Science Museum.[502] Groups like the NEU and campaigns like 'Fossil Free Science Museum' situate the institution as morally complicit in the harmful activities of Adani: in its polluting extraction of fossil fuels, its abuses of human rights, and its profiting from selling arms.[503]

But protesters also raise questions around the intellectual freedom for Science Museum employees. From the evidence of Freedom of Information disclosures, Fossil Free Science Museum contend that senior management in the SMG ignored the institution's condemning due diligence report on Adani, and failed to share this report with the trustees who approve sponsorship deals.[504] The SMG Director, Ian Blatchford, responded by stressing how vital it

[500] Alexandra Rose, '*Atmosphere* to *Energy Revolution*'.
[501] See Georgina Grant and Ellie Swinbank, 'Retrospective Thinking: Decolonizing Minerals at National Museums Scotland', *Museum & Society*, Vol.22(3), (2024), 117-134.
[502] Joe Ware, 'Education Union Calls on Schools to Boycott London's Science Museum Over 'Image-Laundering' Sponsorship Deals', *The Art Newspaper*, 10 June 2025. Available at: https://www.theartnewspaper.com/2025/06/10/education-union-calls-on-schools-to-boycott-londons-science-museum-over-image-laundering-sponsorship-deals [accessed 17 September 2025].
[503] Fossil Free Science Museum. Available at: https://www.fossilfreesciencemuseum.com/ [accessed 17 September 2025].
[504] Fossil Free Science Museum, *Science Museum Group: An Unravelling Tragedy. The Story Behind Adani, Coal Giant and Corporate Sponsor* (2023). Available at: https://cultureunstained.org/smg-unravelling-tragedy/ [accessed 17 September 2025]. Also see Geraldine Kendall Adams, 'Questions Raised About Process Behind

is for the Museum to receive funding from corporate sponsors to support its public offer, asserting that:

> 'Any company that wishes to work with the Science Museum Group has to accept that editorial control sits firmly with the museum. The deceitful innuendo from activists who try to suggest otherwise is an insult to our fine curators and the expert external advisors who support them.'[505]

While I think it is necessary to examine the practices of curators on *Energy Revolution* in light of the controversies and contestations surrounding the gallery—and explain how the Museum's financial relationship to Adani Green Energy poses difficulties to my analysis of their curatorial practices as 'subversive' and 'decolonial'—I nonetheless agree with Blatchford that the curators' work was certainly their own. The curators carried out their work with care, integrity and open-mindedness. I thus turn to Oliver Carpenter's testament as Lead Curator as a conclusion on this matter:

> 'In a sense, I was concerned about it when I joined the project. Am I going to have the [final] say? But I feel like, because there was a bit of perceived worry about editorial control, I was given *more freedom* and *more control* to try and combat any possible accusation that the curatorial team didn't have editorial control. I was not given complete free reign, because obviously there were constraints, budget and space, and all the things we've spoken about. But in terms of the ideas, absolutely. Completely. It was down to us as a 'curatorial content' team, and down to me as Lead Curator, to say, to decide, what the topic was.'[506]

Carpenter's witness that he 'was not given complete free reign', due to all the factors that limit and shape curators' work, serves as a reminder of the ecological nature of curatorship. In Table 2.5, I summarise the micro-, meso-, exo-, macro- and chrono-level actors that shaped and impacted the curators' agency to subvert historical paradigms of progress in *Energy Revolution*.

SMG's Adani Deal', *Museums Journal*, 4 April 2023. Available at: https://www.museumsassociation.org/museums-journal/news/2023/04/questions-raised-about-process-behind-smgs-adani-deal/ [accessed 17 September 2025].

[505] Ian Blatchford, 'New Climate Change Gallery at the Science Museum', *Science Museum Blog*, 19 October 2021. Available at: https://blog.sciencemuseum.org.uk/new-climate-change-gallery-at-the-science-museum/ [accessed 17 September 2025].

[506] Interview with Oliver Carpenter (Science Museum). 9 January 2025.

Table 2.5 Summary of Ecological Agencies in Gallery Legacies: *Energy Revolution*

Agencies Supporting, Shaping and Challenging Curators' Subversion of 'Progress' Paradigms				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
The curators exercised historical analysis, and many have been trained in principles of History. This shaped Carpenter's aversion to upholding paradigms of 'progress' and 'development'.	There is no budget to accommodate future updates, so curators had to ensure it stayed relevant across its lifespan. This underpins the use of 'historic' objects.	Being sponsored by Adani Green Energy—and being associated with Adani by extension—problematises the ethical stance of the gallery.	The gallery curators recognise that different societies around the world have different energy issues. They believed that it was important to reflect diverse, global stories of energy transition.	Carpenter believed that interpreting the energy transition as a linear evolution would echo 'old-school Whig history'. He interprets time in ways that are more complex and entangled.
Carpenter cited 'actor-network theory' and the 'social construction of technology' as frameworks through which he interprets collections. This is to highlight the human actors in technological stories.	The Executive and Masterplan teams stipulated that the gallery should have a 'global' focus. This permitted curators to disrupt Global North-centric perspectives on technological 'innovation'.			
	The 'people-oriented' philosophy of curating at the Science Museum means that technologies are judged more by social criteria than by technological criteria. This inspired a focus on 'grassroots' science and technology.			
	Because of perceived doubts around curators' editorial control, Carpenter was granted more intellectual freedom to shape the gallery as he saw fit.			

Shifting Curatorial Practices and the Legacy of *Our Changing Planet*

In this section, I spotlight how the *Our Changing Planet* gallery facilitated the Birmingham Museums science curators to be 'experimental' in their practices and approaches. I foreground how they situate the gallery as doing something fundamentally 'new' and 'different' in Thinktank, and indeed across Birmingham Museums as a whole. My purpose in doing so is to premise my argument in the Conclusion to this thesis that the changing planet demands paradigm shifts in the practices and rationale of science curatorship.

Our Changing Planet is significant to the curators for being, they suspect, the first the gallery in Thinktank to take a 'consciously critical historical angle, rather than necessarily telling the 'story of the past'.'[507] This critical historical angle was provided by the Anthropocene concept, which supplied a lens to shift their perspective on Birmingham Museums' collections and ask different questions from them. Specifically, questions of how they are implicated in human-induced planetary change. However, when I probed them on whether they deem their work on the gallery as 'revisionist history', Felicity McWilliams was cautious to designate her practices as such.

> 'I'm a historian of technology, and it's a historical approach. So, to me, that doesn't feel necessarily controversial to look at the past and present of something happening in the world now, and understanding how the way we talk about the past has shaped that. That's core to history.'[508]

In response to this point, Lukas Large emphasised that underpinning their historical critique was their 'cross-collections approach', bringing together art, archaeology, social history and natural history into conversation with science and technology. 'That was definitely something that we'd never done, really anywhere, I don't think, to that degree.'[509] Uniting multidisciplinary objects from across Birmingham Museums' collections permitted the curators to take a deliberately multidimensional approach to the changing planet. It was an opportunity to go beyond the 'science communication' paradigm of science museums—didactically explaining what climate change is, what caused it, and what its future impacts might be—to contextualise and critique the historical, socio-cultural complexities of an

[507] Felicity McWilliams, in interview with Lukas Large and Felicity McWilliams (Thinktank). 12 December 2024.
[508] Ibid.
[509] Lukas Large in ibid.

altered Earth. It brought climate change into dialogue with ethical questions about the history of humankind.[510]

McWilliams stressed this would not have been possible without their access to multidisciplinary collections, because the diversity of objects and the multiple perspectives they bring provided the tools to '[ask] visitors to engage with a scientific topic in a social and cultural way.'[511] Again, this links back to the meso-level circumstance of Thinktank's belonging to a collective of museums. It provided the curators with flexibility to draw on a diverse body of knowledge, evidence and material culture. Having opportunities to work with objects of 'natural history', 'social history' and 'cultural history'—along with 'artworks' and 'archaeological artefacts'—is unusual for a science and technology museum, given the historic legacy of disciplinary boundaries that separated 'science' from other strands of knowledge and creativity.

Their 'experiment' in 'throwing [the collections] together and seeing what happens' has, in turn, instilled a greater sense of confidence among the curators.[512] Not just for Felicity McWilliams and Lukas Large, but across Birmingham Museums. One of ways in which their approach to the gallery has impacted subsequent curatorial work is through their 'surveys of significance' of the collections. As McWilliams notes, these surveys had previously forced curators down 'really narrow, discipline-specific ways of thinking.' However, working on *Our Changing Planet* has led her to think differently about 'significance', and has encouraged her to adopt more interdisciplinary modes of researching the collections, 'working with a lot more colleagues to see what collections we have that speak to each other.'[513]

Another way in which the curators situated *Our Changing Planet* as *doing something different* for Thinktank was through its juxtaposition with other galleries and displays in the Museum. McWilliams drew attention to two simultaneous displays of William Murdoch's steam locomotive. One of these is an original working prototype locomotive [Fig. 2.18], which is displayed in the 'Industrial Revolution' sub-section of *Our Changing Planet*. But located downstairs, on the ground-floor *Power Up* gallery, is a *model* of William Murdoch's locomotive. Here, it is displayed in a tableaux of Boulton and Watt's workshop which tells a 'story of innovation', spotlighting the 'genius' of engineers and industrialists who galvanised the Industrial Revolution. In *Our Changing Planet*, with the *original* locomotive, McWilliams

[510] Interview with Felicity McWilliams (Thinktank). 6 February 2023.
[511] Ibid.
[512] Ibid.
[513] Ibid.

was conscious to put this story of 'innovation' on its head. Through an Anthropocene lens, McWilliams sought to shift the framing of its significance, implicating the object in activities that have ultimately been detrimental to the planet. In contrast to the model downstairs, it forms part of 'a narrative that's about *we're now trying to deal with the effects of how much we've embraced*' these technologies.[514]

The curators' positive experiences of exercising historical critique in *Our Changing Planet*, in consequence, has inspired new approaches to interpretation and display at Thinktank, wherein science and technology are entangled in socio-cultural realms. Their new priority is to draw out the stories of *people,* as opposed to the stories of science and technology that are abstracted from human actors, socio-historical context and environmental impact. Certainly, McWilliams noted her desire to 'update' the interpretation for the industrial collections that are showcased in the *Power Up* gallery, particularly the monumental machinery [Fig. 2.19] which fell under her curatorial remit of Science and Industry. She perceived their current interpretation to be 'very technical and quite dry, and […] lacking, really, in any critical engagement with histories of empire or climate change in any way.' That being so, they are definitely 'rising up the hierarchy of 'needs attention' areas at Thinktank!'[515] While McWilliams was motivated to reinterpret the engines in *Power Up* in ways that critique their association with colonialism and climate change, she nevertheless faced meso-level constraints of time, money and resources in carrying out this work.

Going back to consider the impact of *Our Changing Planet* on curatorial practice at Birmingham Museums, beyond the surveys of significance, McWilliams drew attention to how her and her colleagues have shifted their approaches to writing interpretive text. The content that they have developed for the new BMAG galleries has been consciously 'more punchy and hard-hitting than probably we would have gone for in the past'—situating the institution as taking a *firm stance* on various contentious issues. McWilliams believes that her current practice (at the time of interview) is even 'less on the fence, and more like making a statement of fact and belief' than her work in *Our Changing Planet*.[516] As an example, she referred to some text that she had developed for temporary displays in BMAG that opened in 2022, during its redevelopment. She approached this text 'much more like how somebody would speak to you, rather than the 'passive museum voice'. Likewise, she and her colleagues have employed personal pronouns—'we' and 'us'—to signal the museum's 'positionality', deliberately overturning the 'passive neutrality' that traditionally

[514] Ibid.
[515] Interview with Lukas Large and Felicity McWilliams (Thinktank). 12 December 2024.
[516] Ibid.

dominates museum interpretation. As a success story of this, she drew attention to a visitor's remark on social media that one of the labels was 'a welcome introduction of sass': this sassiness being something that the curators were aiming for.[517]

Reflecting further on her and her colleagues' rejection of the 'passive museum voice', McWilliams highlighted factors in her exosphere and macrosphere of influence. Around the time that she and Large were developing *Our Changing Planet*—in 2020—there was a lot of discourse in the museum sector and beyond around decolonisation, which, following the resurgence of the Black Lives Matter (BLM) movement, gained significant momentum. Her and her colleagues were finding museum labels—not just in Birmingham Museums, but across the field—increasingly problematic in their tendency towards 'passivity' and 'neutrality'. This was at the forefront of McWilliams' and Large's minds when they were writing text about the Columbian Exchange and Industrial Revolution in *Our Changing Planet*, and how they addressed issues of colonialism and empire in these sections.

They both asserted that a gallery on the Anthropocene could not overlook the role of globalisation and colonialism in transforming the Earth. With his background in natural science, it is not surprising that Large's critique of colonialism centred more around its environmental impacts than its socio-cultural ramifications. He stressed that, 'if someone from the future was looking back at the history of the Earth without knowing anything about human history', they would be able to discern that the opening of trade routes and European colonisation (from the fifteenth century onwards) had a seismic impact on the planet.[518] In particular, through the trans-Atlantic movement of nonhuman species.

Considering their work to engage with decolonial concepts, I feel compelled to lend my critique of the Anthropocene as problematic for its inherent coloniality. I argue that interrogating this colonial underpinning of the Anthropocene would have added an important layer of nuance to the questions and debates being posed in *Our Changing Planet*. The Anthropocene represents a collective humankind, denoting that all humans share equal blame for damaging the Earth. As such, it downplays the role of political and economic structures like capitalism and colonialism. I am therefore wary of the Anthropocene as a colonialist framing, obscuring the subordination of people whose worldviews and ways of living are harmonious with healthy environments and ecosystems.[519]

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[517] Ibid.
[518] Ibid.
[519] See Andrew Baldwin and Bruce Erickson, 'Introduction: Whiteness, Coloniality and the Anthropocene', *Environment and Planning D: Society and Space*, Vol.38(1), (2020), 3-11.

I commend the curators for integrating colonial critique into their practice, approaching *Our Changing Planet* with a mind to complexify and problematise histories of science and technology in relation to colonialism and climate change. But I suggest that in future climate change-related projects, they go beyond the environmental impacts of colonialism to engage more deeply with the histories and experiences of Indigenous people, Black people and People of Colour, assessing how these communities are unjustly impacted by the changing planet. For example, they could reanimate a museal debate on the Anthropocene, but this time critiquing its colonial connotations and inviting deliberation on the concept from a diversity of perspectives. This, in turn, would support Birmingham Museums' mission to celebrate the city's 'super-diversity' and build 'social trust' amongst these super-diverse communities.[520]

In Table 2.6, I summarise the ecological agencies that were at play in Felicity McWilliams' and Lukas Large's 'experimental' and subversive approaches to science curatorship: both for *Our Changing Planet* and in the legacy of the gallery's development.

[520] Birmingham Museums, 'Annual Report and Consolidated Financial Statements for the Year Ended 31 March 2024', 3.

Table 2.6 Summary of Ecological Agencies in Gallery Legacies: *Our Changing Planet*

Agencies Supporting and Shaping the Curators' Shifting Practices				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
McWilliams is a historian, so consciously critiquing the past for its entanglement in present and future worlds is central to her outlook and practice.	Taking a socio-cultural-historical critique of the changing planet was enabled by the diverse, interdisciplinary collections of Birmingham Museums.	Decolonisation discourse across the museum field meant that Large and McWilliams were conscious to address colonial legacies in *Our Changing Planet*.	BLM raised awareness of issues of museums' neutrality and complicity in racism.	The curators are conscious of a sector-wide transition away from 'passivity'. They perceive that taking firm stances on ethical issues is shaping future directions in curatorship.
Working in an interdisciplinary way has led McWilliams to reevaluate her outlook and criteria for 'surveys of significance' of her collections.	The curators were conscious to apply the Anthropocene framing in ways that contrasted ad disrupted the interpretive norms of Thinktank.	Sector-wide decolonisation discourse, and lessons learned from *Our Changing Planet*, have led the curators to take a more active positionality on ethical issues in interpretation.		
Having a background in natural science, Large's approach to interpreting the colonial history centred on the environmental impacts of global trade. The gallery does not explore the social aspects of colonialism and how they relate to the Anthropocene.	Carrying out a wholescale reinterpretation of collections and displays costs time, money and resources. Individual gallery, exhibition and display projects provide a viable means to engage with reinterpretive methodologies.			

Conclusion

Both of the case-study galleries that I analysed in this chapter—*Energy Revolution* and *Our Changing Planet*—offer 'antidotes' to the short-term thinking about the past, present and future of the changing planet.[521] They anticipate the future of the climate-changed planet on the basis of a long history of technological and social-cultural change. In both galleries, the curators made active choices to complexify notions of time, history and development. Their decisions and frameworks were underpinned by their conception of themselves as *historians*; it is their unique prerogative and skillset to analyse the evidence of the past to complexify and contextualise the realities of the present, and from there contemplate possible futures.

As I emphasise throughout this thesis, the agency of science museum curators in future-making and futures thinking in a time of planetary upheaval lies precisely in their unique role as interpreters of history and material culture. They can harness the artefacts of the past to examine and complexify our present reality of living on a changing planet. From the basis of this tangible evidence of complex change, they can engage audiences in anticipatory thinking about the future. Permanent galleries are a particularly powerful medium to do this because they situate the issue of the changing planet at the very heart of the institution and its role in serving the public. The changing planet is not a fringe problem to engage with on a short-term basis, but rather, an issue that is redefining concepts of temporality, history and heritage. This was made evident through the curators' engagement with the Energy Revolution and the Anthropocene as frameworks through which they interpreted both *time* and the *changing planet*, grounding human histories, including anticipated future histories, in relationality with the Earth's environments and regulatory systems.

Throughout this chapter, I have analysed the inherent challenges of developing permanent galleries. Namely, the fact that this activity consumes a huge amount of time, labour, energy, money and resources for the institution. But despite the constraints that these meso-level factors pose, I argue that galleries are nevertheless an important medium through which science curators can (re)interpret science in ways that are challenging and subversive of institutional convention. As I have evinced through the case-study science museum galleries, I celebrate curators' agency to reconceptualise science and technology in ways that embrace ethics of sustainability, equity, diversity and inclusion.

[521] See Fiona R. Cameron, Bob Hodge and Juan Francisco Salazar, 'Representing Climate Change in Museum Space and Places'.

3 | Speculating the Future of the Changing Planet in Temporary Exhibitions

> '*[An exhibition is] not a book—once you write things down, you're always going to get stuck in explaining what you meant. So, I think the ephemeral nature of the exhibition is […] important. It's something that frees one to take a more speculative mode, perhaps*.'[522]

Overview

Compared to 'permanent' galleries, in this chapter, I argue that 'temporary' exhibitions grant opportunities for curators to engage with the changing planet in ways that are more speculative, imaginative, inquisitive and experimental. Primarily, I compare the Science Museum's exhibition, *Our Future Planet* (2021-2022), with Museums for Climate Action's exhibition, *Reimagining Museums for Climate Action* (2021), hosted by Glasgow Science Centre. I examine the ways in which their curators harnessed the exhibitions to pose questions and prompt speculative thinking in audiences. I also bring them into dialogue with a third exhibition in an art museum: the Sainsbury Centre's *Sediment Spirit: The Activation of Art in the Anthropocene* (2023-2024).

I examine the nuances in curatorship across these three case studies, and in doing so address my research objective to contextualise curatorial practices in relation to the ecological agencies that shape them. Specifically, I compare the 'conventional' science curatorship being practiced in the Science Museum with the practice of curator-academics who produced an exhibition 'externally' to the institution it was housed in, as well as the practice of an art museum curator whose role as 'Curator of Art and Climate Change' was devised in collaboration with a scientific research unit. I demonstrate how, through their different contexts and different media, the curators activated speculative thinking in unique ways across their exhibitions.

In particular, I analyse how the curators employed their exhibitions to speculate the 'solutions' that would kindle positive futures on a changing planet. These solutions range from the tangible to the intangible. My ultimate purpose in bringing *Reimagining Museums* and *Sediment Spirit* into conversation with the Science Museum's *Our Future Planet* is to

[522] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.

provide inspiration for future directions in science curatorship. Specifically, and which I will delve into more deeply in the thesis Conclusion, I propose an expansion of science curatorship to embrace the interdisciplinary, participatory, creative and imaginative modes of thinking and practice exemplified by these case studies. I argue that this would help to reconceptualise *science* as a praxis that is underpinned by ethics of sustainability, equity and relationality.

Introduction to Temporary Exhibitions

Temporary exhibitions are a crucial asset to museums in their public-facing activities, attracting a high profile in academic, media and public discourse; providing a focus for targeted learning, discussion and outreach; and enticing new and returning audiences, which generates revenue. In theoretical and practical critiques of museological engagements with the changing planet, temporary exhibitions supply a major focus.[523] Correlating with the high-profile nature of exhibitions, this medium constitutes the most prevalent activity through which 'curating climate change' is enacted and studied.[524] For that reason, it might be surprising that I analyse temporary exhibitions so late in this thesis. I do so here, after examining practices of collecting and developing permanent galleries, to accentuate their temporal capacities by comparison. These capacities empower curators to engage in *speculative* modes of futures thinking.

For the preceding chapters, I assessed the curators' thinking and practice as taking place through temporal frames of 'permanence'. A view on their long-term impact, perhaps even 'in perpetuity', means that curators—particularly at the Science Museum—are more wary of the potential obsolescence and irrelevance of their work for future audiences, and thus exercise caution, restraint and anticipatory thinking in their decision-making. In consequence, the curators are less likely to take risks, adopt new methodologies and philosophies, and challenge established modes of interpreting, developing and presenting content.

Being 'temporary', exhibitions provide ideal ground for museums to engage with 'new' and 'unfamiliar' ideas, knowledge, media, discussions, people and practices that are otherwise not represented in the 'permanent' displays, or do not constitute 'normal' practice. In this way, the temporal transience of exhibitions offers scope for experiment, both in the sense of

[523] For example, see Fiona R. Cameron and Brett Neilson (eds.), *Climate Change and Museum Futures*; Jennifer Newell, Libby Robin and Kirsten Wehner (eds.), *Curating the Future*; Felicity Fenner, *Curating in a Time of Ecological Crisis: Biennales as Agents of Change* (Routledge, 2022).
[524] See Sarah Wade, 'Emerging Exhibition Ecologies'.

exercising experimental practices, but also in the sense of generating knowledge and contributing to scholarship.[525] For science museums, they supply a medium of addressing and exploring contemporary issues, innovations, debates and controversies in science, technology and medicine, and their impacts on contemporary societies.[526] This is confirmed by the Science Museum's Exhibitions Strategy: 'We can take risks, try new things and be playful.'[527]

As one of the curators of *Our Future Planet*, Rupert Cole, noted, compared to permanent galleries, temporary exhibitions free him and his colleagues from the constraints of longevity and long-term relevance. This permits them to be 'rooted in the now' and engage with contemporary topical issues that will not necessarily remain on the public agenda for years to come.[528] In addition, one of the curator-academics behind *Reimagining Museums*, Rodney Harrison, underscored the advantages of exhibitions' ephemerality. First, on a more general level, they allow the curator to 'speculate much more freely': 'One can use them as a way of thinking. Thinking about futures in a way that's maybe not so serious—in which one is less committed to the outcome.'[529]

Speaking as a researcher, however, he observes that exhibitions 'create space for failure'.[530] They are a context in which researchers can experiment with new perspectives, ideas and ways of working, and if they do not work or do not resonate, then the researcher can learn from that experience. In these cases, he stresses that exhibitions—as short-lived modes of practice-led communication—can be much more forgiving than long-lived written communication through articles and books; 'once you write things down, you're always going to get stuck in explaining what you meant.'[531] That is not to say that exhibitions completely disappear once they are closed, leaving no trace in written and visual records. Certainly, the curators of *Reimagining Museums* went on to produce two books about the exhibition, its

[525] See Sharon Macdonald and Paul Basu (eds.), *Exhibition Experiments* (Blackwell Publishing, 2007); Peter Bjerregaard (ed.), *Exhibitions as Research: Experimental Methods in Museums* (Routledge, 2020); Marianne Achiam, Michael Haldrup and Kirsten Drotner (eds.), *Experimental Museology: Institutions, Representations, Users* (Routledge, 2021); Henriette Pleiger, *Interdisciplinary Exhibitions and the Production of Knowledge: Perspectives from Curatorial Practice* (Transcript Verlag, 2024).
[526] See Erminia Pedretti and Ana Maria Navas Iannini, *Controversy in Science Museums: Re-imagining Exhibition Spaces and Practice* (Routledge, 2020).
[527] Science Museum Group, 'Group Exhibitions Strategy 2020-2024' [unpublished] (2020), 1.
[528] Interview with Rupert Cole (Science Museum). 29 May 2025.
[529] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[530] Ibid.
[531] Ibid.

content and calls to action.[532] But by their very nature as *not* being an academic text, *not* having to comply with academic convention, with exhibitions, the curator-academic is permitted some freedom to be experimental without so much fear of being cited and critiqued by other academics for years to come.

By facilitating curators' adopting experimental modes of thinking and acting, I argue that temporary exhibitions permit them to engage with climate change futures in ways that are more speculative, imaginative and radical than collecting activities and permanent galleries. In these more long-term-focused modes of working, as I have established, curators still engage in futures thinking. But I designate processes of futures thinking in object acquisition and the development of permanent galleries as 'anticipatory'. I situate 'anticipation' as an act of looking forward that is more certain of the outcomes, calling on evidence of the past and the present in the expectation and subsequent preparation for the future. On the other hand, I interpret 'speculation' as less certain of the outcomes and more freely imaginative, not necessarily grounded in past and present realities.[533] In this way, speculative thinking can render futures in ways that are more creative, unorthodox, subversive and challenging to anticipatory thinking. But regarding the extent of how radical speculative thinking is in curatorial practice, I will analyse with the case-study exhibitions.

Political ecologists, Rusca, Harris and Santos, argue that speculation is necessary given the huge uncertainties of the changing planet. Conventional knowledge structures, they contend, cannot fully comprehend the rapidly changing planet nor adequately predict future events, and this subsequently demands a turn to more speculative, pluralised methods of imagining the future.[534] Furthermore, speculating the future is valuable to climate and environmental action because it permits thinking around *alternative* approaches, addressing the systemic problems that induced the changing planet. It can invite a radical rethinking of current systems and paradigms—social, economic and political (as well as scientific and technological)—and a rejection of the capitalist-colonialist status quo.[535]

Thinking around the future in ways that are more open and uncertain creates space for plurality, recognising diverse worldviews, epistemologies and experiences. This, in turn,

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[532] Rodney Harrison and Colin Sterling (eds.), *Reimagining Museums for Climate Action* (Museums for Climate Action, 2021); Henry McGhie, *Mobilising Museums for Climate Action: Tools, Frameworks and Opportunities to Accelerate Climate Action in and with Museums* (Museums for Climate Action, 2021).
[533] Rebecca Bryant and Daniel M. Knight, *The Anthropology of the Future*, 21-48; 78-104.
[534] Maria Rusca, Dylan M. Harris and Dan Santos, 'Experimental and Speculative Political Ecologies for an Age of Crisis, Hope and Action', *Progress in Environmental Geography*, Vol.3(4), (2024), 377-378.
[535] See Lesley-Ann Noel, 'Dreaming Outside the Boxes that Hold Me In'.

helps to imagine futures that are more holistic, compassionate, equitable and just.[536] Speculation, as such, can be interpreted as a more decolonial and democratising mode of futures thinking. For *Reimagining Museums*, the curator-academic, Rodney Harrison, was particularly concerned for the exhibition to embrace a speculative outlook that challenged the museological status quo; the rationale for the exhibition was to imagine museums 'otherwise' to address the challenges of climate action and social justice.[537]

Although the short-term nature of temporary exhibitions can enable a sense of curatorial freedom to speculate futures in creative, radical ways, the ephemerality of this medium risks undermining the agenda to imagine *sustainable* futures. Temporary exhibitions, after all, provide a short-term gain in the face of long-term pressures. For one, they can generate a considerable amount of waste if bespoke materials for display and interpretation are not recycled or repurposed. Besides their environmental unsustainability, temporary exhibitions pose challenges to social sustainability, putting enormous pressure on staff to work to tight deadlines while also encouraging short-term contracts of employment.[538] In this chapter, I do not examine in detail the practicalities of producing 'sustainable' exhibitions, given that such procedures did not fall explicitly under the purview of the curators. However, I acknowledge here that the case-study curators (and liaising staff at Glasgow Science Centre) were all conscious to *advocate* for sustainable practices and materials in the development of their exhibitions.

Taking the ephemerality of exhibitions as a guiding principle, I analyse the two main case-study exhibitions that inform this chapter: *Our Future Planet* [Fig. 3.1], on display at the Science Museum from May 2021 to September 2022, and *Reimagining Museums for Climate Action* (which I frequently shorten to *Reimagining Museums*), on display at Glasgow Science Centre between June and November 2021, which continues to remain accessible as an online exhibition (at the time of writing).[539] *Our Future Planet* was premised around the central question of 'can carbon capture help us fight climate change?'. It was advertised as

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[536] Christine Mortimer and Maria Alejandra Luján Escalante, 'Introduction', in Christine Mortimer and Maria Alejandra Luján Escalante (eds.), *The Trouble with Speculation: Natures, Futures, Politics* (Bristol University Press, 2024), 1.
[537] See Rodney Harrison and Colin Sterling, 'Museums Otherwise: A Compendium of Possible Futures', in Rodney Harrison and Colin Sterling (eds.), *Reimagining Museums for Climate Action*, 6-15.
[538] Caitlin Southwick, 'Collections Management and Conservation', in Nick Merriman (ed.), *Museums and the Climate Crisis*, 121-122.
[539] See Museums for Climate Action, *Reimagining Museums for Climate Action* [Google Arts & Culture exhibition], (2021). Available at: https://artsandculture.google.com/story/reimagining-museums-for-climate-action-cabinet-office/tAWB_rRlcmpjkQ?hl=en [accessed 17 September 2025]; Museums for Climate Action, 'Reimagine | Possible Futures | View the Exhibition'. Available at: https://www.museumsforclimateaction.org/reimagine/exhibits [accessed 17 September 2025].

the first major exhibition in a UK museum to focus on carbon removal and its practices.[540] Meanwhile, the premise of *Reimagining Museums*, as the title suggests, was centred around the question of 'what would it take for museums to become catalysts for radical climate action?'. This question was posed as an open call for creative submissions, which the curators designated as 'concepts'. Together, they functioned as a 'participatory thought experiment'.[541] The main content of the exhibition, as such, showcased the eight winning concepts for reimagining museums, each presented as a speculative 'what if …?'.[542]

I bring an art museum exhibition into dialogue with the primary and secondary case studies. This exhibition is *Sediment Spirit: The Activation of Art in the Anthropocene*, which was on show at the Sainsbury Centre in Norwich between October 2023 and April 2024. Primarily, I spotlight this exhibition for its unique approach to speculative thinking. The exhibition is a speculation of the Earth's animism, imagining and invoking the 'spirit' of the material realm. Second, I draw attention to the context of its being curated in a dynamic setting through an innovative mode of curatorship. Thirdly, a personal, micro-level factor that underpins my inclusion of *Sediment Spirit* is my proximity to the Sainsbury Centre as a student of Art History at the UEA. Indeed, I could observe the exhibition from my desk. Bearing witness to the changes taking place at the gallery since Jago Cooper's appointment as Director in November 2021, I consider it an exciting opportunity to be able to document some of this change—albeit briefly—in my research.

Exhibition Contexts: Agencies that Initiated and Shaped the Exhibitions

Our Future Planet: A Tomorrow's World Exhibition on Carbon Capture

Throughout this thesis, I have analysed the *processes* and *products* of curatorship in symbiosis. Likewise in this present analysis, I am conscious that reviewing an exhibition as a final, fully formed product would obscure the actors and contexts that shaped those exhibitions. Exhibitions do not come out of nowhere but emerge, evolve and exist through an ecology of actors, inputs, perspectives, experiences, motivations, intentions and ambitions. That being so, I deem it crucial to examine exhibition contexts to be able to understand and assess the ways that they engage with the changing planet. Contextualising exhibitions,

[540] Science Museum, 'Science Museum Group Announces Major Public Programme on Climate Change as Government Launches UK Year of Climate Action', 4 February 2020. Available at: https://www.sciencemuseum.org.uk/about-us/press-office/science-museum-group-announces-major-public-programme-climate-change [accessed 17 September 2025].
[541] Rodney Harrison and Colin Sterling, 'Museums Otherwise: A Compendium of Possible Futures', 14.
[542] Museums for Climate Action, 'Reimagine | Possible Futures | View the Exhibition'.

moreover, is important to my theorisation of curatorship as taking place in ecological systems.

Our Future Planet forms part of a long legacy of 'special exhibitions'—as the Science Museum designates them—that were consciously conceived and marketed as bringing contemporary science and technology to the fore. Being temporary in nature, exhibitions lend themselves to engage with topical issues and contemporary innovations in science, technology and industry. In his analysis of eight Science Museum exhibitions that took place between 1935 and 1982, Morris argued that the institution was not only attempting to 'enlighten' the public on these matters but was also seeking to shape public opinion.[543] Today, Science Museum staff would avoid any explicit statement of intent to influence public opinion. Regarding the aims of temporary exhibitions, the emphasis is to engage visitors with 'the science that shapes our lives', to grow their 'science capital' and to 'inspire curiosity in STEM'.[544] Exhibitions of contemporary science and technology, such as *Our Future Planet*, are grounded in these principles of science engagement.

Our Future Planet was housed in a temporary exhibition space known as 'Tomorrow's World' (which closed in May 2024). Opening with its first exhibition in 2017, Tomorrow's World was a rebranding of the 'Antenna' exhibition space that had formerly occupied this location on the ground floor of the Wellcome Wing. It simultaneously replaced Antenna's function to showcase contemporary science and technology and engage with topical issues.[545] Developed in collaboration with the BBC, Tomorrow's World paid homage to the iconic television series that, between 1965 and 2003, imagined future worlds through its showcasing of contemporary innovations in science and technology.[546] Mirroring the show, this exhibition space used contemporary science and technology as a springboard to speculate the future.

Unlike Antenna exhibitions, which were developed by a team of 'science communicators', Tomorrow's World came under the purview of curators. Specifically, a team of 'Curators of

[543] Peter J.T. Morris, ''An Effective Organ of Public Enlightenment': The Role of Temporary Exhibitions in the Science Museum', in Peter J.T. Morris (ed.), *Science for the Nation: Perspectives on the History of the Science Museum*, 242-243.
[544] Science Museum Group, 'Group Exhibitions Strategy 2020-2024', 1-3.
[545] See David A. Ucko, 'Production Aspects of Promoting Public Understanding of Research', in David Chittenden, Graham Farmelo and Bruce V. Lewenstein (eds.), *Creating Connections: Museums and the Public Understanding of Current Research* (AltaMira Press, 2004), 214-215.
[546] Roger Highfield, 'Launching the Tomorrow's World Partnership', *Science Museum Blog*, 2 May 2017. Available at: https://blog.sciencemuseum.org.uk/launching-the-tomorrows-world-partnership/ [accessed 17 September 2025].

Contemporary Science' who were managed by the Keeper of Science Collections. This is the environment in which *Our Future Planet* was developed. Being object-rich with a speculative temporal gaze towards *tomorrow's world*, it diverged from the Science Museum's previous exhibitions on the changing planet that were displayed in 'Science Box'[547] and Antenna, which were small, rapid-response, object-light and temporally focused on the *now*: on *contemporary* news stories of science and technology (see Appendix A).

The fact that it formed part of the display schema of Tomorrow's World is not the only meso-level factor that shaped the approaches of curators to *Our Future Planet*. Crucial to initiating and establishing the focus of the exhibition were the Executive and Masterplan teams, located in the curators' mesosphere of influence. They, in turn, were responding to a range of agencies in their exosphere, macrosphere and chronosphere; agencies that roused them to set the exhibition in motion at that particular moment in time. This moment in time being the summer of 2019, with the intention that the exhibition would open in December 2020.

First, the exhibition's opening—which was ultimately postponed due to Covid-19—was intended to 'align strategically' with COP26 in Glasgow (also postponed),[548] which brought the UK into the spotlight of international climate change diplomacy. This macro-level context was integrated into the core aims of the project. To address the (former) Strategic Priority to 'extend our international reach', while also speaking to the Exhibitions Strategy's aim to 'influence government and policymakers',[549] one of the top-line objectives of *Our Future Planet* was to 'promote the exhibition as a destination for delegates to COP26.'[550]

Besides its role in relation to the conference, the exhibition was deemed timely in other ways. First, on a meso level, it would provide the Museum with an alternative space to engage with the changing planet that counteracted the 'antiquity of *Atmosphere*'.[551] Second, on a macro level, it would provide a means of reacting to the wider socio-political context of climate action and dialogue, including the growing prominence of Extinction Rebellion, Greta

[547] See Lorraine Ward, 'Lessons of Science Box', in Graham Farmelo and Janet Carding (eds.), *Here and Now: Contemporary Science and Technology in Museums and Science Centres*, 83-90.
[548] Science Museum Group, 'Annual Report and Accounts 2020-21' (2021), 17. Available to download at: https://www.gov.uk/government/publications/science-museum-group-annual-report-and-accounts-2020-to-2021 [accessed 17 September 2025].
[549] Science Museum Group, 'Group Exhibitions Strategy 2020-2024', 3.
[550] Science Museum Group, '*Carbon Capture* (Working Title) Interpretation Plan' [unpublished], (2021), 2. Shared by Alexandra Rose, 10 April 2024 (personal communication).
[551] Roger Highfield, 'SMG Exhibition Proposal – Supporting Information: *Down with Carbon/The Artificial Forest*' [unpublished], (2019), 3. Shared by Roger Highfield, 29 May 2025 (personal communication).

Thunberg and youth climate strikes, as well as the UK Government's recently instated policy to commit to net-zero carbon emissions by 2050.[552]

Responding to this context, the SMG Director, Ian Blatchford, provided the initial spark for *Our Future Planet*. He wanted to set in motion an exhibition about the vital role of trees and plants in removing carbon dioxide from the atmosphere and thus helping to achieve the UK's targets for net zero. He conveyed this idea to Roger Highfield, Director of Science, and Julia Knights, Deputy Director of the Science Museum (who are both SMG Executives). Highfield was interested to pursue an 'artificial trees' route, exploring how scientists and engineers are inspired by nature to develop carbon removal technologies. Knights, conversely, with her background in soil and climate science, advocated for a focus on 'nature-based solutions' *alongside* the 'high-tech solutions'.[553]

Their motivation to engage with carbon removal as a subject was also underpinned by the wider, exo-level scientific context. Specifically, the growing legitimacy and prominence of carbon removal in strategies and recommendations for climate change mitigation. They were entering the 'mainstream' through the IPCC, which was factoring in carbon removal as a key player in pathways that averted the worst effects of climate change.[554] For Highfield, this context of scientific endorsement was 'critical' in his decision to bring carbon capture into the intellectual remit of the Science Museum, maintaining the scientific integrity of the institution.[555] From a curator's perspective, Rupert Cole recalled that a UK-focused report by the Royal Society from 2018 on *Greenhouse Gas Removal*[556] was also instrumental in validating and galvanising his and his colleague's work on the exhibition.[557]

This exo context was interesting to Highfield because it permitted the Museum to platform a subject which maintained an element of controversy, yet which nonetheless had scientific integrity. Carbon removal was (and remains) controversial amongst environmentalists who critique it as a 'Get Out of Jail Free Card' for the fossil fuel industry.[558] However, the fact of its being backed by authoritative scientific bodies legitimised carbon removal as an issue for the Science Museum to cover. As Highfield reflected 'with a massive benefit of hindsight', it was an opportune moment to develop an exhibition on carbon capture because it subsequently

[552] Ibid.
[553] Interview with Roger Highfield (Science Museum). 10 June 2025.
[554] See IPCC, 'Summary for Policymakers' (2018), 3-24.
[555] Interview with Roger Highfield (Science Museum). 10 June 2025.
[556] See The Royal Society, *Greenhouse Gas Removal* (2018). Available to download at: https://royalsociety.org/news-resources/projects/greenhouse-gas-removal/ [accessed 17 September 2025].
[557] Interview with Rupert Cole (Science Museum). 7 December 2022.
[558] Interview with Roger Highfield (Science Museum). 10 June 2025.

went on to receive further endorsement from scientists, especially in response to the ever-growing risk of global temperature increase surpassing 1.5ºC.[559]

So, building on the Director's vision and the wider scientific context, Highfield developed a more formal proposal for a carbon capture exhibition, which he presented to the SMG Exhibitions Programme Board. In formulating this proposal, he sought feedback and comments from curators; 'I really wanted them to be invested in the idea as well.'[560] When the exhibition was approved by the Board, the project was assigned to a curatorial team. After some delays caused by the pandemic, along with a curatorial reshuffling due to curators returning from furlough, by autumn 2020 the role of Lead Curator for the project was passed on to one of the (then) Curators of Contemporary Science, Sophie Waring. Joining her on the exhibition was Rupert Cole, who was also part of the Contemporary Science team at that time. In developing the actual content, the curators were in the 'driving seat', but Highfield remained involved through his role as Chair of the Advisory Board on the exhibition.[561]

From his perspective as a curator, Cole noted how the involvement and personal investment of SMG Executives in an exhibition was unusual at that time. He surmised that one of the likely reasons for this was the tight, yet still uncertain, deadline towards which curators were working, having only half a year to source objects and develop text for the exhibition. This meant that there was an urgency to approving and signing off content, and Executives came in to fulfil this responsibility. But on further reflection, he highlighted the macro, socio-political context that was impacting not just the Science Museum, but the whole museum sector.[562]

Across 2019 and 2020, campaign groups including Extinction Rebellion and Black Lives Matter (BLM) were actively targeting museums and heritage organisations, denouncing their complicity in social and environmental injustices: namely, the fossil-fuel-induced climate crisis, colonialism and endemic racism. In direct response to BLM protests, Oliver Dowden (then Culture Secretary, overseeing the DCMS) stressed that national museums—as publicly funded bodies—are beholden to act 'impartially', and should 'not be taking actions motivated by activism or politics.'[563] In other words, they could not be seen to openly support protest

[559] Ibid.
[560] Ibid.
[561] Ibid.
[562] Interview with Rupert Cole (Science Museum). 29 May 2025.
[563] Oliver Dowden, 'Letter from Culture Secretary to DCMS Arm's Length Bodies on Contested Heritage', 22 September 2020. Available at: https://www.gov.uk/government/publications/letter-from-culture-secretary-on-hm-government-position-on-contested-heritage [accessed 17 September 2025].

groups such as BLM and Extinction Rebellion, nor openly promote activist rhetoric. Given how highly politicised and sensitive the issue of climate change was for the Museum at this time—as well as the pressures from Government to demonstrate 'impartiality'—from Cole's perspective, it led to the Executives providing an extra level of oversight on *Our Future Planet* compared to previous exhibitions.[564]

In Table 3.1, I summarise the various agencies—across curators' microsphere, mesosphere, exosphere, macrosphere and chronosphere of influence—that informed the context in which *Our Future Planet* was taking place.

[564] Interview with Rupert Cole (Science Museum). 29 May 2025.

Table 3.1 Summary of Ecological Agencies of Exhibition Contexts: *Our Future Planet*

Agencies that Initiated and Shaped the Exhibition				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
The curators, Cole and Waring, were brought on board late in the project, meaning they were not involved from the beginning and were working to tight deadlines.	Tomorrow's World fell under the purview of curators, rather than 'science communicators'. These shows are object-led, future-oriented deep-dives into contemporary science issues.	Amongst the scientific community, e.g., the IPCC, there was a growing focus on carbon removal in climate models and mitigation pathways.	The exhibition responded to the momentum of the climate protest movement and the UK Government's newly instated commitment to net zero.	There appeared to be a *zeitgeist* at the time of the exhibition's conception of widespread concern and action on climate change and sustainability.
	The Science Museum's curatorial team espouses 'people-centred' approaches to engaging with science in their practice.		Institutional pressures from the Government and campaign groups (such as BLM and Extinction Rebellion) created a heightened sense of caution amongst Executives.	Developing content for the exhibition was carried out with haste. The curators had to work within tight parameters of time.
	A climate change exhibition was deemed vital to counteract the 'antiquity of *Atmosphere*'.		The Covid-19 lockdown disrupted working patterns and postponed the exhibition.	
	Blatchford (SMG Director) was keen for an exhibition on the role of trees in mitigating climate change.		The exhibition functioned as a public engagement activity to coincide with COP26.	
	SMG Executives, Highfield and Knights, were involved in shaping the project from its conception.			

Reimagining Museums for Climate Action: A Contribution to COP26

Moving on to examine the context of *Reimagining Museums for Climate Action*, an immediate contrast emerges between this exhibition and *Our Future Planet*. Its curators, and by extension the exhibition, did not *belong* to the institution in which it was displayed. Unlike *Our Future Planet*, *Reimagining Museums* was not building on institutional strategies and objectives for programming. The curators (which I also refer to as curator-academics)—Rodney Harrison, Colin Sterling and Henry McGhie—functioned more independently. In developing their exhibition, they were not drawing on *internal* precedents or lessons learned *by the institution*, but rather their own, micro-level, *external* perspectives and approaches as academics (Harrison and Sterling) and a museum consultant (McGhie).

The reason the curators asked Glasgow Science Centre to host their exhibition was because it formed part of the physical environment of COP26. It provided the official 'Green Zone' for the conference: the designated venue for public-facing engagement. Addressing this meso- and exo-level context—and recognising its active role within it—the curators foregrounded policymakers and COP delegates as crucial audiences for the exhibition. One of its core aims was to provide policymakers with 'opportunities to connect their work with the public, and to foster dialogue among diverse stakeholders.'[565]

While I emphasise the externality of the exhibition's curators, that is not to overlook the work of staff at Glasgow Science Centre who helped to bring it into being. For the run-up and aftermath of COP26, the Science Centre created a dedicated, temporary role for climate engagement—a Climate Change Programme Manager—performed by Emma Woodham. She was the first point of contact for the *Reimagining Museums* curators when they made the request to develop an exhibition for the COP26 Green Zone. While Woodham was the primary advocate and spokesperson for the Science Centre in the *Reimagining Museums* project, other actors who supported its physical development and installation were Robin Hoyle, Director of Science; Graham Rose, Creative Director; and Jenny Galbraith, Exhibitions and Project Manager. Together with Rodney Harrison, Colin Sterling and Henry McGhie—as well as Rowan Gard and Janna oud Ammerveld from the UCL Institute of Archaeology—they formed the Museums for Climate Action project team.[566]

[565] Museums for Climate Action, 'Reimagining Museums for Climate Action Design Manual V4' [unpublished], (2020), 10. Shared by Graham Rose, 4 April 2023 (personal communication).
[566] See Museums for Climate Action, 'Rethink | Why Rethink Museums? | Project Team'. Available at: https://www.museumsforclimateaction.org/rethink/background#project-team [accessed 17 September 2025].

As Graham Rose and Robin Hoyle reflected, one of the primary reasons that they accepted the exhibition proposal was because it would bring something *different* to the Science Centre. Hosting the Green Zone, the Science Centre was a very attractive venue for individuals and organisations that wanted to develop a public engagement activity for COP26. But the *Reimagining Museums* exhibition was particularly appealing to them because of its global reach—speaking to diverse perspectives from across the world—which, ultimately, was suitable for a global conference.[567] For Rose, one of the most exciting aspects of the exhibition was the 'variety, the dynamism that it [brought], the different cultures, the totally different perspectives on climate change. […] Understanding how that affected how people might interact with museums was a fascinating subject.'[568]

Hoyle, moreover, was intrigued by the museological focus and 'philosophical approach' of the exhibition, given that it was being brought into a space that, to him, is fundamentally different to a museum. 'I'm always quite interested by the fact that, when museums do something, people sit up and pay attention. They talk about it in reverential tones […]. Whereas, when *we* create an exhibition, people go: 'oh, that's really nice. I must take the kids there to see it'.'[569] As Rose remarked in a similar vein, hosting a culturally-focused exhibition 'gave us kudos'.[570] Beyond their individual interest in the exhibition, both Rose and Hoyle were also drawn to its potential to attract new and different audiences to the Science Centre—particularly independent adults—as well as to provide a unique offer for their existing audiences.[571]

In explaining their role in the exhibition development process, Hoyle and Rose emphasised that they were *not* curators. Their responsibility was to support the physical installation of the exhibits, and *not* to influence the intellectual and creative content. As Hoyle reflected, enabling the curators' 'freedom of expression' was paramount to him in negotiating the relationship between the Science Centre, the curators and the exhibit creators. Framing the curators and contributors as 'artists', he stressed that 'the artist's freedom of expression is the absolute essence of what you and they are doing and your interaction with it.' As such, 'you have no editorial control over what they are saying or doing. You're bringing their contribution of what they want to say about the world to the fore.'[572]

[567] Interview with Graham Rose (Glasgow Science Centre). 28 February 2023.
[568] Ibid.
[569] Interview with Robin Hoyle (Glasgow Science Centre). 28 February 2023.
[570] Interview with Graham Rose (Glasgow Science Centre). 28 February 2023.
[571] Ibid.; Interview with Robin Hoyle (Glasgow Science Centre). 28 February 2023.
[572] Interview with Robin Hoyle (Glasgow Science Centre). 28 February 2023.

Being external to the Science Centre therefore empowered the curators and exhibit contributors to engage with the changing planet according to their creative visions. They were not bound to the aims, frameworks, practices and conventions of the institution. In turn, this permitted them a greater sense of agency and authorship compared to that held by the curators of *Our Future Planet* at the Science Museum. I should emphasise, however, that the exhibits that formed the basis of *Reimagining Museums* were not selected by the curators themselves. Harrison, Sterling and McGhie made the call for contributions, which was through an international design and ideas competition, launched on 18 May 2020. But it was the responsibility of a separate jury panel—including prominent figures from the field of climate museology—to sift through the 264 submissions, from forty-eight countries, and select eight concepts for a reimagined museum.[573] Following the jury's decision, it was the curators' role to negotiate with the exhibit creators and help to bring their ideas to life.

In this chapter, I have already established that I characterise the curators as curator-academics. Only Rodney Harrison and Colin Sterling work as academics in a formal sense, but that is not to overlook McGhie's academic contributions and published works. Rodney Harrison is a Professor of Heritage Studies at University College London (UCL), and Colin Sterling, at the time of the exhibition's conception, was an AHRC Early Career Leadership Fellow at the UCL Institute of Archaeology. Meanwhile Henry McGhie is the founding director of 'Curating Tomorrow', a consultancy that supports museums in aligning their activities with UN blueprints for sustainable development and human rights. So, although it is not their official, full-time occupation, these three individuals were the 'curators' of *Reimagining Museums*. Moreover, their practices of curatorship were not typical in a museum sense, since most of the content development for the exhibition fell to the individual exhibit producers: 'we were, really, facilitating the work of other people within the context of the exhibition.'[574]

The exhibition was devised as a contribution to COP26 from the AHRC's 'Heritage Priority Area' (2017-2020), a project led by Rodney Harrison which drew together scholars and practitioners to devise priorities for, and shape understandings of, heritage.[575] But beyond this, *Reimagining Museums* was underpinned by, and contributed to, multiple aspects of the work and research of Harrison, Sterling and McGhie. The project arose from an

[573] See Museums for Climate Action, 'Rethink | Why Rethink Museums? | Competition Jury'. Available at: https://www.museumsforclimateaction.org/rethink/background#competition-jury [accessed 17 September 2025].
[574] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[575] Rodney Harrison et al., '*Heritage* Research: The AHRC Heritage Priority Area', *Archaeology International*, Vol.21(1), (2018), 75-81. Also see 'AHRC Heritage Priority Area: Heritage Research'. Available at: https://heritage-research.org/ [accessed 17 September 2025].

amalgamation of influences in their microsphere relating to their practice, expertise and aspirations. First, the language and approaches it took to climate action drew significantly from the UN. This speaks particularly to Henry McGhie's work in supporting museums to participate in UN frameworks and agendas.[576] Specifically, the exhibition was conceived to relate the work of museums to the Paris climate targets, Agenda 2030 and its seventeen SDGs, and Action for Climate Empowerment (ACE).[577] These policy frameworks and agendas, in turn, are crucial actors in the curators' macrosphere.

From the beginning, the exhibition was devised in connection with the ACE agenda.[578] The UNFCCC adopted ACE as a framework that seeks to engage all members of society with climate action, and it comprises six avenues for empowerment.[579] Following this blueprint, *Reimagining Museums* was developed on the principle of demonstrating how museums could support *education*, *training*, *public awareness*, *public participation*, *public access to information*, and *international co-operation* to address the challenges of climate change.[580] Also underlining the applicability of this framework was the fact that the Doha Work Programme on ACE (2012-2020)—to which McGhie contributed[581]—explicitly mentioned museums as key sites for mobilising the public in climate action. The Work Programme was subject to redrafting at COP26, which provided a targeted focus for the team. The exhibition offered a means for them to demonstrate compellingly how the museum sector currently does, and can, contribute to ACE.[582]

Besides its being underpinned by macro-level UN agendas and policies, the exhibition also emerged from micro-level contexts of research. Significant among these was a collaborative project carried out by an interdisciplinary team of researchers (managed under Rodney Harrison) and supported by twenty-five partner organisations. The project, 'Heritage Futures' (2015-2019)—involving non-academic partners from heritage, museums, zoos, herbaria,

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[576] See Henry McGhie, 'Curating Tomorrow Guides', *Curating Tomorrow*. Available at: https://curatingtomorrow.co.uk/curating-tomorrow-guides/ [accessed 17 September 2025].
[577] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024. Also see Museums for Climate Action, '*Reimagining Museums for Climate Action* Open Call', (2020). Available to download at: https://www.museumsforclimateaction.org/rethink/background [accessed 17 September 2025].
[578] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[579] See United Nations Climate Change, 'Action for Climate Empowerment'. Available at: https://unfccc.int/topics/education-and-youth/big-picture/ACE [accessed 17 September 2025].
[580] Museums for Climate Action, 'Reimagining Museums for Climate Action Design Manual V4', 6.
[581] Henry McGhie, 'Information on Steps Taken by Global Museums to Implement the Doha Work Programme and in Relation to Action for Climate Empowerment', (2020). Available at: https://www4.unfccc.int/sites/SubmissionsStaging/Documents/202002131238---Curating%20Tomorrow%20Doha%20Review.pdf [accessed 17 September 2025].
[582] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024. Also see Rodney Harrison and Colin Sterling, 'Rethinking Museums for the Climate Emergency', in Rodney Harrison, Nélia Dias and Kristian Kristiansen (eds.), *Critical Heritage Studies and the Futures of Europe* (UCL Press, 2023), 27.

seed banks, botanical gardens, rewilding projects and national parks—took a deliberately broad approach to heritage to explore its future-making practices and philosophies.[583] *Reimagining Museums* emerged directly out of the findings of Heritage Futures, 'taking really seriously the idea that heritage is something that's done on behalf of future generations; that it somehow resources the future.'[584] Thus, key to the rationale of the exhibition was to '[think] about when those futures are, what those future imaginaries look like, and what the actual, real capacity for different sorts of heritage practices to realise these imagined futures is.'[585]

Building on Heritage Futures, Harrison conceptualised the exhibition as 'speculative'—concerned with imagining future worlds—but also 'profane'—concerned with unravelling and reconfiguring ideas, practices and phenomena that were inherited from the past and which continue to shape the present.[586] The focus for speculation was the 'museum', speaking to both its conceptual and practical qualities. *Reimagining Museums* therefore harnessed speculative visions of the future of museums as the basis to call for their radical transformation.[587]

But beyond their own contexts of research and practice, the curators also situate the vital work of reimagining museums in a macro context of social upheaval across 2020. First, the Covid-19 pandemic. Bringing museum activities to a halt, and disrupting everyday lives, the lockdown provided space, time but also urgency to contemplate the future of museums, being 'a stark reminder of the constant need for reflection and reimagination across all walks of life.'[588] Another impetus to *reimagine* was presented by 'that other seismic event of 2020': the murder of George Floyd by police in Minneapolis, which reignited the BLM movement to an unprecedented degree.[589] As the curators reflected, BLM 'crystallised and accentuated a range of issues simmering beneath the surface of museological discourse and practice for at least a decade, not least around questions of decolonisation, restitution, diversity and inclusion.'[590] Living through this moment—which called upon public institutions to be actively anti-racist and decolonial—amplified the gravity of reimagining museums for the post-

[583] Rodney Harrison et al., 'Heritage Futures', *Archaeology International*, no.19, (2016), 68-72; Rodney Harrison et al. (eds.) *Heritage Futures*.
[584] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[585] Ibid.
[586] Rodney Harrison and Colin Sterling, 'The Speculative and the Profane: Reimagining Heritage and Museums for Climate Action', in Nick Shepherd (ed.), *Rethinking Heritage in Precarious Times: Coloniality, Climate Change, and Covid-19* (Routledge, 2023), 93-110.
[587] See Henry McGhie, *Mobilising Museums for Climate Action*, 117.
[588] Rodney Harrison and Colin Sterling, 'Museums Otherwise: A Compendium of Possible Futures', 7.
[589] Ibid., 7.
[590] Ibid., 7-8.

pandemic world; museums could not go 'back to normal'.[591] Combined, Covid-19 and BLM intensified for the curators the necessity to reimagine museums in ways that underscore their pivotal role in social and racial justice, recognising that systemic racism and colonialism are entangled in the climate and environmental crises. The 'climate action' in *Reimagining Museums for Climate Action* therefore encompasses a myriad of social, cultural, political and economic dimensions beyond the geophysical mitigation of climate change.[592]

Besides the curators' responding to the wider context of BLM and growing calls for museums to decolonise, on a more personal level, it was paramount to Harrison that the exhibition was underpinned by principles of social justice. Being Australian by birth and having worked with Aboriginal communities in his archaeological and heritage practices—particularly on issues of land rights—Harrison understands climate change 'as a strongly racialised problem, and one that relates to colonial processes as well as capitalist processes.'[593] Drawing on his microsphere of influence, he perceives heritage and museums as 'interwoven' with these issues. To sufficiently address climate change and biodiversity loss, as such, he considers it pivotal for the sector to acknowledge and rectify its role in underpinning the structures of capitalism, colonialism and racism.[594] That being so, justice was a key theme of the exhibition,[595] and the decolonisation and indigenisation of museums were prominent and recurring issues in the exhibits.

In Table 3.2 I summarise all of the complex, interacting agencies that constituted the context from which the *Reimagining Museums* exhibition emerged. I categorise them according to the ecological spheres of influence around the curators: Rodney Harrison, Colin Sterling and Henry McGhie. Even though Glasgow Science Centre is not technically within mesosphere in a formal, permanent sense—given that they are not employed by the institution—I nonetheless situate it in the curators' mesosphere given that they worked collaboratively with staff at the Science Centre to develop the exhibition.

[591] Ibid., 8.
[592] Ibid, 8.
[593] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[594] Ibid.
[595] Museums for Climate Action, 'Reimagining Museums for Climate Action Design Manual V4', 6.

Table 3.2 Summary of Ecological Agencies in Exhibition Contexts: *Reimagining Museums for Climate Action*

Factors and Actors that Initiated and Shaped *Reimagining Museums for Climate Action*				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
Harrison, Sterling and McGhie functioned as *external* Curators to Glasgow Science Centre. They did not have to conform to its exhibition policies.	Glasgow Science Centre was hosting the 'Green Zone' of COP26.	The exhibition was devised as a contribution to COP26. It served to represent the museum sector at the conference, being physically located in the COP 'Green Zone'.	Covid-19 and BLM were major issues that shaped the content and approaches of the exhibition.	Covid-19 and the revival of the BLM movement created a sense of living in unprecedented times, which upheld the aim to reimagine museums.
The exhibition drew on McGhie's expertise on UN frameworks and how they intersect with museum work.	The Science Centre accepted the exhibition because they believed it was a compelling addition for COP26.		BLM revived discussion and action to decolonise museums, denounce endemic racism and call for social justice.	
The project grew out of Harrison's research in 'Heritage Futures' and thinking around the speculative role of museums.	For the Science Centre, hosting the exhibition would attract new audiences as well as provide a different offer to existing visitors.			
Harrison is passionate about decolonising and indigenising museums.	Hoyle and Rose stressed the importance of the curators having editorial control.			
	The curators were working with concepts that had been selected by an independent panel of experts.			

Sediment Spirit: An Exhibition in a Reimagined Institution

While *Reimagining Museums* was calling for museums to transform themselves, the Sainsbury Centre's *Sediment Spirit* did precisely emerge from a context of institutional reimagining and transformation upon the appointment of Jago Cooper as Director in 2021. One of the standout transformations that Cooper initiated pertains to exhibition programming. Moving on from exhibitions that explored themes, artists and movements in isolation—which, in general, spoke to the interests of art and cultural history—exhibitions are now configured to address an overriding theme, posed as a question to the audience. Every six months, the Sainsbury Centre enters a new 'season' where it confronts a major societal challenge within its two exhibition galleries and their related events and activities. *Sediment Spirit* emerged from one such season, called *Planet for Our Future*, which speculated *how do we adapt to a transforming world?*[596]

Cooper's decision to structure the gallery's public programming around important societal issues—such as 'How are we going to deal with climate change? How are we going to stop people killing each other? What is truth? How can I find love in my life?'—emerged from his reimagining of the museum to improve the lives of its audiences. That led Cooper to realise a vision for the Sainsbury Centre that was constructed upon a social responsibility to '[answer] the questions people want an answer to. […] If everything starts with a question that people want answered, then it changes the way you do things. It makes what you're doing useful in society.'[597]

This reorientation of the Sainsbury Centre to engage with *big issues*, activating art to address major societal challenges, also led to the gallery establishing the position of 'Curator of Art and Climate Change'—the first curatorial position of its kind in the UK. This role was granted to Ken Paranada in autumn 2022, and his first exhibition at the gallery was *Sediment Spirit: The Activation of Art in the Anthropocene*, which opened in October 2023. The institution's aim in creating the position was to nurture a synergy between art, science and climate action; 'It's important to point out that it's an art *and* climate change role—so, it's bridging those two things together.'[598] This interdisciplinary objective was underscored by the

[596] See John Kenneth Paranada and Vanessa Tothill (eds.), *Planet for Our Future: How Do We Adapt to a Transforming World* (Sainsbury Centre for Visual Arts, 2023).
[597] Quoted in Geraldine Kendall Adams, 'Profile | 'Everyone Was Like "Oh My God, He's Actually Serious"'', *Museums Journal*, 31 July 2025. Available at: https://www.museumsassociation.org/museums-journal/people/2025/07/profile-everyone-was-like-oh-my-god-hes-actually-serious/ [accessed 17 September 2025].
[598] Interview with John Kenneth Paranada (Sainsbury Centre). 16 February 2024.

role's being developed in partnership with the UEA's Tyndall Centre for Climate Change Research. To Paranada, this ties in with the Sainsbury Centre's ambition to '[explore] new ways of developing exhibitions': embracing interdisciplinarity, complexity and rhizomatic thinking in its mobilisation of art to address the big, intersectional issues of today.[599] *Sediment Spirit*, therefore, is grounded in this context wherein the praxis of the curator was deliberately conceptualised as *challenging* to museal convention, and deliberately conceived through interdisciplinary collaboration. I speak more on the impacts of this in the following section, as well as the thesis Conclusion.

Exhibition Speculations: Activating 'Objects', 'Concepts' and 'Art' towards Imaginative Thinking

Our Future Planet: Utilising *Objects* to Speculate the Future of Carbon Capture

The Science Museum's *Our Future Planet* was premised around the overarching question of 'can carbon capture help us fight climate change?'.[600] Therefore, the speculative thinking that visitors were invited to partake in centred on their imagining a world in which carbon capture is taking place and conjecturing the extent to which it will help to mitigate climate change. After setting up this speculative premise, the exhibition introduced what carbon capture is, demonstrated the urgency to mitigate climate change, and then imparted evidence as to how different forms of carbon capture and storage could contribute to these mitigative efforts.

The journey through an exhibition does not begin at the exhibition entrance. Rather, the visitor arrives at that entrance by first traversing the space in which it is housed, whether that is a museum, a science centre, an art gallery, or otherwise. So, the speculative journey through *Our Future Planet* really begins at the entrance to the Science Museum. To arrive at the exhibition (providing that they did not take any detours upstairs or downstairs), the visitor would have first walked the length of the ground floor, travelling through *Energy Hall*, *Exploring Space* and *Making the Modern World*. As Cole described, by the time visitors had arrived at *Our Future Planet*, essentially, they would have walked through 'the last 250 years of industrialisation.'[601]

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[599] Ibid. Also see John Kenneth Paranada, 'A Path Forward: Curating Art & Climate Change at the Sainsbury Centre, University of East Anglia', *Museum International*, Special Issue: 'Museum Sustainabilities', Vol.75(1-4), (2023), 58-59.
[600] Introduction panel, *Our Future Planet*.
[601] Rupert Cole, in Tom Previte and Emily Swaddle, 'S2#1 | Communicating Carbon at the Science Museum', *The Carbon Removal Show* [podcast], 3 August 2022. Available at: https://thecarbonremovalshow.com/episode/s2-1-communicating-carbon-at-the-science-museum [accessed 17 September 2025].

Energy Hall, Exploring Space and *Making the Modern World*—in both their purpose and content—celebrate a material history of 'progress' and 'achievement' through the development of science, technology and industry. Crucially in this story of achievement, across the galleries, there is no mention of climate change and the environmental impacts of industrialisation, transport and space travel. *Our Future Planet*—located at the far end of the Museum in the Wellcome Wing, in Tomorrow's World—therefore constituted the first moment when visitors would encounter climate change (providing that they had not already visited *Atmosphere* on Level 2).

In its spatial figuration following *Making the Modern World*, Tomorrow's World thus offered a space to speculate the legacies of science, technology and industry in shaping the future. In the case of *Our Future Planet*, it is an imagining of the future that seeks to rectify the climate change that resulted from a long history of extraction, industrialism and consumerism. Although the exhibition did not directly allude to *Making the Modern World*, its portrayal of a causal relationship between climate change and 'centuries of human activity, notably the burning of fossil fuels',[602] along with its spatial relationship with the preceding gallery, situated climate change in a historical continuum that commenced with the Industrial Revolution. Fundamentally, *Our Future Planet* was oriented in the present with a speculative gaze on the future, compared to *Making the Modern World*, which is situated in an empirically constructed past and present of technological and industrial innovation.

Underpinning *Our Future Planet*'s speculative gaze towards the future were meso-level factors that stressed the need for audiences to come away feeling *hopeful* and *inspired*. Front-end name testing and formative evaluation by the Audience Research team revealed that visitors indeed stressed *hope* as a crucial want from the exhibition. Responding to this, the exhibition's Interpretation Plan stipulated that it should highlight 'inspiring stories of people taking current action to find solutions', as well as reinforce messaging on 'collective action beyond the individual.'[603] *Our Future Planet*, through its employment of a collective 'our', thus served to foreground this sense of collectivity in climate action. In the wider field of museal activity, *Our Future Planet* was one of many exhibitions and galleries occurring simultaneously that framed the causes, impacts and responses to climate change through the plural personal pronouns of 'we', 'our' and 'us', denoting a collective humankind. Across 2021 and 2022 alone, along with ***Our*** *Future Planet*, they included ***Our*** *Broken Planet: How*

[602] Introduction panel, *Our Future Planet*.
[603] Science Museum, '*Carbon Capture* (Working Title) Interpretation Plan', 4; Victoria Lockley, 'Carbon Capture Exhibition and Climate Events Name Testing' [unpublished], (2020).

We *Got Here and Ways to Fix It* (Natural History Museum, London), ***Our*** *Changing Planet* (Thinktank) and ***Our*** *Time on Earth* (Barbican Centre, London).

Throughout *Our Future Planet*, in response to the findings of Audience Research and the subsequent recommendations of the Interpretation Plan, collective pronouns were employed in the text to echo the messaging around the need for collective action. This, in turn, underpinned the key message of the exhibition that 'no technology or person can stop climate change alone. But together, there is hope for our future.'[604] Despite this being a universal call to action, the remainder of the exhibition primarily spotlighted the agency of scientists, engineers and industries to take mitigative action, along with governments and corporations to a degree. Objects provided the medium through which to represent these agencies in future-making.

The curators' employment of objects in this endeavour was shaped by their meso-level context of the people-centred framework of Science Museum curatorship. In line with this (unofficial) mode of thinking and practice, the project team behind *Our Future Planet* were less concerned with relaying knowledge and facts about carbon removal and how it works, and more with encouraging visitors to contemplate the potential futures of carbon removal. Accordingly, the Interpretation Plan stipulated that the exhibition should not come across as 'didactic' but instead 'questioning in tone'. Objects were figured as a tangible connection to carbon removal practices, '[inviting] visitors to imagine *living* with carbon capture technologies and consider their impact on their lives [emphasis in original].'[605] Rather than promote didactic learning, objects served to provoke imagination, speculation and discussion.

In the following discussion, I draw attention to how objects functioned in these capacities. I highlight how the curators deployed objects to speculate future worlds and signify agency in making those futures possible. In particular, I draw attention to how the objects in the exhibition were figured as real, tangible *evidence* to provide a basis to speculation. Unlike the concepts in *Reimagining Museums*—which imagined futures in ways that were not necessarily based in reality—the objects in *Our Future Planet* existed in their own right in the 'real world'; they are already an empirical, present reality. They ensured that speculating the future was grounded in 'current action' and 'direct responses': 'The exhibition will explore responses happening today—not yesterday, not tomorrow. Researchers are *doing* things,

[604] Introduction panel, *Our Future Planet*.
[605] Science Museum, '*Carbon Capture* (Working Title) Interpretation Plan', 2; 8-9.

people are *protesting*, conservationists are *planting* trees'.[606] The speculative mode then comes into play in thinking about how these activities and technologies, 'if scaled up, applied where appropriate and actioned collectively, could be part of a solution to the climate crisis.'[607] The methods and technologies of carbon removal exist, and this is evinced by the objects on display. The question being posed to audiences, therefore, is whether, and how much, they can 'help us fight climate change'.[608] In other words, what future *potential* do they imagine for carbon removal practices to mitigate climate change and help heal the planet?

But before I examine how objects were utilised as empirical groundwork to speculate the future of carbon removal, I spotlight objects that were used in an introductory capacity to provide context to these practices. The first object display that audiences would encounter in the exhibition—before they were removed (see Chapter 1)—were the youth climate strike protest materials. They were conceived as forming part of the 'Threshold' to the exhibition, providing a familiar touchpoint to the urgency of climate action [Fig. 1.8]. Being recognisable objects in the public imagination—evoking a well-known form of climate action—the protest placards functioned to reassure and encourage visitors further into the exhibition, stimulating their continued engagement.[609] Furthermore, these objects provided a connection to the curatorial objective to 'explore responses today'. They functioned to embody the fact that 'people are *protesting'*:[610] they are evidence of the drive, dedication and agency of young people to call out injustices and demand those in power to do more to safeguard the future of life on Earth.

However, when the creators of the placards asked for them to be removed from the exhibition a few months after it opened, in protest against Shell's sponsorship, this act of removal subsequently erased the presence of activists from the exhibition. It took away their power in future-making from the exhibition's speculations. On the suggestion of Rupert Cole—who was at that point Lead Curator on the exhibition, covering Sophie Waring's maternity leave—the placards were replaced by a collection of newspapers from 10 August 2021, which all had front-page headlines responding to the publication of Working Group I's contribution to the IPCC Sixth Assessment Report [Fig. 3.2].

[606] Science Museum, '*Carbon Capture* (Working Title) Interpretation Plan', 9.
[607] Ibid.
[608] Introduction panel, *Our Future Planet*.
[609] Science Museum, '*Carbon Capture* (Working Title) Interpretation Plan', 10.
[610] Ibid., 9.

As he described, ‘it was a real, special material culture moment where all the newspapers aligned’ in their reporting on the crisis and urgency of the changing planet. Many of these front pages featured the same image of a woman in Greece who was crying out in despair at the wildfires engulfing her home. She ‘became a sort of icon of this moment of panic, of alarm, of the fact that governments around the world—and leaders—needed to wake up and do more about climate change.’[611] Calling for ‘code red’ and the need to ‘wake up’, the newspapers thus fulfilled a purpose in the introduction to situate the urgency of climate action in context: in the growing reality of climate change and its catastrophic impacts.

Another object display from this introductory section was the fossilised plant material [Fig. 3.3]. Here, these fossils were harnessed for their materiality, providing a physical, tangible introduction to carbon, thereby working to make the concept of carbon capture and storage less abstract for audiences. I draw particular attention to these fossils not so much for their role in the speculative rationale of the exhibition, but because they provide a compelling example of the agencies that impact curating. These objects were incorporated into the exhibition by the curators precisely due to their being passionately advocated for by Roger Highfield. As an Executive of SMG, he is a notable and highly influential actor in curators’ mesosphere.

> ‘[…] the only thing I remember having big arguments with the curators about—something a bit surreal—was that I really wanted an object that would explain what a fossil fuel is. Of course, if you look at the carbonaceous deposits, you can see imprints of trees and ferns in them. You can actually see how they were ancient plant life. And after much argument, we did put that into the exhibition, just to show that, there’s people who glibly use the phrase ‘fossils fuel’, but they don’t really understand that it literally does mean a *fossil* fuel.’[612]

From Cole’s perspective, the fact that an Executive was so prescriptive in what they wanted for the exhibition was unusual, given that the selection of objects typically falls to the judgement of the curators. But as he recalled, the fact that there was ‘room for this kind of influence’ was likely due to the curators having such little time to plan and source objects before the show’s opening, once lockdown restrictions had been eased. Luckily for Cole and Waring, they were able to loan—at the last minute—natural history specimens of coal from Manchester Museum. They were assisted by a former colleague from Manchester’s Science

[611] Rupert Cole, in Tom Previte and Emily Swaddle, ‘S2#1 | Communicating Carbon at the Science Museum’.
[612] Interview with Roger Highfield (Science Museum). 10 June 2025.

and Industry Museum (part of the SMG), but who had at that point recently transferred to become Head of Collections at Manchester Museum.[613] So, while it is one thing to analyse, from an intellectual standpoint, why and how objects function in display contexts, I recognise that there are always practical circumstances that underpin the object's appearing in the exhibition in the first place. The final product of curators' work—whether that is an exhibition, a gallery or an acquisition—is entangled with the processes that led them there and the ecological interactions through which those processes took place.

Following the introductory zone, the exhibition proceeded to explore its 'different visions at play' in speculating the future of carbon removal.[614] Objects supplied a means to encapsulate these different visions. Following the fossil display was 'Working with nature': a section of the exhibition that examined the role of nature-based solutions in bringing the Earth's carbon into balance, posing the speculative question of 'can the planet save us from climate change?'. In this space, the focus on trees was accentuated by the wall panelling, depicting UK species that are targeted by scientists as carbon sinks.[615] To speak to the future potential of nature-based solutions—and to evidence the work of scientists in investigating and instigating these approaches—objects included cross sections of tree trunks [Fig. 3.4], a soil respiration apparatus, a soil core extractor and a tree stem dendrometer [Fig. 3.5].

As I explore in more detail in 'Exhibition Legacies', foregrounding the work of ecologists is a turning point for the Science Museum and its curators in their conceptualisation of its scientific scope. Bringing these objects of ecological and conservation science into the exhibition—and afterwards acquiring some for the permanent collections—signals the curators' active expansion of the Museum's intellectual remit to incorporate nature as an agential actor in constructing scientific knowledge and subsequent future-making. Besides emphasising the human actors by '[highlighting] the importance of ecological and conservation work', the objects also serve to emphasise the nonhuman actors in climate change mitigation, demonstrating how woodlands and forests are 'areas of cutting-edge research that involve innovative methodologies', but also vital agents in their own right in regulating atmospheric systems.[616]

[613] Interview with Rupert Cole (Science Museum). 29 May 2025.
[614] Interview with Rupert Cole (Science Museum), 29 May 2025.
[615] Rupert Cole, in Tom Previte and Emily Swaddle, 'S2#1 | Communicating Carbon at the Science Museum'.
[616] Science Museum, 'Acquisition Proposal ACQ0000676: Soil Respiration Apparatus and Tree Dendrometer' [unpublished], (2021), 2.

Moving into the latter half of the exhibition, the focus turned towards the future potential of *engineered* approaches to carbon capture and storage. Entitled 'Out of thin air', the curators intended this section to have a visual identity that contrasted with the nature-based approaches, thereby accentuating the 'different visions' of the future. Instead, it had 'a much more stripped-back, industrial, grey feeling. And this was supposed to mirror the change of content towards the more industrial, technological projects that we're highlighting.'[617] While the previous section spotlighted the agency of natural scientists, ecologists and conservationists, 'Out of thin air' drew attention to the agency of chemists, engineers and inventors, foregrounding *technological* approaches to carbon removal and storage. Notable objects that represented engineered forms of carbon capture and storage included Klaus Lackner's Mechanical Tree prototype [Fig. 1.5], the Climeworks direct air capture unit [Fig. 1.6], and submissions from the 'Carbon XPRIZE' competition 'for breakthrough technologies that convert carbon dioxide emissions into usable products' [Fig. 3.6].[618]

As an example of how these objects were harnessed as an evidential basis to speculative thinking, I spotlight the Mechanical Tree prototype. By its very nature as a *prototype*, it offered a story of 'technology in development', and to Rupert Cole, the fact of its not being the 'finished article' supplied its rationale in the exhibition.[619] It demonstrated the principle of carbon removal technologies as *works in progress*; they exist now, in the present, but what they will look like and how they will work in the future is open to the viewer's speculation. The curator's situating the object as a tangible prompt for imaginative thinking was also reinforced by its retro-seeming appearance and resemblance to science-fiction technologies, which he found particularly compelling. 'It really is a stunning object. […] to me, it looks like a futuristic object from the 1950s or '60s. It's very mechanical, very prototype-y.'[620] Roger Highfield was drawn to the Mechanical Tree in a similar way: 'it's a wonderful Heath Robinson—or Rube Goldstein, as the Americans would say—apparatus.'[621] By calling to mind fantastical, sci-fi-esque visions of future technologies in his material encounter with it, to the curator, the object helped to convey a dual sense of *material reality* and *future imaginary*, evoking a speculative wonder about its future potential. From the curator's material encounter with the object, he deemed it compellingly appealing to audiences as well as aligning with its narrative function in the exhibition space.

[617] Rupert Cole, in Tom Previte and Emily Swaddle, 'S2#1 | Communicating Carbon at the Science Museum'.
[618] 'Carbon XPRIZE objects' object label, *Our Future Planet*.
[619] Rupert Cole, in Tom Previte and Emily Swaddle, 'S2#1 | Communicating Carbon at the Science Museum'.
[620] Ibid.
[621] Interview with Roger Highfield (Science Museum). 10 June 2025.

To conclude my analysis of objects in *Our Future Planet*, I consider how the role of the exhibition curator was figured in relation to this exhibitionary medium. Arriving on the project late in its timeline, to Cole, *Our Future Planet* was 'quite a strange situation to walk into.'[622] Because of all the setbacks posed by the pandemic, and the resulting upheavals in the exhibition team, by the time that Cole and Waring joined, the overarching narrative and themes of the exhibition were in place—and some of the text had started to be written—but 'pretty much none of the objects had been secured, and some of them not even identified.'[623] Although Cole acknowledges that there are many different ways to approach exhibition-making in the Science Museum, to his experience, this situation was quite difficult to grapple with for the curators; 'it's not the usual way you go about things in exhibition development. You would try to lock down and have a very secure idea of what the objects are first and *then* approach the text.'[624] So, producing an object list for *Our Future Planet* was carried out within a pre-established framework: 'we need this sort of thing to do this kind of story/narrative device. And we write the texts according to whatever we want to communicate.'[625]

In comparison with the concepts in *Reimagining Museums*, as I explore below, the objects in *Our Future Planet* were harnessed *collectively* by the curators for their ability to stimulate futures thinking. Separately, the objects do not invoke unique, standalone speculations of future worlds (as the concepts do in *Reimagining Museums*). Rather, it is in their being displayed and interpreted *together*—united by the overarching narrative and top-level messages of *Our Future Planet*—that the objects function as tools for speculation. The curators did not emphasise the agency of the objects on an individual level—permitting them to speak for themselves—but rather, they worked the objects to speak collectively to the pre-determined messages and ideas of the exhibition. As such, the curatorial voice—even though much of the content of this voice was already decided before the curators came on board—took precedent over the voice of the objects' creators. This stands in contrast to the dynamic between the curators and the concept creators in *Reimagining Museums*.

Being grounded in the *real* science and the *real* technology that are having a *real* impact on climate mitigation efforts, there was little room in *Our Future Planet* to speculate freely beyond the prescribed perspectives of the exhibition—the perspectives of scientists and engineers. In large part, the exhibition's lack of critique on broader issues of the changing

[622] Interview with Rupert Cole (Science Museum). 29 May 2025.
[623] Ibid.
[624] Ibid.
[625] Ibid.

planet—social, cultural, political—stems from the meso-level context that Tomorrow's World exhibitions had a limited capacity to unpack scientific issues beyond the introductory science communication: explaining what the science or technology is and how it works. In the Science Museum's exhibitionary schema, this was how Tomorrow's world exhibitions functioned: as *snapshots* into issues and practices of contemporary science.[626]

The meso-level circumstances within which the curators were working—as I highlighted at the end of this section—were crucial factors that underpinned their approaches to working with and interpreting objects in *Our Future Planet*. In the table below, I summarise the interacting agencies—micro, meso, exo, macro and chrono—that I identified in this section as influencing curators' harnessing of objects as speculative tools.

[626] Ibid.

Table 3.3 Summary of Ecological Agencies in Exhibition Speculations: *Our Future Planet*

Agencies that Shaped How *Objects* Were Harnessed for Speculative Thinking in *Our Future Planet*				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
A lot of the meanings that curators drew from objects in the exhibition, e.g., the Mechanical Tree, stemmed from the personal encounters that they had had with the objects' materiality.	An SMG Executive had a direct influence over the object list, advocating especially for the inclusion of fossil specimens.	The curators had a contact at Manchester Museum, which facilitated their loan of fossil specimens at the last minute.	The Covid-19 lockdown meant that curators had to go on furlough, leading to a reorganisation of curatorial and project teams. As such, Cole and Waring were brought on board late in the exhibition development.	Tomorrow's World is figured by the curators as an extension of the time-space constructed by the preceding gallery, *Making the Modern World*. *Our Future Planet* was seen by Cole to function in dialogue with this, critiquing its celebration of modernity.
The curators had to negotiate around the pre-determined messages and text in their selection of objects. This created an unusual situation for them to be working in.	It is common practice for the interpreters' voice to *speak for* the object. Objects are harnessed collectively to conform to an overarching narrative and top-line messages.	The young activists who had made the placards which were on display in the exhibition called for them to be removed in protest against the show's sponsorship by Shell. As such, Cole had to think on his feet to replace this 'Threshold' display.		
	The Audience Research team's front-end and formative evaluation found that audiences favoured an exhibition with hopeful messages and content that related to their own lives.			
	Tomorrow's World was a small space that was seen to only lend itself to basic science communication.			

Reimagining Museums for Climate Action: Utilising *Concepts* to Speculate the Future of Museums

In contrast to my other case studies in this thesis, this example of exhibition-making extends beyond the realm of the museum 'object' and museum 'collections'. Rather than designate its media in conventional, material terms—such as 'objects' and 'artworks'—*Reimagining Museums for Climate Action* speculated the future of the changing planet by means of exhibiting 'concepts'. Specifically, 'concepts that reflect the diversity and creativity of museums', but which are also underpinned by 'a broader set of debates on the roots of social and environmental injustice, and the role of museums in these histories.'[627] By accentuating the *intangible* nature of the exhibits comprising the exhibition—foregrounding their *ideas* over their aesthetic or material qualities—the curators of *Reimagining Museums* are implicitly promoting a paradigm shift in curatorship that decentres the 'traditional' focus on objects and instead conceptualises it as a praxis centred around nurturing and sharing *ideas*.[628] It also leans into Harrison's existing work of engaging with heritage through new-materialist and relational-ontological frameworks.[629]

This approach to defining the curators' media mirrored the philosophy of *Reimagining Museums*, which pivoted around the question of 'what would it take for museums to become catalysts for radical climate action?'[630] Each concept functioned as a response to this question, being a standalone exhibit that speculated a radical future museum. The visitor, moreover, could themselves engage with the *big question* at the exhibition's 'HQ'. Here, they were provided with postcards containing the prompt 'What if museums …?', to which they could share their own imaginations of the future museum.[631]

The visitor experience through the eight concepts of *Reimagining Museums* would have varied drastically according to when they were making their visit to Glasgow Science Centre. While COP26 was taking place—between 1 and 12 November 2021—the Science Centre would have been abuzz with activity and conversation around climate action. So much so, the exhibition visitor would have not particularly engaged with the Science Centre's permanent galleries, given that these were superseded by the organisations, businesses,

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[627] Rodney Harrison and Colin Sterling, 'Museums Otherwise: A Compendium of Possible Futures', 7.
[628] See Hilde S. Hein, 'The Authority of Objects: From Regime Change to Paradigm Shift', *Curator: The Museum Journal*, Vol.50(1), (2007), 77-85.
[629] See Rodney Harrison, 'On Heritage Ontologies: Rethinking the Material Worlds of Heritage', *Anthropological Quarterly*, Vol.91(4), (2018), 1365-1384.
[630] Museums for Climate Action, 'Reimagine | Possible Futures | View the Exhibition'.
[631] Ibid.

community groups, researchers, artists, inventors, activists, and so on, who were there to showcase their work and contribute to discussions.

Being in proximity with other public engagement activities, raising awareness about diverse approaches to climate action, the visitor walking through *Reimagining Museums* would have situated the exhibition along a continuum beside the other discussions at COP26. It was not a culmination or a separate entity to the preceding activities, but part of a whole, amalgamated dialogue on sustainable future-making. Building on what they would have encountered from other exhibits in the Green Zone, the purpose of *Reimagining Museums* was to then 'challenge visitors to think about museums' in a critical way,[632] assessing their unique contribution to climate action, but also contemplating how they could complement other forms of climate action. In this setting, the audience was thus invited to speculate the *future museum*, imagining how it could go further to cement its role in building sustainable worlds. The exo-level context of COP26—integrating a plurality of perspectives on climate action—thus provided an essential underpinning to the speculative thinking employed by the exhibition.

Even if the visitor did not experience *Reimagining Museums* while Glasgow Science Centre was hosting the Green Zone, the exhibition still bore relation to the environment in which it was displayed. In the months preceding COP26, the exhibition was more of a standalone experience, being spread out across *Powering the Future* [Fig. 3.7], *Idea No59* [Fig. 3.8] and *Our World, Our Impact*. Of course, the exhibition did not move out of these locations during the conference, but their contents were obscured by all the lively activity.

Powering the Future is an interactive gallery centred around 'our energy challenge', looking at energy generation and consumption in the UK through the three-pronged framework of sustainability, security and affordability. *Idea No59*, meanwhile, is a future-oriented display that explores potential 'world-changing' innovations. The theme of 'Resourceful Planet', for example, speculates the future impact of vertical farming, urban mining, bio-based materials, and artificial intelligence-informed conservation. And *Our World, Our Impact* is a small display space focusing on issues of the changing planet and sustainability, linked to the broader *Our World, Our Impact* programme of public engagement that was initiated in connection with COP26.

[632] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.

By granting space for the exhibition on the second floor of the Science Centre—so that it could be viewed in proximity to the gallery and displays that are already thematically concerned with the changing planet—it is clear that Museums for Climate Action team, including Robin Hoyle and Graham Rose, were making a purposeful connection (or juxtaposition) between their ideas and messages. Besides this meso-level ambition to link the spaces intellectually, *physically* building the exhibition in and around permanent spaces also succeeded, to the curators, in underscoring the philosophy of the exhibition. That is, it 'mirrored aspects of the competition brief itself, forcing us and our designers to practically explore ways of reimagining an existing exhibition for climate action.'[633]

The intended journey through *Reimagining Museums* began and ended at the exhibition's 'HQ', located near *Idea No59*. Here, a large text panel, illustrated by a map of the exhibits, introduced the big idea of the exhibition: a showcase of eight imaginative proposals for future museums that are underpinned by radical principles of socio-environmental action. Beyond the HQ, the remainder of the exhibition was dedicated to the concepts, each proposing a vision for a future museum. Spread out across the second floor of the Science Centre, the exhibits proceeded as follows (according to the journey on the exhibition map):[634]

1. *The Museum of Open Windows* (UK) imagined a 'repurposing' of museum infrastructure to support inter-community collaboration, acting as hubs of citizen research into climate change and collective climate action ('What if museums became centres for community-led climate research and action?').[635]

2. *Existances* (Brazil) imagined a network of mobile, transient micro-museums that support Afro-Brazilian and Indigenous communities to share their knowledge and practices of care for the environment ('What if museums were small places that supported communities in addressing local climate challenges and actions?').[636] To Harrison, the concept was complementary with the Science Centre's messaging that 'everyone is a scientist':

[633] Rodney Harrison and Colin Sterling, 'Museums Otherwise: A Compendium of Possible Futures', 10.
[634] See Museums for Climate Action, 'Reimagine | Possible Futures | View the Exhibition'.
[635] Nico Alexandroff, 'Reflecting on the Museum of Open Windows', in Rodney Harrison and Colin Sterling (eds.), *Reimagining Museums for Climate Action*, 20-25; Glasgow Science Centre, 'Sensing Climate Change—Museum of Open Windows', (2021). Available at: https://www.glasgowsciencecentre.org/discover/our-world-our-impact/the-hub/sensing-climate-change-museum-of-open-windows [accessed 17 September 2025].
[636] Jairza Fernandes Rocha da Silva et al., 'Existances Museums: Postponing the End of the World', in Rodney Harrison and Colin Sterling (eds.), *Reimagining Museums for Climate Action*, 42-51.

> ‘this [concept] is about drawing on other forms of science. Indigenous cosmologies are also conservational. They’re also about observing cause and effect, but often come up with quite different solutions to ‘Western’, or ‘modern’ forms of science. […] The idea is to open the debate about climate action to Indigenous forms of knowledge in a more substantial way than has been the case until now.’[637]

3. *Natural Future Museums* (UK) imagined conferring the status of museums onto Indigenous lands, knowledge and practices of care, safeguarding and empowering communities who are fighting to protect the environment (‘What if Indigenous lands were thought of as a kind of museum for climate action?’).[638]

4. *Weathering With Us* (Singapore) imagined a form of museum architecture wherein climate action is embedded in the very structure, materials and experience of the building (‘What if museum buildings themselves contributed to real climate action, through their material fabric?’).[639]

5. *Dundee Museum of Transport* (UK) imagined a new role for the museum in the transition to net zero, especially in supporting communities to transition to sustainable modes of transport (‘How can museums support the move to climate-friendly technology and lifestyles?’). Being the least speculative of the proposals, the exhibit drew attention to the real-life efforts that the real-life Dundee Museum of Transport has engaged in to support and facilitate Dundee’s position as ‘ahead of the game’ in the broader ‘race towards net zero’ across Scotland.[640]

6. *Elephant in the Room* (USA) imagined, through a fantastical animation about a taxidermy elephant coming to life at the American Museum of Natural History, how museums could compel western society to redress processes of colonialism and exploitation that have led to climate change (‘What if museums and society were forced to confront their role in

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[637] Rodney Harrison, ‘*Reimagining Museums for Climate Action*: Staff Familiarisation’ [unpublished video]. Shared by Graham Rose, 4 April 2023 (personal communication).
[638] Takumã Kuikuro and Thiago Jesus, ‘Natural Future Museums’, in Rodney Harrison and Colin Sterling (eds.), *Reimagining Museums for Climate Action*, 70-73; Thiago Jesus, ‘Natural Future Museums: Indigenous Territories as Museums for Climate Action’, in Rodney Harrison. and Colin Sterling (eds.), *Reimagining Museums for Climate Action*, 74-81.
[639] Isabella Ong and Tan Wen Jun, ‘Healing and Intimacy in Climate Narratives’, in Rodney Harrison and Colin Sterling (eds.), *Reimagining Museums for Climate Action*, 100-107.
[640] Alexander Goodger, ‘The Journey to Becoming a Carbon Neutral Museum’, *Museums Journal*, 27 May 2021. Available at: https://www.museumsassociation.org/museums-journal/in-practice/2021/05/the-journey-to-becoming-a-carbon-neutral-museum/ [accessed 17 September 2025].

climate change?'). The animation was devised as a 'speculative ecofeminist fable for the climate crisis' and was narrated by Donna Harraway.[641]

7. *Story:Web* (UK) imagined museum collections as sources of big, open-access data, where people could access information and curate their own climate stories ('How can people curate their own climate information, to support climate action?').[642]

8. *A Series of Collective, Non-Statistical Evidence* (Indonesia) imagined a deconstruction of the museum and a redistribution of activities in collecting, interpreting and storytelling to communities. ('What if people gathered their own collections and information to support dialogue and climate action?'). The exhibit brought together everyday-seeming objects and presented them on a ping-pong table, where they functioned to provoke dialogue around climate change—this *dialogue* being the foundation to their reimagined museum.[643]

Together, the concepts took part in deconstructing and reconstructing the practices and ideas that underpin the 'museum'. But the ways in which they called for radical paradigm shifts—practical, physical and conceptual—varied. *Existances*; *Natural Future Museums*; *Elephant in the Room*; and *A Series of Collective, Non-Statistical Evidence* all imagined future museums that were grounded in principles of decolonisation, indigenisation and social justice. They all completely reassembled the very idea of the museum; taking it apart and redistributing it ways that redressed its colonial underpinnings. They accentuated the agency of decolonial practices, Indigenous communities and People of Colour towards mitigating and adapting to the changing planet, as well as nurturing just and sustainable futures.

Although *Dundee Museum of Transport* contained elements of a concern for social justice, on the whole, it was focused more on reimagining the museum in ways that spotlighted its agency in climate change mitigation. It shared this focus on physical mitigative action—centred around reducing the amount of carbon in the atmosphere—with *Weathering With Us*. In contrast to these proposals, *The Museum of Open Windows* and *Story:Web* suggested a future existence for the museum that completely removed it from a physical basis. They resituate the museum on interactive digital platforms, wherein users are granted

[641] Rania Ghosn and El Hadi Jazairy, 'Elephant in the Room', in Rodney Harrison and Colin Sterling (eds.), *Reimagining Museums for Climate Action*, 121.
[642] The Great North Museum: Hancock et al., 'Story:Web', in Rodney Harrison and Colin Sterling (eds.), *Reimagining Museums for Climate Action*, 137.
[643] Kamil Muhammad et al., 'A Series of Collective, Non-Statistical Evidence', in Rodney Harrison and Colin Sterling (eds.), *Reimagining Museums for Climate Action*, 154-157.

power to generate content. As such, they speculate futures in which practices of curatorship, research, heritage and storytelling are reassigned to publics. In turn, they foreground the agency of 'everyday people' to both shape the future of museums but also to take transformative action on the environment.

The 'reimagining' element of *Reimagining Museums* brought to the fore a plurality of voices, perspectives and ideas, and relayed these by designating the media of their exhibits as 'concepts' engaged in a participatory thought experiment. While the Science Museum's *Our Future Planet* was structured around two visions of the future—one based upon nature-based solutions and the other based upon engineered solutions—the underlying premise of *Reimagining Museums* was that it speculated *multiple* visions of the future. Being developed from a global callout for creative submissions, part of the rationale to the exhibition was that it would imagine the future of museums from diverse, international perspectives, but it would also speculate what *sustainable* and *just* futures look like to different communities around the world. This is a key contrast with *Our Future Planet*, which had a strong UK focus.

Moreover, unlike the Science Museum exhibition, *Reimagining Museums* did not have to conform to the rules of Glasgow Science Centre's exhibitionary schema. On a physical level, it had to work around the galleries. But on an intellectual level, the curators had the freedom to represent diverse issues across the standalone exhibits. Being independent from institutional demands in their mesosphere, they could shape the rationale and objectives of the exhibition to their own ends. Through their agency to conceptualise the exhibition as a journey through individual, distinct concepts, the curators could free it from a need to conform to an overarching narrative. In turn, this permitted the exhibition to speculate the future in a diversity of ways, from a diversity of perspectives. The exhibition's plurality of speculations was buttressed by its use of 'concepts' as its mode of creative and communicative media.

These concepts were contrived and presented as forms of creative expression; they voiced the ideas, visions, perspectives and imaginations of the individual creators (who I situate in the curators' exosphere of influence). In this way, the curators—Harrison, Sterling and McGhie—but also the Science Centre consultants—including Rose and Hoyle—maintained that it was important *not* to inhibit or dictate their creative expression. The curators conceptualised one of their primary responsibilities being to 'advocate' for the concept creators, ensuring their agency to speak for themselves through their work. Their role was to *defend* the creators 'where there might be conflicts that arose [with the Science Centre] over

things that they wanted to say, or things they wanted to present.'[644] Moreover, producing and editing a companion to the exhibition—the *Reimagining Museums for Climate Action* book—meant that the curators could elevate the agency of the concept creators even further, empowering their voices so that they could dive more deeply into their individual practices and philosophies and the contexts in which they devised their proposals.[645]

The mode of curatorship performed by Harrison, Sterling and McGhie thus centred around their role as *negotiators*. They set out to mediate between the concept creators and the actors who brought their exhibits into being. Rather than using objects to construct a journey and overlaying them with a curatorial interpretation, instead, the curators granted the individual concepts with freedom to hold their own, to speak for their creators, as well as to be independent from a linear narrative. This approach to curating was embedded in the philosophy and rationale for the exhibition as a *participatory* thought experiment. Agency to engage in the thought experiment—to reimagine and speculate the future of museums—was distributed among the diverse exhibit creators. In this way, the concepts provided a medium through which their makers could exercise their voice directly, without the interposition of curatorial or co-authored interpretation.

To the curators, this was fundamental to the exhibition's overarching rationale to imagine more *just* futures.[646] It was imperative to them that they did not erase or obscure the distinct perspectives and voices that the diverse creators, coming from all over the world, brought to their concepts. The process of curating concepts and accentuating the concept-makers' voices, therefore, helped to embed and relay the key principle of the exhibition as *reimaginative*; as '[gesturing] towards possible worlds that might take us beyond the conventions of current social, economic or political systems.'[647] In this case, going beyond the convention of curatorial authority over their 'objects', and challenging the power dynamic that exists between a curator and their communicative media.

This decision drew particular inspiration from Harrison's microsphere of influence. Learning from his experience of the Heritage Futures project, which had brought together numerous academics and practitioners, it was important to Harrison that the exhibition was also a collaborative endeavour, granting many different people the space and freedom to speak on

[644] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[645] Rodney Harrison and Colin Sterling (eds.), *Reimagining Museums for Climate Action*.
[646] Museums for Climate Action, 'Reimagining Museums for Climate Action Design Manual V4', 4.
[647] Rodney Harrison and Colin Sterling, 'The Speculative and the Profane', 94.

their own terms in imagining futures otherwise.[648] But the distribution of agency to speculate the future of museums also functioned as a social commentary on these organisations. To Harrison, one of the key messages of the exhibition was to challenge people to 'demand more' from museums. 'These organisations—we own them as much as anyone else does. We should be able to demand things of them.'[649] Accordingly, the exhibition was 'about modelling a move where museums have a role which is more collaborative with the communities they serve, rather than this very expert-led model of museums as authorities.'[650] Enabling the creators to speak for themselves, the concepts were figured as decentring the power of the 'institution' and the 'curator', relinquishing editorial control and redistributing agency in exhibition-making.

Opening up the exhibition development process to diverse actors draws parallels with Nina Simon's concept of the 'participatory museum'.[651] Being conceptualised as a 'bottom-up' approach to exhibition authorship,[652] participants could critically and creatively speculate the future of museums to 'demand things of them'. As the curators set out in the competition brief, they sought creative contributions from many different people—not just museum professionals—opening up the exhibition to a variety of perspectives, knowledge, expertise and creativity. This included designers, architects, academics, artists, poets, philosophers, writers, Indigenous groups, community groups and the public at large.[653]

Although the exhibition was not actively empowering people with no experience in the arts, culture and heritage, it was nonetheless a participatory approach to exhibition-making in the sense that it subverted institutional practice and disrupted the existing schema at Glasgow Science Centre. Talking to this point, Robin Hoyle emphasised how the concepts of the exhibition induced a different dynamic between the visitor and the intellectual space of the Science Centre, inviting them to participate in more abstract modes of thinking. In our discussion of the differences between the exhibition and the Science Centre's permanent galleries, he drew attention to the ways in which different media configure different relationships with audiences:

[648] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[649] Ibid.
[650] Ibid.
[651] Nina Simon, *The Participatory Museum* (Museum 2.0., 2010).
[652] Henry McGhie, 'Connecting the 21 Principles of Ecomuseums, the Sustainable Development Goals and Climate Action', in Nunzia Borrelli, Peter Davis and Raul Dal Santo (eds.), *Ecomuseums and Climate Change* (Ledizioni, 2022), 58.
[653] Museums for Climate Action, '*Reimagining Museums for Climate Action* Open Call', 3.

> ‘[The *Reimagining Museums* exhibition] was more at the art end of things compared to this gallery [*Powering the Future*]. The thing behind you says: ‘what is the future role of coal?’. It’s written as a question, and it provides an answer underneath! Art doesn’t necessarily do that. It might ask questions, but it isn’t necessarily looking to give you the answer. There are many answers depending on your own perspectives and where you’re coming from, and so on.’[654]

Designating the concepts as ‘art’, Hoyle stressed that they were doing something fundamentally different as tools for futures thinking compared to the text panels and interactives of *Powering the Future*. In this space, the pedagogic interpretative devices promote *anticipatory* futures thinking; thinking about the future in ways that are grounded in present realities and certainties. ‘What is the Future Role of Coal?’, the text panel asks. And the answer it provides is that ‘its environmental impact has caused many countries to pledge to phase out coal’, with the caveat that ‘some countries still see coal as a way to fuel their economic development’ [Fig. 3.9].[655]

Bringing the exhibition concepts into this space, however, disrupted this sense of certainty and instead manifested more *speculative* futures thinking. Many of these concepts do not speak to present, ‘real’ museums, but they are visualisations of what museums *could be* if they were completely reimagined, starting from scratch. They imagine worlds that do not yet exist. And this, in turn, speaks to the curators’ intention to bring together a plurality of ideas and perspectives, and enabling these contributing actors to speculate freely about *different* and *alternative* futures that are not grounded in the constraints of present reality.[656] This contrast between the exhibition and its meso-level context in the permanent spaces of Glasgow Science Centre, therefore, helped to underscore the key principle of activating a different kind of thinking in audiences: a *speculative* and *(re)imaginative* mode of observing the world and contemplating its future.

In Table 3.4, I summarise the ecological agencies that shaped the speculations at play in the exhibition and the factors that underpinned the curators’ deployment of ‘concepts’ as creative and communicative media.

[654] Interview with Robin Hoyle (Glasgow Science Centre). 28 February 2023.
[655] ‘Coal’ text panel, *Powering the Future*.
[656] Interview with Harrison, R. (Museums for Climate Action). 24 January 2024.

Table 3.4 Summary of Ecological Agencies in Exhibition Speculations: *Reimagining Museums for Climate Action*

Agencies that Shaped How *Concepts* Were Harnessed for Futures Thinking in *Reimagining Museums for Climate Action*				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
The curators conceived themselves as 'advocates' for the exhibit-creators. Their role was to bring their views to the fore.	The speculative, imaginative qualities of 'concepts' were highlighted in juxtaposition with the Science Centre galleries.	Being permitted to express themselves freely, the concept creators took risks and made radical calls for action in their speculative proposals.	Underpinning many of the exhibition concepts were macro-level socio-cultural issues such as colonial and racial injustice and Indigenous rights.	The exhibition was deliberately brought into the future-oriented time-space of the Science Centre's second floor. These spaces were harnessed together to contemplate the future of the changing planet.
Harrison learned from Heritage Futures the value of multivocality—making space for a plurality of perspectives.	Hoyle and Rose relinquished editorial control to the curators and concept creators, enabling them to express themselves freely.	The exhibit creators came from diverse backgrounds and brought diverse perspectives on museums and climate action.		
Harrison was driven by a personal ambition to incite audiences to 'demand more' from museums. For him, the exhibition served a fundamental role in democratising these spaces.		The context of COP26 brought the exhibition into relation with other activities and discussions centred around climate action. To the curators, this provided a catalyst for audiences' critical thinking around the future of museums.		

Sediment Spirit: The Activation of *Art* to Speculate the Earth as Alive

I now bring the Sainsbury Centre's *Sediment Spirit: The Activation of Art in the* Anthropocene—curated by Ken Paranada—into dialogue with the other exhibitions for the ways in which it employed its media towards speculative thinking. Under the institution's guiding philosophy that *art is alive*, *Sediment Spirit* situates its media—'art'—in a middle ground between the tangible objects of *Our Future Planet* and the intangible concepts of *Reimagining Museums*. As I explore below, this blurring of boundaries between the *tangible* and *intangible*, *material* and *abstract*, *matter* and *soul*, was the defining principle of *Sediment Spirit*. As such, the exhibition functioned to echo the Sainsbury Centre's vision: that material, tangible works of art possesses a hidden anima that can be *activated* to address the big questions in life. In the case of *Sediment Spirit*, art is activated to engage with the Anthropocene.

After first contextualising the institution's ethos that art is alive, I then examine how this shaped the speculative mode of thinking being deployed in the exhibition. I argue that, for the curator, embracing an Indigenous-inspired praxis and philosophy that traverses the dualism between matter and spirit was central to his sense of agency to act on the changing planet. Through his mode of curatorship, he conceptualises 'solutions' in intangible ways. He recognises his power to shift audience values: 'to [change] something in our heads' that lead you to 'look at the world in a different light.'[657]

Over the last decade, many art practitioners, art historians and critical art theorists have embraced interdisciplinary approaches to analyse how art has been harnessed as a creative response to the changing planet, but also to advocate for its role in nurturing broader cultural shifts that align with the demands for climate change mitigation and socio-environmental justice.[658] Art has a remarkable ability to mobilise feelings, emotions and affects towards futures thinking which, in turn, can be a significant impetus to take action. Sparking joy, wonder, curiosity and hope, art is a tool to help imagine, inspire and thus build positive futures on a changing planet.[659]

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[657] Interview with John Kenneth Paranada (Sainsbury Centre). 16 February 2024.
[658] For example, see Andrew Brown, *Art and Ecology Now* (Thames & Hudson, 2014); Julie Reiss (ed.), *Art, Theory and Practice in the Anthropocene* (Vernon Press, 2019); Maja Fowkes and Reuben Fowkes, *World of Art: Art and Climate Change* (Thames & Hudson, 2022); Sarah Wade, 'Ecologies of Display: Contemporary Art, Natural History Collections and Environmental Crisis', *Journal of Natural Science Collections*, Vol.10, (2022), 94-106; Pandora Syperek and Sarah Wade (eds.), *Oceans* (Whitechapel Gallery and The MIT Press, 2023).
[659] Fiona R. Cameron, Bob Hodge and Juan Francisco Salazar, 'Representing Climate Change in Museum Space and Places', 17-18.

Focusing attention on the affective capacities of art—on its capacities to connect with the human psyche—is precisely the approach that curators at the Sainsbury Centre are taking to their engagement with art. This aligns with the gallery's guiding principle, initiated by Jago Cooper in 2023, that art is *alive*. The philosophy was born out of his personal conviction—as an archaeologist—that objects possess a lifeforce; that they are animate expressions of the creator's soul.[660] But it was also inspired by the Sainsbury Centre's expansive collections that transcend the traditional separation between 'fine art', 'archaeology', 'architecture' and 'anthropology', treating all of these works on equal terms as 'material manifestations of human creativity'.[661] Working with the premise that art is alive, the Sainsbury Centre's programming activities are now less concerned with foregrounding the art-historical value of art, and more concerned to mobilise visitors to relate to and interact with art in affective ways.[662] As such, the art is activated to explore the *big questions*, and it is the role of exhibition curators to display and interpret these living entities in ways that provoke emotional and dialogic responses from audiences, helping them to make sense of the big questions.

In curating *Sediment Spirit*, Paranada was directly responding to the Sainsbury Centre's philosophy of living art, providing the 'crux' of the exhibition.[663] As the exhibition's introductory panel declared: 'These works are not merely representational; but imbued with a spirit that moves us into action.'[664] In the exhibition title, Paranada deliberately sought to bridge the material and immaterial realms. 'Sediment' alludes to the Earth and the language of geology, speaking to the physical realm. Meanwhile, 'Spirit' alludes to the abstract realm of the soul and anima. 'That's the foundational inspiration behind [*Sediment Spirit*]. Let's try to create a new word to describe that the Earth is alive.'[665]

With the premise that *art is alive*, Paranada harnessed the exhibition as promoting a philosophy of the *Earth as alive*. By activating this hopeful imagining, his intention was to inspire a shift in audiences' values and understandings of sustainability. Situating the tangible world of art alongside minerals, rocks, water, plants and animals, and collectively imbuing them with spirit, provides the foundation in the exhibition to speculating futures:

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[660] Michael Prodger, 'Hug a Henry Moore!', *Apollo*, 30 May 2023. Available at: https://www.apollo-magazine.com/sainsbury-centre-east-anglia-collection-jago-cooper/ [accessed 17 September 2025].
[661] Jago Cooper, 'The Future of the Sainsbury Centre', cited in John Kenneth Paranada, 'A Path Forward: Curating Art & Climate Change at the Sainsbury Centre', 64.
[662] Geraldine Kendall Adams, 'Profile | 'Everyone Was Like "Oh My God, He's Actually Serious"'; Kate Dunton et al., *A Handbook of Living Art* (Sainsbury Centre, 2023).
[663] Interview with John Kenneth Paranada (Sainsbury Centre), 16 February 2024.
[664] Introduction panel, *Sediment Spirit: The Activation of Art in the Anthropocene*.
[665] Interview with John Kenneth Paranada (Sainsbury Centre). 16 February 2024.

‘Imagining a world where all living beings and the planet can flourish together’.[666] Interpreting artworks as living beings, therefore, is all about speculating a cosmology for the future—inspired by Indigenous worldviews—wherein humankind takes care of the Earth and its living things as sacred and divine.[667]

The ability to harness art in this way relates back to art’s capacity to invoke a ‘plurality of interpretation’;[668] its openness to a variety of responses, experiences, thoughts, emotions and ways of knowing. There is no one way to look at and engage with art, and art does not provide *certain* answers. Rather, the *uncertain* and *enigmatic* qualities of art open it up to speculative modes of thinking about the world.

> ‘The arts help us to imagine infinite possibilities. Looking through the kaleidoscopic filter of art can help us see the full spectrum of human ingenuity, and offer hope for how we can heal our relationship with the planet.’[669]

Using art as a tool for speculation offers scope to imagine hopeful, paradigm-shifting futures where humanity has completely transformed itself, and in the process, healed its relationship with the Earth. The speculative mode in *Sediment Spirit*, therefore, centres around speculating an *intangible* solution to the changing planet: an ideological shift that values the Earth and its beings as living, powerful kin. Paranada’s mode of curatorship wherein he recognises his media—art—as alive is a manifestation of this ideology. ‘Our highest form of adaptation is basically acknowledging our weaknesses as humans’: weaknesses that Paranada identifies as relating to ‘human exceptionalism’, particularly the idea that ‘science can solve everything.’[670]

So, Paranada’s curatorial praxis deliberately mirrors his interpretation of *adapting* to the changing planet. By situating art and the Earth as living beings, he seeks to decentre ideologies of human exceptionalism that ultimately are detrimental to the environment. He espouses a philosophy for science that overturns its hubristic ambition to provide tangible solutions that would permit humans to *control* their environment. Rather, through his work as a curator, he seeks to model a philosophy wherein the material world is transformed from a passive object of human mastery, to an active subject that shapes human lives and works

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[666] Introduction panel, *Sediment Spirit: The Activation of Art in the Anthropocene*.
[667] Interview with John Kenneth Paranada (Sainsbury Centre). 16 February 2024.
[668] Ibid.
[669] ‘Have you Ever Experienced the Transformative Power of Art?’ panel, *Sediment Spirit: The Activation of Art in the Anthropocene*.
[670] Interview with John Kenneth Paranada. 16 February 2024.

alongside humans in regulating the Earth. His is a practice of speculating a posthuman future for the Earth.

Exhibition Legacies: Lessons Learned for Individuals and Institutions

Complementing my conceptualisation of exhibitions as providing scope for *experiment*, it therefore follows that they are spaces from which the actors involved—curators or otherwise—can *learn* from their experiences. In this section, I summarise the findings from my interviews with Rupert Cole, Graham Rose, Robin Hoyle and Rodney Harrison that spoke to their perspectives on the exhibitions in hindsight, and how that went on to influence their future work in the Science Museum, Glasgow Science Centre and academic research respectively. As *Sediment Spirit* was still quite fresh in Ken Paranada's memory—and given that our interview took place quite early into his appointment as Curator of Art and Climate Change at the Sainsbury Centre—unfortunately, the legacy of the exhibition on his practice was not a topic that arose during our interview. As such, I have not included a discussion on *Sediment Spirit* in this section.

From *Our Future Planet* to *Future of Food*

First, I consider a micro-level impact that *Our Future Planet* and its evidence-based speculative thinking had on one of its curators, Rupert Cole. At the early stages of the exhibition's development, he had doubts as to whether carbon capture was 'going to be a viable, realistic, scientifically-endorsed approach to mitigating climate change.' However, throughout the timeframe of the show and following its closure at the Science Museum, he became more convinced of the future potential of carbon capture—providing it is combined with emissions reductions alongside many other approaches to mitigating climate change, which is how it is endorsed by the IPCC.[671] Working on the exhibition and carrying out research for it, indeed, shifted his own speculative thinking around the future role of carbon capture.

Moving on to a meso-level impact, *Our Future Planet* marked a new disciplinary focus for the Museum that it has since embraced to a greater degree: the natural sciences. All of the objects and interpretive media across both 'Working with nature' and 'Out of thin air' were activated to stimulate audiences to 'imagine *living* with carbon capture' and speculate its future impacts on both the *natural* and *infrastructural* landscape.[672] To speculate future

[671] Interview with Rupert Cole (Science Museum). 7 December 2022.
[672] Science Museum, '*Carbon Capture* (Working Title) Interpretation Plan', 9.

technologies and industrial practices—foregrounding the future-making agencies of engineers and physical scientists—is in keeping with the traditional display schema of the Science Museum. But to accentuate the agential role of *nature*—and to focus attention on the work of *biological* scientists—was a new departure for the Museum.

As I noted regarding the context of *Our Future Planet*, the Science Museum's Deputy Director, Julia Knights, advocated for the exhibition's focus on nature-based solutions, being 'one of the big things that Julia was passionate about'; 'the early proposals were very technological, and we needed to make sure that we reminded people that nature provides lots of critical carbon sinks.'[673] As Highfield recalled, because of the long-established, arbitrary disciplinary boundaries between the Science Museum and its neighbour the Natural History Museum, there would previously have been reservations around developing an exhibition that gave such prominent attention to the natural sciences, exploring the role of nature in human lives and wellbeing.[674]

However, as evinced by *Our Future Planet*, the institution's disciplinary remit has recently expanded to encompass the natural sciences—an intellectual move that marks new avenues for the Museum. 'I think if we had put *Our Future Planet* together in the '90s, it would have had only technological solutions, and then we wouldn't have mentioned nature at all, because it wasn't part of our balliwack.'[675] *Our Future Planet*, provides the first instance of a Science Museum exhibition on climate change (see Appendix A) where the agency of nature in mitigative action has been spotlighted (albeit through human intervention in the environment). Previous exhibitions, along with the *Atmosphere* gallery, had foregrounded the role of engineering and technology to galvanise sustainable futures.[676] Since *Our Future Planet*, Science Museum curators have started to incorporate the natural sciences into their remit for acquisition and display.

In parallel, curators have been thinking critically around what the Science Museum *does* and what it *represents*. From Rupert Cole's perspective, 'there's definitely been a kind of easing of the national museums having 'different remits' and needing to 'stick to their remits', because [other museums] don't.'[677] Over the last few years, throughout his roles as Curator

[673] Interview with Roger Highfield (Science Museum). 10 June 2025.
[674] Ibid.
[675] Ibid.
[676] Despite suggesting a focus on nature-based solutions, the Antenna exhibition *Can Algae Save the World?* (2008) actually concerned the role of algae in producing biofuels and explored their future potential in comparison with other technologies of sustainable energy production and consumption.
[677] Interview with Rupert Cole (Science Museum). 29 May 2025.

of Contemporary Science, Curator of Scientific Instruments, and now Curator of Chemistry, Cole has been personally motivated to reassess the disciplinary scope of his curatorship—and the Science Museum by extension—by purposely addressing the absence of biological sciences.[678] Testament to the influence of his microsphere of agency, Ecology is 'a big area which we've started to try to represent—that we've been advocating [for]', being given an unprecedented focus in the preliminary plans for the *Ages of Invention* gallery (due to open by the end of the decade).[679]

As this shows, Cole is conscious to speculate futures in ways that respond to ecological needs, rather than solely promote the agency of techno-solutions to overcome environmental issues. A dual emphasis on *ecological* and *engineered* approaches in sustainable future-making—situating them as equals in 'dialogue'—is key to the rationale and messages of *Future of Food*: an exhibition that opened in July 2025, over which Cole presides as Lead Curator. Within the exhibition, he and the Assistant Curator on the project, Katie McNab, were looking 'to problematise that there's this one scientific, technological view of what the future should be. [To highlight that] there's actually a pluralism.'[680] In their speculations of the future, they were mindful to avoid lending hubristic weight on the agency of engineered techno-solutions. Instead, they sought to balance and question these approaches in conversation with ecological approaches that are less concerned with concepts of technological and scientific innovation. The curators' conception of the visitor journey through the exhibition—emphasising a plurality of solutions and thus speculating different visions of the future—took inspiration from *Our Future Planet*'s dual emphasis on nature-based and engineered approaches.

But Cole was aware that, in Tomorrow's World, there was little room in *Our Future Planet* to delve deeper into the social, cultural, political and economic complexities of carbon removal. Being able to draw out these broader issues regarding the future of agriculture, therefore, was important to him in the development of *Future of Food*. While it would have been difficult to do so—given the meso-level obligation of Tomorrow's World to engage with the 'introductory science' of a contemporary issue—Cole was nonetheless critical of *Our Future Planet* for not including alternative perspectives on carbon removal beyond advocating for nature-based approaches. In hindsight, he reflected that he and the exhibition team did not 'question what we were propping up in terms of a 'status quo' approach'. They did not critique carbon removal in terms of its potentially sustaining the current system of 'high-

[678] Ibid.
[679] Ibid.
[680] Ibid.

capitalist' consumption, nor explicitly challenge the exceptionalist assumption that technology that will 'save the day'.[681]

Furthermore, to him, it would have been valuable for the exhibition to have addressed the arguments around carbon removal as a form of greenwashing. Particularly in light of the exhibition's controversial sponsorship by a fossil fuel company, 'it would have created better trust around the technology, in being quite open about those conversations which were already playing out in other media.'[682] If the exhibition had recognised and addressed the counterarguments to carbon removal—for one, that it permits business as usual—it could have helped to alleviate the widespread condemnation of the institution for signing a 'gagging clause' with Shell.[683] Condemnation by activists, scholars, museum practitioners and the media of this sponsorship deal was and continues to be prevalent. This is despite the sponsor coming late to the project, after content had already been produced, and despite Ian Blatchford's counter-assertion that the SMG retains 'editorial control' in all of its financial partnerships.[684] By avoiding the greenwashing issues of carbon removal, the exhibition appeared to align with the agenda of the fossil fuel industry: that a fossil-fuel future could remain possible through carbon capture technologies.[685]

Nevertheless, given the exo- and macro-level context around the exhibition—namely, the stipulation from Oliver Dowden and the DCMS that national museums could 'not be taking actions motivated by activism or politics'—I recognise that it would have been difficult for the Museum to engage with the activist arguments against carbon removal. Instead, the 'neutral' approach, according to Dowden's political paradigm, would have been to focus on the *official science*, such as the IPCC's endorsement of carbon removal (although their recommendations to transition away from fossil fuels contradicts the Museum's financial relationship with a corporation that continues to profit from oil and gas).

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[681] Ibid.
[682] Ibid.
[683] For example, see Geraldine Kendall Adams, 'SMG Under Fire for 'Gagging Clause' in Shell Deal', *Museums Journal*, 30 July 2021. Available at: https://www.museumsassociation.org/museums-journal/news/2021/07/smg-under-fire-for-gagging-clause-in-shell-sponsorship-deal/ [accessed 17 September 2025].
[684] Ian Blatchford, 'Engaging the Public While Dealing Calmly with XR Protesters', *Science Museum Group Blog*, 30 August 2021. Available at: https://blog.sciencemuseumgroup.org.uk/engaging-the-public-while-dealing-calmly-with-xr-protesters/ [accessed 17 September 2025].
[685] For example, see George Monbiot, 'Why is the Science Museum Still Being Contaminated by Shell's Dirty Money?', *The Guardian*, 21 April 2021. Available at: https://www.theguardian.com/commentisfree/2021/apr/21/science-museum-shell-money-exhibition-climate [accessed 17 September 2025].

In *Future of Food* (July 2025-), having been granted a much larger footprint in the Museum's 'Special Exhibition Gallery 1', a larger budget and a longer timeframe for development, Cole had more space and freedom to exercise his critical thinking. In this meso-level circumstance, he could speculate the future of agriculture with a broader lens on interconnected social, cultural, political and economic issues. Specifically, these issues are brought into play in the dialogue between the different visions of the future: the engineered and the ecological. In the thematic focus on engineered approaches—'laboratory-style' and 'factory-style' biotechnologies—he included a critical angle on whether and to what extent they were 'pushing a status-quo approach' (as they did in *Our Future Planet*), maintaining the capitalist paradigm of growth and consumption. This critique is brought further into light by the dialogic comparison between the engineered and ecological methods. From the ecological perspective—centred around practices of organic farming and agroecology—'the vision is all about trying to completely *undo* a lot of the food system and start afresh.' As such, it serves to question current systems of consumption and imagining alternative futures beyond the capitalistic growth paradigm.[686]

The inclusion of ecological perspectives, moreover, served to 'extend what we think of science and technology', 'pushing the boundaries of what counts as technology and science'. Cole deliberately sought to problematise the more 'traditional conception of science and technology for the Science Museum', conceived on techno-centric notions of development and innovation.[687] One of the key moments in the curators' construction of the visitor journey through *Future of Food*—which he hopes will have a great emotional impact—was a moment of realisation 'that we can't just continue with what we've got. Something needs to change.'[688] Having greater agency over the exhibition as Lead Curator, and being granted with more space, budget and time to develop it, in *Future of Food*, Cole has been able to challenge the Museum's paradigms of scientific and technological development. He can speculate futures from alternative perspectives that lean into a critique of capitalist growth and consumption. Learning from his experiences of *Our Future Planet*, he has had the autonomy and agency to speculate futures of science and technology in ways that posed a challenge to the 'status quo'.

In Table 3.5, I summarise the ecological agencies at play in the lessons that Cole learned from *Our Future Planet* and how he set about developing *Future of Food*.

[686] Interview with Rupert Cole (Science Museum). 29 May 2025.
[687] Ibid.
[688] Ibid.

Table 3.5 Summary of Ecological Agencies in Exhibition Legacies: *Our Future Planet*

Agencies that Shaped the Lessons Learned from *Our Future Planet* and the Development of *Future of Food*				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
Learning from *Our Future Planet*, Rupert Cole felt more convinced of the viability of carbon capture. Working on the exhibition was an exercise in his own speculative and critical thinking.	Tomorrow's World had limited scope to examine issues deeply. Small-scale exhibitions do not lend themselves to the broad concerns of the changing planet.	The exhibition's sponsorship by Shell was widely criticised. Writers and activists questioned the editorial control of the Museum, suggesting it supported the fossil fuel agenda.	Cole was conscious to address the public mistrust of the Science Museum that stemmed from its controversial sponsorships with fossil fuel companies and its sense of upholding the 'status quo'.	Rather than sustain a historical paradigm of techno-centric innovation leading to socio-economic development, Cole is advocating for futures that are centred around the needs of the environment.
Cole has been personally invested in bringing natural sciences and ecology into the Science Museum's collections and subject remits.	Julia Knights supported the focus on natural sciences in *Our Future Planet*, which has since been taken on in other projects.	Across national museums, disciplinary remits are relaxing, enabling a growing focus on biological sciences in collecting and display in the Science Museum.		Circumstances in his working environment meant that Cole could exercise speculative futures thinking more freely in *Future of Food*.
Cole was critical of *Our Future Planet*'s upholding the 'status quo'. He was conscious of the public scrutiny in this regard.	Bringing ecological perspectives into the Science Museum's remit takes an emphasis away from techno-solutions in Museum collections and narratives.	The arms-length public sponsor of the Museum, the DCMS, exerts great power over how the institution defines its political 'neutrality'.		
As Lead Curator on *Future of Food*, Cole problematises techno-solutions and capitalist consumption, and looks to shifting paradigms of science.	Offering a larger space, budget and time for an exhibition facilitates the curator to explore the bigger issues of a subject and think critically beyond the 'introductory science'.			

From *Reimagining Museums for Climate Action* to 'Petroculture's Intersections with Cultural Heritage'

Similar to Rupert Cole, in the aftermath to *Reimagining Museums for Climate Action*, Rodney Harrison has continued to orient his work towards shifting paradigms in museology and heritage. The exhibition provided impetus to extend his analysis of the politics of museums, examining their real and conceptual operation within social, economic and political structures of power.

> 'One of the things which became really obvious to me at the end of the project was the […] intersectionality of race and climate and extinction. Colonialism. Capitalism. There are these really structural issues which make it very difficult for museums to change, actually.
>
> 'And it's all very well to talk about change. But these ways of evaluating what constitutes success, for example, for a museum as an organisation—which is the number of people through the door, the number of people in the exhibitions, the number of exhibitions touring different places—these are all very carbon intensive ways of thinking about what constitutes success.'[689]

So, in his own personal journey of speculating the future through the *Reimagining Museums* project, Harrison has concluded that to catalyse radical climate action and build sustainable futures, museums should totally move beyond the capitalist-colonialist structures in which they are embedded. Specifically, they should move beyond the paradigm of economic growth, given that the carbon-intensive nature of visitor footfall and subsequent profit and development is counter-intuitive to the ethics and aims of sustainability. Pursuing his vision for museums and heritage to reimagine themselves *otherwise*—to overcome their capitalist-colonialist structures—Harrison has been involved in a research project concerning 'Petroculture's Intersections with the Cultural Heritage Sector in the Context of Green Transitions' (PITCH).

Building on what he learned from *Reimagining Museums*, the aim of the project is to explore in more detail issues of intersectionality as they relate to museums. Specifically, exploring how *petroculture*—'as a broad term that describes our reliance on fossil fuels, and the forms of society that emerged through that'—is entangled in the ideas and practices that constitute

[689] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.

museums and heritage, with a purpose to experiment approaches that disentangle museums and heritage from petroculture.[690] Without being embedded in a museological institution, Harrison has had the freedom to pursue a project that poses a significant challenge to the paradigms and systems in which the museum sector operates. Being free from the structures of a heritage organisation—and the demands of visitor footfall and public engagement—he has agency to question and critique those power structures that value numbers, growth and income.

Meanwhile at Glasgow Science Centre, Graham Rose and Robin Hoyle are working in the context of an institution that relies on the income generated by fee-paying visitors. Visitor footfall, as such, is paramount to its survival. To this end, Hoyle drew attention to the *market positioning* of the Science Centre. In juxtaposition to museums, 'we're aiming for more of the instant gratification end of the market.' People pay to visit the Science Centre because they *expect* to have fun, playful, interactive experiences.[691]

When I questioned him about whether he thought the *Reimagining Museums* exhibition brought a form of 'cultural capital' to the Science Centre, first, he agreed that it brought a diversity of perspectives and worldviews to the Science Centre, and this was a culturally valuable and eye-opening experience to him and his colleagues. But second, he was doubtful as to whether this 'cultural capital' was perceived as such by their usual audiences. Although they did not carry out evaluative research of the exhibition, he was sceptical that it sufficiently drew the attention of visitors who were there for the *science centre* experience and not specifically visiting the exhibition. He was unsure whether it was sufficiently scaffolded to attract and relate to the Science Centre's family audiences, questioning whether it broke across the 'invisible chasm' between the science centre experience (characterised by entertainment and physical engagement), and the museum/art gallery experience (characterised by contemplation and intellectual engagement).[692]

For Hoyle, counter to the curators' aim to blur these institutional boundaries,[693] the exhibition actually reinforced his perception of the divide between 'museums' and 'science centres', 'science' and 'art'. Speaking to the issue of how the exhibition sat within the schema of the Science Centre, Hoyle recalled a 'vociferous' complaint from a visitor about the *Elephant in the Room* exhibit. Specifically, they took offence from its feminist, anti-capitalist, anti-

[690] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[691] Interview with Robin Hoyle (Glasgow Science Centre). 28 February 2023.
[692] Ibid.
[693] Museums for Climate Action, '*Reimagining Museums for Climate Action* Open Call', 6.

colonialist messaging.[694] Hoyle surmises that the visitor became so enraged because they were not expecting to encounter such content during their visit to the Science Centre: a space that is constructed on (supposed) principles of political neutrality.[695] In turn, going against a supposed neutrality provoked a response that echoed the broader 'culture wars', being 'tied in with all the agenda around *what about white male teenagers?* kind of thing.'[696]

> 'It's quite interesting that this exhibition aroused such feeling within that individual. I suppose, in a sense, that's what art pieces are looking to do. As an art piece, it might have found itself in a gallery amongst other artworks and art-loving people, who are already in agreement with that thing. But it was brought into an environment where people are going to walk around the corner without any warning and be confronted by it. They weren't necessarily thinking, 'I'm going to agree with this'. There's an interesting dynamic going on there which maybe wouldn't have happened in an art gallery-type experience. You are bringing it into this different venue.'[697]

In contrast to Harrison, Hoyle did not have freedom from the institutional mesosphere in which he was embedded. As his anecdote and reflections attest, he was very concerned for the experience of the Science Centre's (fee-paying) audiences, making sure that it satisfied their expectations. Furthermore, working within these parameters of anticipating audiences' expectations, he had less inclination and less autonomy to speculate paradigm shifts for the institution; to completely reimagine its contents and ways of working. For instance, talking on the *Powering the Future* gallery (where we were sitting), his speculations for the future of the gallery centred more around the *addition* of issues rather than a total transformation. Specifically, the inclusion of a perspective on the need for 'just transitions' in energy, bringing a social justice dimension into the framework of security, affordability and sustainability.[698]

To conclude, then, the approaches and extent to which individuals and institutions can speculate futures otherwise is highly dependent on the agency of those individuals to diverge from the 'traditional' structures, methodologies, aims and perspectives of the institution in/with which they are working. The speculations of the individual are ecologically intertwined with the contexts in which they operate. In Table 3.6, I summarise the ecological

[694] Interview with Robin Hoyle (Glasgow Science Centre). 28 February 2023.
[695] Ibid.
[696] Ibid.
[697] Ibid.
[698] Ibid.

agencies that shaped the interviewees' reflections, lessons learned and subsequent work following the *Reimagining Museums* exhibition.

Table 3.6 Summary of Ecological Agencies in Exhibition Legacies: *Reimagining Museums for Climate Action*

Factors and Actors that Shaped the Lessons Learned from *Reimagining Museums for Climate Action*				
Microsphere	**Mesosphere**	**Exosphere**	**Macrosphere**	**Chronosphere**
The exhibition drew Harrison's attention to the intersectionality of the changing planet with capitalism, colonialism and social injustice.	Harrison has freedom to pursue academic interests, not being employed by a museum institution.	A visitor to *Reimagining Museums* made a harsh complaint on social media about its feminist, anti-colonial messaging. This reinforced to Hoyle the binary between 'museums' and 'science centres'.	Hoyle connected the passionate complaint against *Elephant in the Room* with the broader 'culture wars' in which cultural values are becoming ever more polarised.	For Harrison and the PITCH project, future directions for heritage and museums centre around their becoming embedded in the practices and philosophy of Green Transitions. He calls for paradigm shifts.
In the PITCH research project, Harrison promotes a shift away from the colonialist-capitalist structures and paradigms of Petroculture.	Hoyle was sceptical that the exhibition was sufficiently scaffolded to engage the Science Centre's audiences. He is more conscious of their needs and wants than Harrison.			For Hoyle, future directions for the Science Centre do not involve wholescale paradigm shifts, but rather the addition of issues that have become more prominent in society, such as just and equitable energy transitions.

Conclusion

As I have argued in this chapter, the 'temporary' exhibition supplies a means of participating in more imaginative, speculative, challenging, flexible modes of thinking about the future and spotlighting agency in future-making. Exhibitions, as such, supply a powerful medium for curators and visitors alike to speculate futures 'otherwise', challenging current structures and systems of power. This is particularly pertinent in a time of planetary change, given that our ability—as humankind—to engender positive futures is dependent on wholescale paradigm shifts towards equitable and sustainable modes of living in ecological balance with the planet, nonhuman life and other human beings. However, through my case studies, I have demonstrated that the practices and products of these speculations—and the extent that they promote paradigm shifts—are impacted by various factors pertaining to institutional context, curatorial autonomy and interpretive media.

Conceptualising the curators' communicative media as 'objects', 'concepts' or 'living art' can have a substantial impact on their practices of futures thinking. The latter two have a special capacity to *transcend* physical reality and employ speculative, imaginative, abstract modes of thinking about the future. Meanwhile, in the context of science curatorship, objects have the capacity to *embody* physical reality, presenting empirical, tangible evidence of futures in the making. Combining these two approaches—the imaginative and the empirical—in curatorial practice could powerfully broaden its capacity for speculative futures thinking. They would supply both the intellectual 'robustness', 'rigour' and 'integrity' in the curator's content and messages but also bring these into conversation with 'creativity' and modes of thinking 'otherwise'. In the Conclusion, I delve further into this discussion, arguing for a mode of science curatorship wherein *science* is refigured as an agent in building futures *otherwise*: challenging the status quo through the ethics of sustainability and equity.

4 | Conclusion

Overview

In this Conclusion, I first synthesise my findings from case studies to contemplate current and future directions in science curatorship, with a particular focus on the unique forms of curatorial practice taking place at the Science Museum. I follow this thinking on future directions to define a new role for science curators. In a time of human-induced planetary upheaval, ecological imbalance and uncertain futures, I suggest that science curatorship could be united by a common goal to curate for sustainable and equitable futures. Within this endeavour, I imagine a role for science curators to decouple 'science' and 'technology' from paradigms of economic growth and ever-increasing production and consumption, towards more sustainable paradigms that express an ideology of ecological relatedness, reciprocity and care.

Reflecting on Current and Future Directions of Science Curatorship

The Fluidity and Multidimensionality of Science Curatorship

In this section, I collate some findings about the characteristics of science curatorship from my case studies. In this thesis, I took a deliberately expansive view of science curatorship. I looked within and beyond traditional science curatorship as it takes place in science museums (including *the* national Science Museum of the UK), bringing it into conversation with other forms of curatorship that take place in different environments. My purpose in doing so was to broaden my outlook on curatorial practices and thereby take a more holistic approach to discerning current trends and suggesting future directions for science curatorship. In other words, I look within and beyond the contexts of science museums to contemplate the unique capacities of this type of institution, but also to consider what they could learn from the activities taking place in other institutions. Therefore in this section, I address my research question to discern what is unique about curatorial practice in my primary case study, the Science Museum, and bring this into discussion with my research objective to compare how different forms of curatorship are shaped by their differing environments.

As I have demonstrated throughout with reference to my case studies, 'curatorship'—combining both physical and abstract modes of praxis[699]—is complex, multidimensional and fluid. By 'multidimensional', I do not just mean that curators perform multiple roles and apply multiple methods across their work, encompassing research, documentation, acquisition, interpretation, content development, public engagement, and so on. Rather, the multidimensionality of curatorship that I am concerned with refers to ways in which curatorship embraces many states of being, including those that may otherwise be characterised as dualistic.

Within curatorship, there is a dynamic interplay between different priorities of practice. Curatorship takes place through the agencies of both the *individual* actor and a *collective* of actors. It is concerned with both the *tangible* and the *intangible* as its subjects and rationale. It employs both *empirical* and *imaginative* modes of thinking and acting. Together, these parallel the fluid nature of time within which the curator operates, their practice taking place at the intersections between the *past*, *present* and *future*.[700] As such, curatorship transcends binary states of being, possessing multiple dimensions of thought and action. Embracing this complexity—embracing multidimensional ways of thinking and acting that reject binarism—is a step towards embracing the complex and dynamic nature of reality itself.

Our world is not simple. It does not exist on binary states of being, nor construct rigid boundaries between these beings. Rather, our world is composed of, and sustained by, vastly interconnected beings that interact through complex ecosystems. Reality is relational and fluid, and accepting that we humans exist and thrive in complex systems that defy any sense of binarism—especially between 'humans' and 'nature'—is crucial to addressing the multidimensional issues of the changing planet and sustaining the habitability of Earth's systems.[701] In turn, applying this worldview to curatorship—in a meta sense—provides an opportunity for the individual curator to embed ways of thinking and acting in ecological relation with other agencies, human and nonhuman, with whom they carry out their work.

[699] See Jean-Paul Martinon (ed.), *The Curatorial: A Philosophy of Curating*.
[700] See Ian Wedde, 'Curating Time', in Philipp Schorch and Conal McCarthy (eds.), *Curatopia: Museums and the Future of Curatorship*, 319-326
[701] See Melinda Harm Benson, 'New Materialism: An Ontology for the Anthropocene', *Natural Resources Journal*, Vol.59(2), (2019), 251-280.

The Individual and the Collective: The Relationality of Science Curatorship

Curatorship, fundamentally, is a relational practice.[702] To understand science curatorship, I argue that it is crucial to look at everything in the round that shapes the practices, decisions and outlooks of the science curator. Positioning the science curator as an intermediary between the tangible and intangible realms—between objects, meanings, stories and audiences—underscores this relationality of their thinking and practice. Curatorial agency is embedded in ecological networks of actors, both within and beyond the exhibiting institution. It therefore follows that curating climate change—collecting, interpreting and exhibiting the changing planet—is born from, and entangled within, networks of agencies. The curator is just one actor interacting with and amongst many other human and nonhuman actors. 'It's about being a cog in a wheel.'[703] A similar conclusion was drawn by Sharon Macdonald in her ethnographic study of the Science Museum. Nevertheless, she recognised that the inherent relationality of curatorship should not undermine the agencies of individuals, nor obscure their *accountability* for gallery products:

> 'One of the things that I learned in the Science Museum was that authorship is distributed: behind any supposed 'author' are all kinds of others whose participation, sometimes unwittingly, shapes what is produced, though in the end, it is the acknowledged 'author' who, rightly, bears responsibility.'[704]

Taking place within these fluid and dynamic states of being, I agree with scholars that configure curatorship/curation as a verb *as well as* a noun.[705] It is 'a process of continuous interaction and transformation in which its uses, inclinations, and intentions construct meaning,' and such meaning-making transpires through continuous processes of interacting *with* and *in* the world.[706] Through the media of the museum—objects, space, text, light, sound, and so on—curatorship is an active process of constructing meanings, significances, connections, stories and narratives within complex networks of agencies. Curators are actors in the world whose thoughts, decisions and practices are shaped through their interactions with other actors in the world. In terms of actor-network theory, the individual curator (the person) and the human and nonhuman actors with which they interact (the

[702] Janet Marstine and Oscar Ho Hing Kay, 'Curating as a Relational Practice', 1-6.
[703] Interview with Alexandra Rose (Science Museum). 7 December 2022.
[704] Sharon Macondald, *Behind the Scenes at the Science Museum*, xi.
[705] See Juli Carson, 'Curating as a Verb: 100 Years of Nation States', in Brad Buckley and John Conomos (eds.), *A Companion to Curation* (John Wiley & Sons, 2020), 89-110.
[706] Alice Semedo and Fabiana Dicuonzo, 'Cultivating Slow Curating in Times of Acceleration', *Land*, Vol.14(1), (2025), 2.

network) are 'co-extensive';[707] curatorship takes place both *within* the individual curator and *through* the other actors in their network of influence.

Throughout this thesis, I have argued that curating climate change is a relational process. This relationality takes place through the interactions between the individual curator, the material/visual media in their remit of care, the physical space(s) in which they work, and the different agencies in their spheres of influence. The purpose of my study was not to evaluate the *products* of curatorship through the lens of my individual, external perspective, but to examine the *processes* of curatorship: to discern and interrogate the thoughts, actions and choices of curators when engaging with climate change in relation to the different actors and contexts that guided their thinking and practice. I have examined these agencies—human and nonhuman—as situated in interrelated 'spheres', or 'levels', that comprise the 'ecosystem' around the individual curator. Inspired by Bronfenbrenner's Ecological Systems Theory, I have conceptualised these environmental realms as the microsphere, mesosphere, exosphere, macrosphere and chronosphere.

The relationality of curatorship—the ecological systems in which the curator operates—is key to differentiating forms of curatorship. Curators, and their modes of thinking and acting, are shaped by their *environments*, physical, socio-cultural, political, intellectual and temporal, across micro, meso, exo, macro and chrono levels. It is those environments that distinguish disciplines of curatorship: distinguishing a 'science curator' from, say, an 'art curator', or a 'social history curator'. On a smaller scale, every individual curator is shaped and differentiated by their environment. Every curator operates across their own ecologies of actors, and these systems, in turn, produce unique ways of thinking and acting in the world. But that is not to situate science curatorship in dualistic opposition to other forms of curatorship. Rather, by thinking around science curatorship as operating within ecosystems of diverse, interacting agencies, in this thesis, I hope to have shown the interdisciplinary nature of the practice. In particular, I have argued that practices of curating science and technology in science museums align closely with disciplines of history and principles of historical analysis.

The outlooks, experiences, opinions, decisions and actions of all the curators I interviewed correlate, in different ways, to their environments and spheres of influence. This was pertinent across all aspects of the interviews, but of particular note are the different ways in

[707] Michael Callon and John Law, 'After the Individual in Society: Lessons on Collectivity from Science, Technology and Society', *Canadian Journal of Sociology / Cahiers canadiens de sociologie*, Vol.22(2), (1997), 168-169.

which they conceptualised curatorship *for themselves*. All the curators from the Science Museum and Thinktank grounded their understanding of curatorship in relation to museum objects and collections. Curators across both organisations shared a conceptualisation of themselves as 'advocates for collections' within their institutional structures and working practices.[708] As many acknowledged, conceptualising curatorship in this way—wherein museum objects are the focal point of curatorial work—is embedded in the conceptual, practical and physical identity of their meso environment: the institutions and their defining purpose (or 'mission'). Both the Science Museum Group and Birmingham Museums situate their collections—and the long history of those collections—as their defining 'assets' and central to their rationale for being.[709]

In contrast, Ken Paranada at the Sainsbury Centre is a curator who does not reside over a particular collection in his 'care' as such. Alternatively, his curatorial remit centres around programming—particularly exhibition development—that engages with the changing planet. While the Sainsbury Centre certainly does have a collection that is central to its identity and operation, Paranada's specific role, as 'Curator of Art and Climate Change', is more conceptually than materially focused. He is a 'subject' curator. As such, his understanding of curatorship is significantly more theoretical than that of the curators at Thinktank and the Science Museum. Akin to my present analysis that curatorship is fundamentally relational—and defined by the ecological relationships in which it operates—Paranada also interprets curating in such terms:

> '[…] if you look at it from a contextual type of understanding, my take on curating is basically systems thinking. It's looking at different parts of a system that make it work. This idea is obviously inspired by Gilles Deleuze and [Félix] Guattari, who talked about the 'rhizome' back in the '70s. It's basically this idea that everything is connected, and that it's an ecosystem.'[710]

Paranada's theoretical understanding curatorship—especially his reference to Deleuze and Guattari's rhizomatic philosophy—is also underpinned by his outlook and experiences at the micro level, having trained in fine art, curatorial studies and museum studies. This disciplinary background would have instilled in Paranada a familiarity with the theoretical

[708] Interview with Alexandra Rose (Science Museum). 19 December 2024; Interview with Oliver Carpenter (Science Museum). 9 January 2025; Interview with Felicity McWilliams and Lukas Large (Thinktank Birmingham Science Museum). 12 December 2024.
[709] See Science Museum Group, 'Statement of Public Task'; Birmingham Museums, 'Collection'. Available at: https://www.birminghammuseums.org.uk/collection [accessed 17 September 2025].
[710] Interview with John Kenneth Paranada (Sainsbury Centre). 16 February 2024.

concepts of curatorship; perhaps to a greater extent than the curators at the Science Museum and Thinktank, none of whom received formal, academic training in museum studies or curatorial studies.

As these examples show, conceptions of curatorship are very much embedded in the meso environment in which curators work—their institution—but also their micro environment—their background and experiences prior to their current curatorial role. However, curatorship does not always operate in the context of a museum or gallery institution. Independent curators—such as Rodney Harrison—have a freedom to situate curatorship, and their modes of thinking and acting as a curator, according to their own priorities and ambitions for such work. As primarily a researcher—embedded in academic structures and practices—it is not surprising that Harrison underscored the research dimensions of curatorship. Specifically, he construed exhibition-making as a methodology for research: 'I never really see exhibitions as an end product of a thing. I see them as ways of undertaking research. Ways of engaging publics and trying to understand, at the same time, how publics respond to particular kinds of issues.'[711] Working within an academic agenda, for Harrison, curating is a methodology to communicate and extend his research.[712] It is not tightly bound to institutional structures, aims and rationales, nor is it bound to particular disciplinary modes of thinking and acting.

So, looking at the contexts in which curators work is crucial to determining their individual agency and sense of 'editorial control' over their work. The politics of editorial control are particularly pertinent in the context of external sponsorship of curatorial activities in civic institutions. And these politics are particularly contentious when a corporate funder is perceived by critics, activists and publics to have a vested interest in conveying certain ideas and messages through the work of curators. As I have explored in all three chapters of this thesis, the Science Museum's sponsorship deals with companies that either directly or indirectly profit from fossil fuels—Shell and Adani Green Energy—have been widely criticised in academic, media and activist discourse. It has even led to the creation of a dedicated campaign group, 'Fossil Free Science Museum', who contend that the institution's 'reputation is now compromised by its willingness to participate in the greenwashing of fossil fuel producers', that it 'has lost public trust in its integrity and objectivity', and that 'it is no longer a Science Museum but a corporate mouthpiece.'[713]

[711] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[712] See Lindsay Persohn, 'Curation as Methodology', *Qualitative Research*, Vol.21(1), (2021), 20-41.
[713] Fossil Free Science Museum. Available at: https://www.fossilfreesciencemuseum.com/ [accessed 17 September 2025].

By this reckoning, the context of the corporate sponsor, which I locate in the exosphere of Science Museum curators, overrides all agencies—micro, meso, macro and chrono—that influence the processes and products of their curatorship. However, as I have found in my interviews, Science Museum curators *do* exercise a lot of personal agency over their practice, drawing on their microsphere of individual backgrounds, experiences, motivations, perspectives, values and worldviews. Moreover, their actions and decisions are shaped to a considerable extent by their embeddedness in their institution: in the identity, aims, priorities and conventions of the Science Museum's modes of functioning. And lastly, guiding much of their work—helping to determine its social relevance in both the present and the future—they also look to their macrosphere and chronosphere to discern meaningful trends in socio-cultural values, lifestyles and perceptions of significance.

None of the Science Museum curators I interviewed spoke directly to the idea that corporate sponsors impact their practice. When they mentioned it, they were usually referencing how the onboarding of sponsors confirms the financial viability of a gallery or exhibition, and thereby acts as a catalyst to these projects. Nevertheless, I understand that, given the institutional sensitivities around the issue, they were not in a position to speak openly about sponsorship. So, what does this mean for the concept of editorial control? Do Science Museum curators have total autonomy in their work? On the one hand, I recognise and praise the work of curators as being their own. Oliver Carpenter spoke to this point with reference to his personal agency as Lead Curator in shaping the *Energy Revolution* gallery.[714] However, I argue that editorial control 'sits firmly with the Museum' to a greater extent than it sits with individual curators. In making this argument, I am citing SMG Director Ian Blatchford's own words.[715] He has repeatedly affirmed the Science Museum's holding editorial control to justify the institution's acceptance of corporate funding and defend it from accusations of acting as a corporate mouthpiece.

The Science Museum's close relationship with business and industry has been prominent in its operation and rationale since the very beginning—since the Great Exhibition of 1851, and subsequent exhibitions and galleries following the establishment of the institution.[716] Today, this relationship persists out of perceived necessity to 'cover the considerable cost of the

[714] Interview with Oliver Carpenter (Science Museum). 9 January 2025.
[715] Ian Blatchford, 'Partnerships That are Transforming Our Museum', *Science Museum Blog*, 9 October 2018. Available at: https://blog.sciencemuseum.org.uk/partnerships-that-are-transforming-our-museum/ [accessed 17 September 2025].
[716] See Peter J.T. Morris, ''An Effective Organ of Public Enlightenment''.

ambitious programming or modernisation that is helping the five museums in the Science Museum Group to thrive.'[717] This economic situation is rooted in the devolution of national museums from government control in 1984, whereupon they were made quasi-independent, thus more reliant on external funding and the generation of revenue to revitalise their public offer. Beyond the argument of practicality, Blatchford asserts that 'the right approach is to engage, debate and challenge' corporations and industries 'to do more to make the global economy less carbon intensive', rather than outright refuse to cooperate with them.[718] In doing so, he confirms the social, economic, political and environmental agency of the corporate and industrial sectors to effect change in the world and shape the future.

The Science Museum, in its operations and its positioning of itself as a civic institution, is therefore embedded in a macrosystem of corporate wealth, market-based economy, neo-liberal values and capitalistic conceptions of growth and development. This macrosystem, ripples down to the mesosystem of the organisation. To engage itself in practices of curatorship—to develop galleries and exhibitions, and to acquire and care for collections—the Museum is beholden to generating income and sourcing private funding. And this affects individual curators in turn, who are consciously working in accordance with the Science Museum's aims and strategies, which themselves are interconnected with the objective for long-term financial 'resilience'.[719] So, in effect, the editorial control of its curators is shaped by a complex network of agencies that themselves revolve around the pressures of working in a competitive market-based economy.

Speaking as an independent curator with academic freedoms and insight to critique the systems of power in which curatorship takes place, Rodney Harrison could denounce museums' capitalist underpinnings. Colonialism and capitalism, he recognises, are deep structural issues that make it difficult for museums to change, to shift paradigms and to enact radical practices. Working within these structures, he argues that criteria of success for the products of curatorship—which include 'the number of people through the door, the number of people in the exhibitions, [and] the number of exhibitions in different places'—are inherently carbon intensive.[720] To truly embrace principles and practices of environmental, social and economic sustainability, the implication is that museums should go beyond the status-quo, capitalistic 'growth' paradigm in the ways that it constitutes success. A similar

[717] Ian Blatchford, 'Partnerships That are Transforming Our Museum'.
[718] Ian Blatchford, 'New Climate Change Gallery at the Science Museum'.
[719] Science Museum Group, 'Inspiring Futures: Strategic Priorities 2022-2030', 36-39.
[720] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.

argument is made by Robert Janes across his writings, but he nonetheless has hope that museums 'have the opportunity to rid themselves of these neoliberal shackles.'[721]

Although I recognise that it is not an easy task, in the latter part of this Conclusion, I consider ways in which science curators could decouple 'science' and 'technology' from the unsustainable paradigm of continuous economic growth on a finite planet. In proposing these suggestions, I draw on my findings of the ecological agencies underpinning curatorial work that deliberately seeks to challenge the 'status quo'. I spotlight the personal agencies of curators to perform such work.

The Tangible and the Intangible: Objects, Audiences and Stories

For the curators at the Science Museum and Thinktank, their configuration of curatorship is very much grounded in a *tangible*, *material* rationale; they orient their practices of curatorship from the collections that fall under their remit of responsibility. To curate is to research, interpret and activate the objects under their care for the purpose of 'public engagement' and 'public benefit'. This latter aspect of the definition and rationale of curatorship, however, is where it enters into abstract territory. Who is this 'public' for whom curators are working? On the one hand, this public is very *real* in the sense that there are real visitors who come through the doors of the museums and engage with the products of the curators' work: the objects on display and their interpretive content. At the Science Museum, the Audience Research team helps to make these publics 'tangible' to curators, providing 'real' insights into their characteristics, behaviours and responses to museum content. On the other hand, there were many instances in my interviews where curators invoked an imagined, abstract public. Audiences who existed in the back of their minds as beneficiaries (or critics) of their thinking, decision-making and practice.

One of these imagined audiences is the (contemporary) 'public' at large, conceptualised by the curators across local, national and global scales. The impact of this audience on curatorial thinking was noted by Alexandra Rose. She distinguished an 'intellectual mode' of curatorship that centred around the 'public offer' of her work from intellectual modes that centred on other priorities.[722] One of the factors informing her thinking, reasoning and decision-making, therefore, is her conceptualisation of a 'general public': an amalgamation constructed from both her experience of real visitors but also her abstraction of the macro-

[721] Robert R. Janes, *Museums and Societal Collapse: The Museum as Lifeboat* (Routledge, 2024), 124.
[722] Interview with Alexandra Rose (Science Museum). 7 December 2022.

level society of which she is a part. While Rose situated the public offer as an aspect of her practice that is distinct from other pursuits—such as research—Felicity McWilliams at Thinktank grounded her practices of research in a motivation to collect more stories about objects, and look at objects from different perspectives, so that she could 'help other people to find and access the collection in ways that are meaningful to them.'[723] One of the reasons for these different approaches could be that at the Science Museum, curators are more actively promoted to engage in research for academia—'we're expected to have some kind of academic profile'[724]—which does not necessarily lend itself as a mode of engaging the 'public' at large. Then again, it also points to the academic community as another audience of curatorial practice.

Even more abstract than the 'public' are the 'future audiences' that curators anticipate as beneficiaries and critics of their practice. This was particularly pertinent in collecting and developing permanent galleries, unsurprisingly, given the long-term impact of such activities and hence the requisite application of anticipatory thinking. As encapsulated by Oliver Carpenter, with their responsibility to collect objects of future historical significance, curators are 'feeling that weight from people that might not even be born yet.'[725] The work of the curator—particularly in collecting practices—thus serves an intangible role to imagined audiences. Informing their thinking and decision-making are forces and influences that are not-yet-real.

Curators in science museums thus work at the intersection between the tangible objects under their oversight and the audiences for whom they target their activities (whether real or imagined). Their care for objects is not grounded in a sense of their intrinsic value, divorced from social contexts of use and impact. Rather, the significance of objects is determined by the stories that curators can discern from them, and whether they anticipate that such stories will resonate in meaningful, impactful ways with audiences. Stories—which convey meaning and significance—permit the science museum curator to mediate between the foci of their work: the objects and the audiences. This aspect of science curatorship (and likewise many strands of curatorship), however, has not always been so central to conceptions of the practice.

[723] Interview with Felicity McWilliams (Thinktank). 6 February 2023.
[724] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[725] Interview with Oliver Carpenter (Science Museum). 9 January 2025.

For example, in the 1990s, at the height of the Public Understanding of Science's (PUS) influence over the learning frameworks of the Science Museum, 'science communicators' posited objects as having little bearing on visitors' engagement with science.

> 'Emphatically, objects do not speak for themselves—they are mute on their significance in nature or society—and as far as lay visitors are concerned, the non-verbal language of real things is no more than museological conceit. […]
>
> 'However the strongest argument against traditional object-and-label exhibits, in the context of the public understanding of science, is that 'the failure to convey relevant concepts will prevent [the visitor] from achieving anything more than an illusion of understanding'. [9] So it seems safe to suggest that objects in exhibitions do not, by simply being there, make possible a distinctive (or indeed any) understanding of science.'[726]

Within the Science Museum's PUS framework, the work of curators under Collections Management and the work of 'science communicators' under Public Services became siloed, creating a 'mixed economy of gallery production'[727] to the extent that there existed 'Two Museums'[728] within the organisation: the 'science museum' dedicated to the collections, and the 'science centre' dedicated to engaging audiences with the principles of science. In effect, the structural division situated curators as concerned with the tangible, object-oriented rationale of the Museum, and science communicators as concerned with the intangible, public-oriented rationale of the Museum. Effectively, PUS regarded objects as possessing little value for audiences because of their incapacity to directly relay information and principles of science. However, as I have discerned from their current work in collecting, interpreting and exhibiting the changing planet, objects play a central role in the Science Museum as vehicles to convey knowledge, stories and significances to audiences.

Silos do still exist between Curatorial and the other teams involved in Science Museum projects, notably divisions under 'Public Programme' such as Learning and Interpretation. These teams serve a function that was formerly held by 'Science Communication' but are now scaffolded by the concept of 'science capital'. The Interpretation Unit was first initiated in 1989, under Neil Cossons' institutional restructuring, 'to improve the way in which the

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[726] Roger Miles and Alan Tout, 'Exhibitions and the Public Understanding of Science', in John Durant (ed.), *Museums and the Public Understanding of Science* (Science Museum, 1992), 27-28.
[727] Timothy Boon, 'Parallax Error?', 126-128.
[728] Alison Boyle, '"Not for Their Beauty"', 54-58.

Museum communicated scientific and technological ideas to its audiences, notably to non-specialists.'[729] And this distinction between 'Curatorial' and 'Interpretation' persists in the Museum. As Rose reflected: 'Whereas Interpretation people might be 'advocates for the audience', I think Curatorial are 'advocates for the collections'.'[730] Curators, as such, are still seen to occupy an object-oriented niche that is distinct from Interpretation, which occupies a more people-oriented niche that centres on audience learning, understanding, needs and wants. Nevertheless, as I have explored throughout, a vital part of current curatorship at the Science Museum—like many other museums—is an abstract, people-centred role wherein they serve their 'public', present and future. 'I like to think that I am, hopefully, an advocate for audiences.'[731]

Another key aspect to point out regarding the conceptual shift of curatorship at the Science Museum—from *object*-centred to embracing a dual focus on *objects* and *audiences*—relates to the Museum's cutting down on the size of the curatorial team, along with the kinds of people they have hired to fill curatorial positions. Until the end of the twentieth century, the curatorial team at the Museum was considerably larger than it is today—Oliver Carpenter estimates that it was three times as large—and each curator had oversight of a specific collection, such as 'Civil Engineering', 'Electricity Supply', 'Gas Industry', and so on. These curators tended to be 'experts' from their fields, having practice-based perspectives of science and engineering. But as the Museum has cut the number of curators it employs due to financial pressures, individual collections have become collectivised under broad subject umbrellas. So, 'Civil Engineering', 'Electricity Supply' and 'Gas Industry' are subsumed, along with other collections, under the curatorial remit of 'Infrastructure and the Built Environment' (which Carpenter presides over).[732]

This has resulted in the Museum hiring curators who have a more generalist expertise of their collections rather than specialist. Hence, many curators today are *historians* of science and technology rather than *practitioners* of science and engineering. In turn, given their academic training, these historians tend to eschew interpreting their collections in purely technical terms, instead drawing attention to the human actors and socio-cultural dimensions of science and technology. And accordingly, they are more likely to interpret and construct

[729] Quoted in Timothy Boon, 'Parallax Error?', 123.
[730] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[731] Ibid.
[732] Interview with Oliver Carpenter (Science Museum). 9 January 2025.

narratives of historical change in ways that disrupt techno-centric paradigms of ‘progress’, ‘development’ and ‘advancement’.[733]

Similarly, within Birmingham Museums—although I have less insight into *past* conceptualisations of science curatorship in the organisation—McWilliams and Large are cognizant of a shift away from techno-centric modes of interpreting objects to focusing on ‘people’s stories’. As they both noted, the *Our Changing Planet* gallery provided them with an outlet to take a ‘consciously critical historical angle’ that analysed science and technology in terms of their social contexts and social impacts. This is an approach that ‘just wouldn’t have fallen in within the remit of Thinktank in the early days’, being more concerned to abstract developments in science and technology from the human worlds with which they are related.[734] As McWilliams recognised, herself a historian (of Animal History), this socio-contextualising approach is embedded in the training and outlook that she brings to her practice.[735]

Going further, in their subsequent work producing interpretation for the new galleries at Birmingham Museum and Art Gallery (BMAG), McWilliams and Large noted a curatorial-wide shift towards recognising the institution, its curators, its objects and its displays as themselves socially constructed actors in society. By creating interpretive texts with personal plural pronouns of ‘we’ and ‘us’ to reference the social positionality of the institution and its curators, they were deliberately subverting previous conventions of ‘passive neutrality’.[736] By adopting this linguistic shift, they are looking to relate to audiences on a deeper, more personal level, and thereby utilise the Museum voice in ways that are more impactful and telling of the institution’s socio-political stance on big, contentious issues such as climate change. ‘We’ve tried to be less on the fence and more like making a statement of fact and belief about something as the Museum.’[737]

To continue this work towards people-centred modes of science curatorship, I would recommend that science museum curators engage in more participatory practices of co-curation. Particularly in a time of widespread anxieties about the future and deepening socio-political division, inviting diverse people to take part in curatorship—in practices of exchanging knowledge, stories and perspectives—could help to make a real, transformative

[733] Ibid.
[734] Lukas Large, in interview with Lukas Large and Felicity McWilliams (Thinktank). 12 December 2024.
[735] Felicity McWilliams in ibid.
[736] Ibid.
[737] Ibid.

impact on those people's lives, opening them up to new experiences and worldviews. Moreover, for the curator, to relinquish some of their control over objects and the significances they interpret from them is a powerful act of redistributing and democratising agency. For example, for Rodney Harrison, conceiving the *Reimagining Museums* exhibition as a 'participatory thought experiment' provided an outlet for his values of justice and decolonisation. The process of collaborating with the concept designers formed part of the central, radical, socially empowering message of the exhibition: 'These organisations—we own them as much as anyone else does. We should be able to demand things of them.'[738] The act of yielding some personal agency to empower others is an act that makes manifest principles of altruism, open-mindedness, collectivity, equity and inclusivity.

The Empirical and the Imaginative: Anticipation and Speculation

In my interviews with participants who work in science-based institutions, the empirical nature of their work was called attention to. Indeed, for some, it served as a core element of their practice (as distinguished from their non-curatorial colleagues' practices), and/or a core element of their institution, its ethos and its purpose (as distinguished from other organisations). Specifically, individuals across the Science Museum, Thinktank and Glasgow Science Centre—curators or otherwise—shared in common the following descriptors as integral to their practice: 'evidence-based', 'well-researched', 'rigorous', 'robust', 'reasoned', 'accurate', and having 'integrity'.

> 'Fundamentally, I think, as a curator, the primary thing that you and only you are responsible for is the rigour and the robustness of the content. [To put it] bluntly: is this correct? Is this accurate? Is this thoroughly researched? Am I happy to stand up in front of someone and defend this?'[739]

> 'So, particularly when we're doing research, we want to get our facts right. We go to the primary science as important in that way.'[740]

> '[…] science integrity—the evidence-based approach—is absolutely at the heart of what we do because we're trusted and we're valued, and therefore we need to make sure that what we're saying is absolutely water-tight.'[741]

[738] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[739] Interview with Alexandra Rose (Science Museum). 19 December 2024.
[740] Interview with Lukas Large (Thinktank). 6 February 2023.
[741] Interview with Graham Rose (Glasgow Science Centre). 28 February 2023.

Such language is not unique to the case studies, nor to science museums in general. Across the field, museums are lauded as civic institutions that are 'trusted' sources of information and 'reliable' interpreters of knowledge.[742] This relates to the overarching rationale for museums—the museum ideal—as pedagogical institutions for the benefit of 'the commons'; they have ethical obligations as sources and storehouses of ideas, knowledge and memory that are directed towards sustaining cultural identities and enhancing societal wellbeing.[743]

It is not surprising that the science museum curators employed the language of empiricism given the disciplinary framework of 'science' within which they work, and the conventions of this framework of knowledge. Fundamentally, 'science' is a system of knowing and understanding the world—its processes and phenomena—which is founded upon empirical observation, experience, experimentation and data. The information and findings from such observations and experiments are employed in the production of 'theories' to explain reality and its phenomena. Broadly, this way of knowing and experiencing the world is designated (and venerated) as the 'scientific method'. It is a way of interpreting the world through the observed 'facts' of reality.[744]

Leaving aside arguments for the inherent subjectivities of science and the socio-cultural embeddedness of scientific methods and perspectives,[745] Western science and scientific thought is overwhelmingly associated with empirical methodologies which assume to construct 'objective truths' about the world. Science museums and science centres, in turn, generally conform to this presentation of science as a system of knowledge that produces 'facts' through processes of 'objective' empiricism.[746] Working in institutional contexts of 'promoting' science and scientific literacy—whether through the frameworks of 'science capital',[747] 'STEM skills'[748] or 'learning and engagement with science'[749] —unsurprisingly, the interviewees placed a high value on the traditional principles (and ideals) of science and scientific thought: evidence, research, reason, objectivity and integrity.

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[742] See Sarah Sutton and John Fraser, 'Museums Empowering Climate Action', in Nick Merriman (ed.), *Museums and the Climate Crisis*, 20.
[743] See Robert R. Janes, *Museums and Societal* Collapse, 5.
[744] See J. Scott Armstrong and Kesten C. Green, *The Scientific Method: A Guide to Finding Useful Knowledge* (Cambridge University Press, 2022).
[745] See Thomas S. Kuhn, *The Structure of Scientific Revolutions*.
[746] Stella Butler, *Science and Technology Museums*, 109-116.
[747] See Science Museum Group, 'Our Approach and Science Capital'. Available at: https://learning.sciencemuseumgroup.org.uk/learning/our-approach/ [accessed 17 September 2025].
[748] See the *Find Your Future* gallery (Thinktank).
[749] See Glasgow Science Centre, 'Vision, Mission & Values'.

Furthermore, the case-study participants from all three science-based institutions emphasised the crucial role that *evidence* and *experience* of audience learning and engagement figured in their processes of decision-making. At the Science Museum, Audience Research is a dedicated department that seeks to determine 'the needs, wants and expectations of audiences' through social science methodologies.[750] The Audience Research team is highly involved in exhibition and gallery projects. Front-end and formative visitor research is highly constructive in the development of a project, while summative visitor evaluation and 'lessons learned' provide inspiration and recommendations to inform future projects. Given that audience research is very formalised and distinctly embedded in the operation of the Science Museum, it is little wonder that its curators frequently cited 'empirical' evidence and findings about their audiences as sources of their reasoning and practical decision-making.

At Thinktank and Glasgow Science Centre, the lack of systematised audience research for *Our Changing Planet* and *Reimagining Museums* respectively meant that the 'evidence' being drawn upon by the interviewees with regard to their audience needs, wants, characteristics, behaviours and responses was more anecdotal and contingent upon individual experience of such audiences. Nonetheless, this 'evidence' still featured prominently in the minds of the interviewees: in their decisions, actions and assessments of practice.

Despite their centrality to 'scientific' epistemologies and methodologies, that is not to say that evidence-based systems of knowing are the prerogative of 'science' disciplines. The epistemological paradigm of 'scientific' enquiry that centres on empirical investigation and interpretation of 'real' evidence, broadly speaking, also underpins the methodologies of the historian. Reality can never really be 'known' to science, and likewise the past can never really be 'known' to history. Rather, both disciplinary strands examine and interpret fragmentary pieces of evidence, from which theories, ideas, narratives and relationships of case-and-effect can be induced or deduced. While there may be claims to 'objectivity' in both history and science, nothing of course can be marked as simple 'truth' or 'fact'. Specific questions are preconceived by the scientist and the historian, and these are posed onto the evidential sources of their analysis.[751]

[750] See Science Museum Group, 'Audience Research'. Available at: https://learning.sciencemuseumgroup.org.uk/learning/our-approach/audience-research/ [accessed 17 September 2025].
[751] Mary Fulbrook, *Historical Theory* (Routledge, 2003), 24-25.

In the science museums that I investigated for this thesis, curators conceptualise objects and collections as fulfilling an empirical role in the service of 'historical' enquiry, serving as tangible evidence of phenomena, processes, ideas, ingenuity and adaptation. I put 'historical' in scare quotes because the curators are not only concerned with interpreting the evidence of the past to construct its significance on the present, but another crucial aspect of their work—particularly in contemporary collecting—is to interpret the evidence of the present to anticipate its significance on the future. Many of the curators I interviewed have backgrounds in historical analysis—particularly in the History of Science—and construe their curatorial role in accordance with historical epistemologies and methodologies. These historical epistemologies and methodologies, in turn, are employed in processes of anticipating future worlds.

In the context of Thinktank's *Our Changing Planet* gallery, objects are configured as evidence of the Anthropocene—of humans transforming their environment to the extent that it warrants its own epoch in Earth's history. Here, it is the intended role of the visitor to evaluate these pieces of evidence towards deducing whether the Anthropocene does indeed aptly describe the planetary crisis, but also when it began, and what can be done about it. In the Science Museum's *Energy Revolution*, *Our Future Planet*, and collecting activities more broadly, objects are interpreted both as evidence of *the changing planet*, and evidence of *human response* to the changing planet. In all these cases, objects are engaged by curators to perform, simultaneously, an empirical function—serving as evidence of *what has happened* and *what is happening*—but also an anticipatory function—serving as tools to forecast future worlds on a changing planet.

To the curators of *Our Changing Planet*, objects fulfil an anticipatory role by embodying the 'causes' of the Anthropocene, thereby stimulating the problem-solving, imaginative capacities of the visitor to conceptualise the appropriate 'solutions' and 'future scenarios' that ensure the habitability of the Earth and the wellbeing of humankind. To the Science Museum curators, objects are similarly engaged in evidence-based futures thinking. Objects that embody 'present' worlds—contemporary actions being taken to address the changing planet—are employed as mechanisms for anticipating future histories. Objects provide empirical evidence of socio-technological transitions: 'evidence' of future worlds in which the impacts of climate change have been successfully mitigated, and humankind has successfully adapted to shifting environments.

That curatorship is a praxis of anticipation—a mode of acting in preparation for forecasted future scenarios and events—is underscored compellingly by activities of collecting and

developing permanent galleries. The nature of curating as a practice of anticipatory futures thinking was expressed succinctly by Rupert Cole in his characterisation of museum collecting as 'creating an archaeology for the future'.[752] Through processes of documenting a material record of the *past* and *present*—grounded in notions of empirical reality—curators are acting in anticipation of future worlds: anticipating the future significances that future audiences will draw from the objects being acquired and preserved in the present.

In a time of planetary change—under a looming prospect of environmental and social collapse—employing tangible 'evidence' of action and adaptation towards anticipating positive 'future histories' is a powerful form of action to which science museum curators make a distinctive contribution. Interpreting *historic change*—assembling real stories of transition: of finding and implementing 'solutions' to the changing planet—[753] is a compelling way to inspire hopeful futures thinking in audiences. As both Oliver Carpenter and Rupert Cole reflected on their practices of collecting, 'what survives in both documentary and material history starts to define that history';[754] 'sometimes [what you collect] gets to be seen as *the* version of the past'.[755]

Science curatorship, being grounded in the evidence-based framework of scientific logic, has a unique capacity to situate future possibilities in an empirical grounding; to inspire hope for the future through the tangible evidence of the present that such futures could come to pass. This is not necessarily exclusive to curators of science and technology. Curators operating within the disciplinary remits of art, design, culture, social history, and many more, could similarly employ their collections as 'empirical evidence' of imagined future worlds. Nevertheless, science and technology museums possess a special capacity in this regard owing to the future-oriented nature of their disciplinary remit. Science and technology are uniquely placed as agents of investigating and forecasting futures, thus taking real action to construct desirable future worlds.[756]

Where I suggest that science curatorship can learn from other modes of curatorship is in their *speculative* approaches to futures thinking; imagining future possibilities that are less grounded in present reality, and more open to being otherwise. Speculation is a means of

[752] Interview with Rupert Cole. 7 December 2022.
[753] See Science Museum Group, 'Collection Development Policy 2021', 10-11.
[754] Interview with Rupert Cole. 7 December 2022.
[755] Interview with Oliver Carpenter. 9 January 2025.
[756] See Juan Francisco Salazar, 'Futuring Global Change in Science Museums and Centres: A Role for Anticipatory Practices and Imaginative Acts', in Fiona R. Cameron and Brett Neilson (eds.), *Climate Change and Museum Futures*, 90-108.

conceiving alternative futures (as well as alternative pasts) that are free from the paradigms of the present. For example, the capitalistic paradigm that situates the Earth and nonhuman beings as an 'Other' to humankind: as 'resources' and 'capital' to be exploited for economic gain without being returned with practices of nurture and care. Providing the exhibit-creators with the freedom to speculate the future of museums in ways that were imaginative, transgressive and paradigm-shifting was central to the rationale of Rodney Harrison in the *Reimagining Museums* project.

> 'If you ask people to imagine a future, they tend to imagine something that looks very much like the present. So, the idea is to create a context in which people can imagine *different* futures. Can actually speculate about alternative futures. That's really important.
>
> '[…] So, it was really at the heart of the whole project—this mode of imagining museums otherwise.'[757]

And at the Sainsbury Centre, speculative modes of thinking have been embraced to the extent that they have completely and radically transformed the institution, its activities and its modes of engaging audiences. By reimagining its objects and artworks as alive, they are calling on onlookers to relate to them as living entities without the empirical evidence of them being so, but rather through engaging their imaginative thinking. In effect, the Sainsbury Centre is asking its audiences to have faith in the concept that art is alive, and through processes of shifting their thinking, perception and perspectives, subsequently reimagine their conception of, and relationship with, the Earth as likewise a living entity.

This speculative philosophy underpinned Ken Paranada's approach to *Sediment Spirit*: 'The Earth is animated by different kinds of life that we don't see with our human eyes. It's beyond our comprehension. […] once we consider that the Earth is alive, the hope is that we shift human values in terms of understanding sustainability. That goes into your individual choices in your daily life'.[758] By engaging audiences in a speculative, imaginative mode of relating to art, the curator hopes that this would activate a new way of relating to the Earth, and in turn, activate a new consciousness about the environmental impact of their behaviours and lifestyles. Working in a context where curating is situated as a speculative practice of reimagining the world and what it means to be alive, in turn, facilitates Paranada to engage

[757] Interview with Rodney Harrison (Museums for Climate Action). 24 January 2024.
[758] Interview with John Kenneth Paranada (Sainsbury Centre). 16 February 2024.

in paradigm-shifting concepts. Moreover, the Sainsbury Centre's explicit focus on decolonisation activities[759] provides a crucial endorsement to Paranada—and the institution as a whole—to foreground Indigenous voices, perspectives and worldviews, particularly through the philosophy of animism.[760]

For science curators, embracing a dual focus on the *empirical* and the *imaginative*—engaging both *anticipation* and *speculation*—could help to radically transform the processes and products of their futures thinking. On the one hand, harnessing objects and stories of science provides an avenue to accentuate the role of *evidence* in ways of knowing and acting upon the changing planet. To meet the challenges of the changing planet, everybody, across all systems of society, culture, economics and politics—from the individual to the collective—must adapt their behaviours and lifestyles. Harnessing science curatorship as an empirical praxis of employing evidence is a means to ground futures thinking on a foundation of what we *know* and what we can *perceive* from our reality of a changing planet. On the other hand, I suggest that science museum curators could also take inspiration from curators working in experimental ways with other media in other contexts—looking to the practices, for example, of Harrison and Paranada—to also harness the speculative capacities of scientific thinking. To activate science in ways that enable them to completely reimagine the world; to imagine futures that are radically hopeful and transgressive of present realities. To imagine futures of social and environmental diversity and co-flourishing.[761]

Curating for Sustainable and Equitable Futures

In my final reflections, I expand upon my findings around science curatorship as a future-oriented practice, which actively contributes to futures thinking and discourse, to contemplate a role for science curators as advocates for future worlds that are based on principles of sustainability and equity. By conceptualising science curatorship as having this potential to effect real, paradigm-shifting change in the world, I am inspired by Fiona Cameron's treatise on 'curating for planetary habitability' by means of adopting posthumanist philosophies and praxes.[762] Although she acknowledges that 'it is not possible to escape our

[759] For example, see Sainsbury Centre, 'Decolonisation Activity 2019-2021'. Available at: https://www.sainsburycentre.ac.uk/wp-content/uploads/2021/06/Decolonisation-Activity-2019-21.pdf [accessed 17 September 2025].
[760] An example of a recent exhibition at the Sainsbury Centre that foregrounded Indigenous art, agency and perspectives was *Empowering Art: Indigenous Creativity and Activism from North America's Northwest Coast* (March-July 2023).
[761] See Esther Turnhout, 'A Better Knowledge is Possible'.
[762] Fiona R. Cameron, *Museum Practices and the Posthumanities*.

own anthropocentrism, or to truly curate from a non-anthropocentric position', she proposes eco-curating as a framework 'to represent, compose, and work with other things and processes in experimental ways.'[763]

In harnessing the concept of 'planetary habitability', she is pointing to a mode of surviving and thriving in the world that is pluralistic, rejecting notions of the nature/culture dualism that situates the flourishing of nonhuman beings, environments and processes as distinct from, or antithetical to, the flourishing of human societies and cultures. Moreover, her adoption of the concept draws on her suspicion of 'sustainability' as a term that has been co-opted by a neoliberal agenda to situate the environment, society and economy as separate, oppositional concerns.[764] She therefore espouses the term 'sustaining practices' as a way of moving beyond the connotations of 'sustainability' as serving the interests of capitalist modes of production, consumption and development, and instead works from the premise that all spheres of human society and life on Earth are interconnected.[765]

I agree with this principle that the concept of being 'sustainable' should be utilised in ways that recognise the entanglement of human societies, cultures and economies—thus human health, wellbeing, creativity and overall quality of life—in the ecosystems, environments and climates in which we live. But rather than present a new term, such as 'sustaining practices', I will simply propose a conceptualisation of 'sustainability' and 'sustainable' that denotes this sense of being holistic, emphasising the interconnectedness of human and nonhuman wellbeing.[766] Therefore, by 'sustainable futures', I am thinking about hopeful future possibilities in which humankind—encompassing diverse human societies, cultures, communities, families and individuals—is flourishing in caring reciprocity with nonhuman beings, environments and Earthly processes. So, in this framing, to be sustainable is to safeguard the present and future needs, resilience and wellbeing of humans and more-than-humans alike.

In addition, I stress the need for 'equity' and 'equitable futures' to draw attention to demands for justice—rectifying historical and present injustices—as providing an ethical foundation on which to build sustainable futures. Principally, climate and environmental justice addresses

[763] Ibid., 7.
[764] See Fiona R. Cameron, 'From Sustainable Development to Sustaining Practices for Human, More-than and Other-than Human Worlds'.
[765] Ibid.; Fiona R. Cameron, *Museum Practices and the Posthumanities*, 201-242.
[766] See Tim Lomas, James O. Pawelski and Tyler J. VanderWeele, 'Flourishing as 'Sustainable Well-being': Balance and Harmony Within and Across People, Ecosystems and Time', *The Journal of Positive Psychology*, Vol.20(2), (2025), 203-218.

the reality that those who are least responsible for damaging the Earth—which includes nonhuman beings alongside human societies and communities—are disproportionately vulnerable to the effects of such damage, such as extreme weather events, wildfires and crop failure.[767] One of the suggested approaches to achieving justice for vulnerable, low-income countries, as well as protecting their human rights to life and health, is for high-income, high-polluting countries to supply them with 'climate reparations' to fund their activities in mitigating and adapting to the changing planet.[768] This is a form of *distributive* justice, relating to the allocation of funding, knowledge and supplies as a mode of addressing the unjust vulnerability of low-income countries to climatic and environmental change.[769] Other forms of justice include procedural, corrective, social, recognitional, transitional and restorative.[770]

Rather than promote a specific avenue for environmental justice, I propose that science curators engage in ethical debate around what it constitutes and entails through their work and pose such questions to their audience. Equity, after all, is a justice framework constructed on the nuances of context, recognising that each individual has different needs and therefore cannot subscribe to a universal definition of fairness and equality.[771] Therefore, engaging audiences in discussions of what equity means to them serves to underscore this principle of differentiation, addressing diverse circumstances and experiences. So, in my suggestions for how curators could engage in anticipating and speculating 'equitable futures', what I mean by this is that they develop ideas of the future that are grounded in principles of fairness and justice, and that these principles are themselves grounded in an understanding and framework that accounts for different needs and perspectives. The unique role of the curator, thus, is to harness the media and spaces they oversee—the objects, collections, commissions, exhibitions and galleries under their care—for practices of storytelling; telling stories that are united by morals of equity, justice and inclusivity.

[767] See Petra Tschakert, 'More-than-human Solidarity and Multispecies Justice in the Climate Crisis', *Environmental Politics*, Vol.31(2), (2022), 277-296.
[768] See Audrey R. Chapman and A. Karim Ahmed, 'Climate Justice, Humans Rights and the Case for Reparations', *Health and Human Rights Journal*, Vol.23(2), (2021), 81-94.
[769] See Md. Mofakkarul Islam, 'Distributive Justice in Global Climate Finance—Recipients' Climate Vulnerability and the Allocation of Climate Funds', *Global Environmental Change*, Vol.73, (2022), 1-15.
[770] See Andrea Schapper et al., 'New Directions in Climate Justice? A Dialogue Between Critical Climate Justice and Policy Studies Scholars', *Earth System Governance*, Vol.26, (2025), 2.
[771] See Nathalie J. Chalifour, 'Equity Considerations in Loss and Damage', in Meinhard Doelle and Sara L. Seck (eds.), *Research Handbook on Climate Change Law and Loss & Damage* (Edward Elgar Publishing, 2021), 20-32.

A Role for Science Curators

In a time of socio-ecological upheaval on a changing planet, I advocate for science curatorship—its practices, modes of thinking and overarching rationale—to be directed towards contemplating, anticipating, speculating, and ultimately promoting sustainable and equitable future worlds. In turn, to participate in practices of *constructing* sustainable and equitable futures through their capacity to effect real, meaningful change across their micro, meso, exo and macro environments. By working towards this goal, I propose a role for science curators—curators who engage with concepts, stories, knowledge, history, heritage and material culture relating to science and technology—to thus critically engage with 'science' and 'technology' as key actors in building sustainable and equitable future worlds.

First, to situate 'science', 'engineering' and 'innovation' as processes that everybody can contribute to, and which subsequently help to improve everybody's wellbeing and quality of life. Second, to highlight how 'science' and 'technology' can help humankind to nurture ecosystems and restore balance to other planetary systems, and in doing so, decouple them from paradigms of extraction and exploitation in the pursuit of financial profit. Essentially, I imagine a role for science curators to actively dissociate the concepts of 'science' and 'technology' from colonial-capitalistic ideologies of infinite economic growth at the expense of socio-cultural diversity, biodiversity and nonhuman beings.[772]

On the first point, many science curators—along with various other individuals in science-based institutions—are already working within organisational strategies, missions and frameworks to open up 'science' as something that is accessible for everyone to take part in. Drawing on their mesosphere of influence, Science Museum curators frame the intangible contribution of their work to the public good—particularly their work in developing galleries and exhibitions—through an ambition 'to grow science capital in individuals and society'.[773] At the core of science capital—as a philosophy and approach to science learning, science engagement and increasing science skills—is a focus on the psychological and sociological factors at play in shaping people's ideas of, attitudes towards, and relationships with STEM.[774]

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[772] See Jules Pretty et al., 'The Intersections of Biological Diversity and Cultural Diversity: Towards Integration', *Conservation & Society*, Vol.7(2), (2009), 100-112; Giorgos Kallis et al., 'Post-growth: The Science of Wellbeing Within Planetary Boundaries', *The Lancet Planetary Health*, Vol.9(1), (2025), e62-e78.
[773] This phrase appears repeatedly in curatorial working documents, such as interpretation plans. It refers to the SMG's strategic priorities as laid out in Science Museum Group, 'Inspiring Futures: Strategic Priorities 2022-2030'.
[774] Ibid., 7.

So, rather than undertake science engagement as a universalised endeavour, the science capital framework, in principle, recognises the importance of 'equity and social justice' towards 'enabling and empowering everyone to access the opportunities and wonders of STEM.' By '[understanding] and [challenging] inequalities', it seeks to develop content and create environments where 'everyone can feel they belong.'[775] A key factor underlying the science capital framework and its ambitions for social impact is the context of the UK's 'STEM skills gap'. This is a problem because while available jobs in STEM are expected to increase in the UK, there are not enough young people equipped with the skills and confidence to enter these careers, and those who do tend to have privileges relating to gender, ethnicity, class and economic background.[776]

Science capital is a framework through which Science Museum curators are expected to be conscious of the socio-economic inequalities in access to STEM. Therefore, they are expected to work in ways that not only seek to increase audiences' cognitive understanding of scientific knowledge and science history, but also to enhance audiences' *affective* relationship with science. By relaying stories, information and ideas that have meaningful, personal relevance to diverse visitors, the hope is that 'everyone feels that science is for them, and that they have opportunities to access the social and economic benefits it brings.' In short, it supplies an avenue to help achieve the SMG's collective mission to inspire the 'next generation of scientists, inventors and engineers.'[777] One of the curators I interviewed spoke to this aim of widening participation in science and engineering as being a core motivation in their thoughts, actions and decision-making.

> 'There are all these things where attitudes and behaviours are more important than the tech itself. More important than the science. And I think that's a sort of cross-cutting theme across everything we do.
>
> '[…] there's not one way of doing science. There shouldn't be one template of what a scientist looks like or does. […] you can make change regardless of where you come from and your education and things like that.'[778]

[775] Science Museum Group Learning Team, 'What is Science Capital?'.
[776] Beth Hawkins, 'Why Is STEM Important for Society?', *Science Museum Group Blog*, 2 September 2017. Available at: https://learning.sciencemuseumgroup.org.uk/blog/why-is-stem-important-for-society/ [accessed 17 September 2025]; Louise Archer and Heather King, 'Session 1: Understanding Science Capital', 10.
[777] Science Museum Group Learning Team, 'What is Science Capital?'.
[778] Interview with anonymous participant (Science Museum). 31 January 2023.

Similarly at Glasgow Science Centre, the vision, mission, values and learning framework of the organisation is structured upon principles of inclusivity in access to science, and therefore situates itself as having a responsibility to help people feel empowered 'to discover and enjoy science.'[779] 'We are all scientists', declares the Science Centre's statement on Equality, Diversity and Inclusion.[780] An ambition that was shared and articulated by Graham Rose, Creative Director. 'We don't tend to educate people, but we tell science stories. […] So, it's more about the emotional thrill of being a scientist.' The principle that 'we are all scientists' is based on a broad conceptualisation of a 'scientist' as anyone who makes observations, carries out research, compares and critiques information, and comes to conclusions; anyone who is curious and seeks to understand the world around them.[781]

I argue that this social equity-centred mode of interpreting science and technology—as well as the work of scientists and engineers—is really important to science curators' practices of thinking about the future of the changing planet and contemplating future scenarios in which human societies are more equitable, just and fair. But as I have observed from my discussions with curators, I believe that they can go even further to harness stories of science in ways that pose a more direct challenge to the social, economic and political structures that have created systemic inequalities and injustices.

To confront these systemic issues head-on, I suggest that they employ stories and concepts of science in ways that demonstrate how 'science' and 'technology' have been utilised to challenge the status quo and directly improve the lives and wellbeing of marginalised groups. To accentuate stories of grassroots change and innovation that deviate from traditional, elitist, Global North-centric narratives and concepts of 'progress' and 'development'. And to directly critique how science, engineering and technology have been complicit—historically and continuing into the present day—in the colonialist subjugation of the people and lands of the Global Majority to support the high quality of life for the Global Minority. In short, to both reveal the role of science in achieving equity, but also to be open about the role of science in perpetuating inequalities. From here, curators could enrich their futures thinking by contemplating how these injustices could be addressed through science and technology going forward.

[779] Glasgow Science Centre, 'Vision, Mission & Values'.
[780] Glasgow Science Centre, 'Equality, Diversity and Inclusion'. Available at: https://www.glasgowsciencecentre.org/equality-diversity-and-inclusion [accessed 17 September 2025].
[781] Interview with Graham Rose (Glasgow Science Centre). 28 February 2023.

I acknowledge that working within agendas and frameworks that are explicitly decolonial is difficult for curators in institutional contexts that are cautious of the language, ideas and methodologies of 'decolonisation'. For example, rather than naming 'decolonisation' outright and actively working to deconstruct the colonialist worldviews and structures of power that are present in the institution, its history and its displays, the SMG's action plan on 'inclusive displays and interpretation' instead frames its approach to achieving justice and equity as 'exploring our colonial history'.[782] And not only are curators' meso-level environment imposing restrictions on their freedom to be openly decolonial, but this sense of caution also stems from their exo-level environment. In particular, the UK Government's policy of 'retain and explain' for 'contested heritage' in national museums. So much so, the former SMG trustee, Sarah Dry, declined a second term in the role in protest against the SMG's endorsement of the policy, which undermines 'the independent curatorial and interpretive work of national museums' and 'violates the long-established principle of arm's length bodies'.[783]

By way of comparison, although Thinktank's *Our Changing Planet* gallery presents more of colonial critique than being actively decolonial, Felicity McWilliams nonetheless spoke about how she and her colleagues—particularly in the context of gallery redevelopments at BMAG—were drawing on principles of the decolonisation movement in their interpretive activities.[784] Speaking of their mesosphere of influence, Lukas Large pointed out the 'general supportiveness' of the co-CEOs, Zak Mensah and Sara Wajid, 'for the aims that we're going for', being 'aligned with our approach.' Although they have not received any formal complaints about their colonial critique in *Our Changing Planet*, if they did, 'you know that the CEOs are on your side. It's reassuring at least.'[785] In contrast to the Science Museum, Birmingham Museums is not a national institution. It does not answer to the exo-level agency of the DCMS, wherein it would be obliged to exercise political impartiality and avoid 'taking actions motivated by activism or politics.'[786]

Despite the meso- and exo-level difficulties that they may face, I hope, in this thesis, to have been able to foreground and celebrate the work of science curators in pursuing their ethical

[782] Science Museum Group, 'Inclusive Displays and Interpretation: Exploring Our Colonial History', (2021). Available to download at: https://blog.sciencemuseumgroup.org.uk/our-commitment-to-inclusive-storytelling/ [accessed 17 September 2025].
[783] Quoted in Geraldine Kendall Adams, 'Trustee Quits SMG Board Over 'Retain and Explain' Pledge', *Museums Journal*, 7 May 2021. Available at: https://www.museumsassociation.org/museums-journal/news/2021/05/trustee-quit-smg-board-over-retain-and-explain-pledge/ [accessed 17 September 2025].
[784] Interview with Lukas Large and Felicity McWilliams (Thinktank). 12 December 2024.
[785] Ibid.
[786] Oliver Dowden, 'Letter from Culture Secretary to DCMS Arm's Length Bodies on Contested Heritage'

agendas for equity and justice in ways that point to the decolonial. For example, the efforts of the curators on *Energy Revolution* to thoughtfully integrate stories and perspectives of the Global South, and thus redefine notions of innovation away from traditional, Global North-centric interpretations of the concept, towards a celebration of 'grassroots' science and technologies that meet the needs of the communities they were designed to serve. And the work of the curators on *Our Changing Planet* to root the Anthropocene in the history of colonialism and slavery, and in doing so (although implicitly), recognise how the changing planet and systemic racism against Indigenous and Black people are intertwined. And the approach of the Museums for Climate Action curators to foreground the voices and agencies of the concept creators they collaborated with for *Reimagining Museums for Climate Action*, thereby mirroring a form of procedural justice that challenges notions of hierarchy and power.

To go even further in advocating for equitable futures, I propose that science curators embrace multi-species, more-than-human perspectives on 'equity' to encompass the rights of ecosystems and nonhuman beings *alongside* the rights of humans. It is in this relationality between humans and nonhumans—positioning the wellbeing of humankind and the Earth as entangled—that underpins my conceptualisation of sustainability in futures thinking. One of the defining aspects of current directions in science curatorship that I have discerned is the people-centred nature of curating. In this mode, science curators are drawing attention to 'people's stories': foregrounding the individual perspectives and testimonies of practitioners in science and technology, and consciously interpreting science and technology in ways that are socially contextualised, have social relevance, and relate to people's lived experiences. While this people-centred approach is important to underpinning curators' exploration of equitable futures, it is nonetheless perpetuating human-centric ideas of sustainability and wellbeing.

As such, I speculate a future mode of science curatorship that empowers nonhuman beings as possessing agency and autonomy that are separate from the concerns, priorities and practices of humans. I emphasise my use of the word 'speculate', because my thinking around future directions in curating is not grounded on considerable empirical backing. Nevertheless, it *is* building on my observation of current directions in curatorial thinking and practice that are constructed upon values of equity and sustainability. Moreover, I am optimistic of the Science Museum's recent embrace of the natural sciences and ecological perspectives, particularly through Rupert Cole's work in developing the *Future of Food* exhibition. Where I do discern *evidence* of curating in ways that align with posthumanist and animistic thinking is at the Sainsbury Centre. Specifically, in its guiding framework that *art is*

alive. This subsequently inspired Ken Paranada's philosophy of *Sediment Spirit*, proposing a new concept to describe the invisible lifeforces of the Earth.

As he explained, 'Sediment' denotes the *scientific* mode of evidence-based, logical thinking and discovery of the tangible world around us. Meanwhile, 'Spirit' denotes a faith in a world that exists beyond what we can discern through evidence: the intangible soul and sacred anima that runs through every living being, every mineral, every particle.[787] 'Sediment Spirit', therefore, is a way of marrying scientific ways of knowing with philosophical and spiritual ways of knowing. It poses a frame of looking at 'science' as a form of knowledge and practice that can be used in conjunction with—rather than in opposition to—modes of understanding the world that are based in Indigenous worldviews and principles of animism: that every animal, plant, fungus, microorganism, mineral, body of water and weather event, among other nonhuman beings and processes, has a lifeforce and agency. In connecting these forms of knowing and perceiving the Earth, he is suggesting a role for 'science' to help people's cognitive and affective engagement with the concept of their relationality and kinship with nonhuman beings.

In the context of a science museum, embracing a posthumanist perspective on sustainability could mean that the curator shifts their language and framing of nonhuman beings as 'resources' for the sole benefit of humankind and instead emphasise their right to live and flourish on their own terms.[788] Or rethink their conceptualisations of 'innovation' as not just centring on human ingenuity, human capacities for adaptation and human prospering, but also encompassing the ingenuity, adaptations and prospering of nonhumans. This could mean an embrace of 'wildlife technologies'—tools developed by nonhuman animals—into the museum's material, conceptual and intellectual remits of 'technology'.[789] Or a focus on practices of science and applications of technology (largely within theoretical physics) that seek to understand the nature of life itself, studying the lifeforce and autonomy of particles.

To be able to embrace these conceptual shifts towards more-than-human perspectives and agencies, I realise that science curators would need to be supported—and feel a sense of endorsement—by the mesosystem in which they work. This could entail the personal backing of people in positions of power; processes of redefining institutional missions,

[787] Interview with John Kenneth Paranada (Sainsbury Centre). 16 February 2024.
[788] See Sebastian Engelmann, 'Kindred Spirits: Learning to Love Nature the Posthuman Way', *Journal of Philosophy Education*, Special Issue: 'Love and Desire in Education', Vol.53(3), (2019), 503-517.
[789] Andrew Kitchener, 'How the Secret Lives of Animals Are Revealed: Collecting Wildlife Technology'. Paper for *Collecting Sustainable Technology* symposium [hybrid], National Museums Scotland, 5 December 2023.

visions, aims and strategies; as well as a wholescale reconceptualisation of the institution's intellectual and conceptual remit of 'science'. And these meso-level shifts and advocacies, in turn, would be stronger if they were supported by exo-level agencies, such as prominent scientific bodies. Going further, these agencies would be more impactful with the public backing of the macrosphere, such as that provided through shifts in socio-cultural values. Lastly, all of these agencies would be strengthened by the chronosphere, shaping people's perception of where we have come from, where we are now and where we are headed.

I do not diminish the agency of the individual curator to effect change. Rather, I call on curators to utilise the framework of ecological systems thinking to evaluate their own practice and the diverse agencies that shaped it. In doing so, I invite them to reflect on how they can harness their personal autonomy, expertise and perspectives to initiate change in their institution in manageable waves, starting with small actions and gradually building upon them. It is through thinking in systems—recognising that each individual makes an impact on the world in their own way, and that there is a lot of power in working collectively towards shared ambitions—that humankind will be able to sustain itself and other beings on Earth. Such change can start with the anticipatory and speculative thinking of the curator for hopeful, equitable and sustainable futures.

Illustrations

Figure 1.1. Air-Sampling Flask Used for Observations of Atmospheric Carbon Dioxide (1980s), displayed in *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Source: photograph by the author, 17 June 2024.

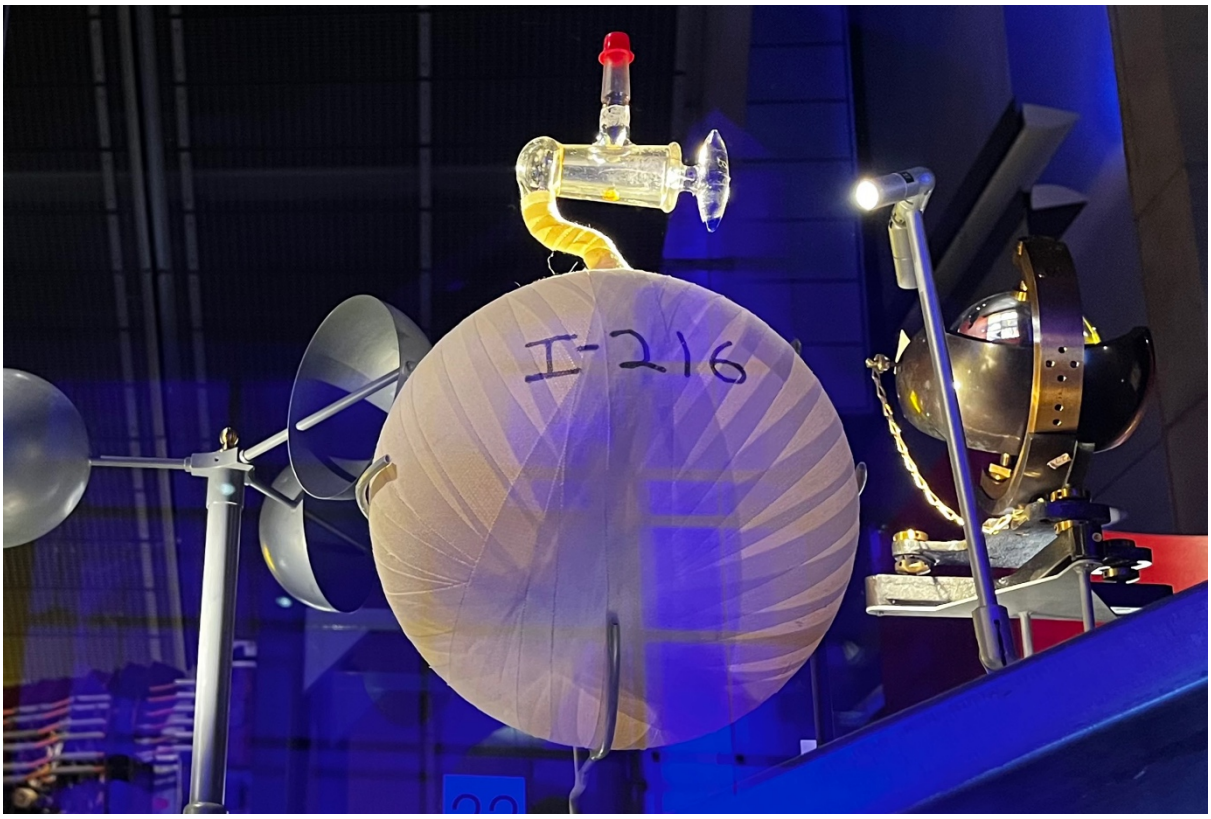

Figure 1.2. Tidal Turbine Blade from Orbital Marine Power's SR2000 Turbine (2016), displayed in *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Source: photograph by the author, 17 June 2024.

Figure 1.3. Reeddi Capsule (Solar-powered Portable Battery, 2021) and We Care Solar Suitcase (2017), displayed in *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Source: photograph by the author, 17 June 2024.

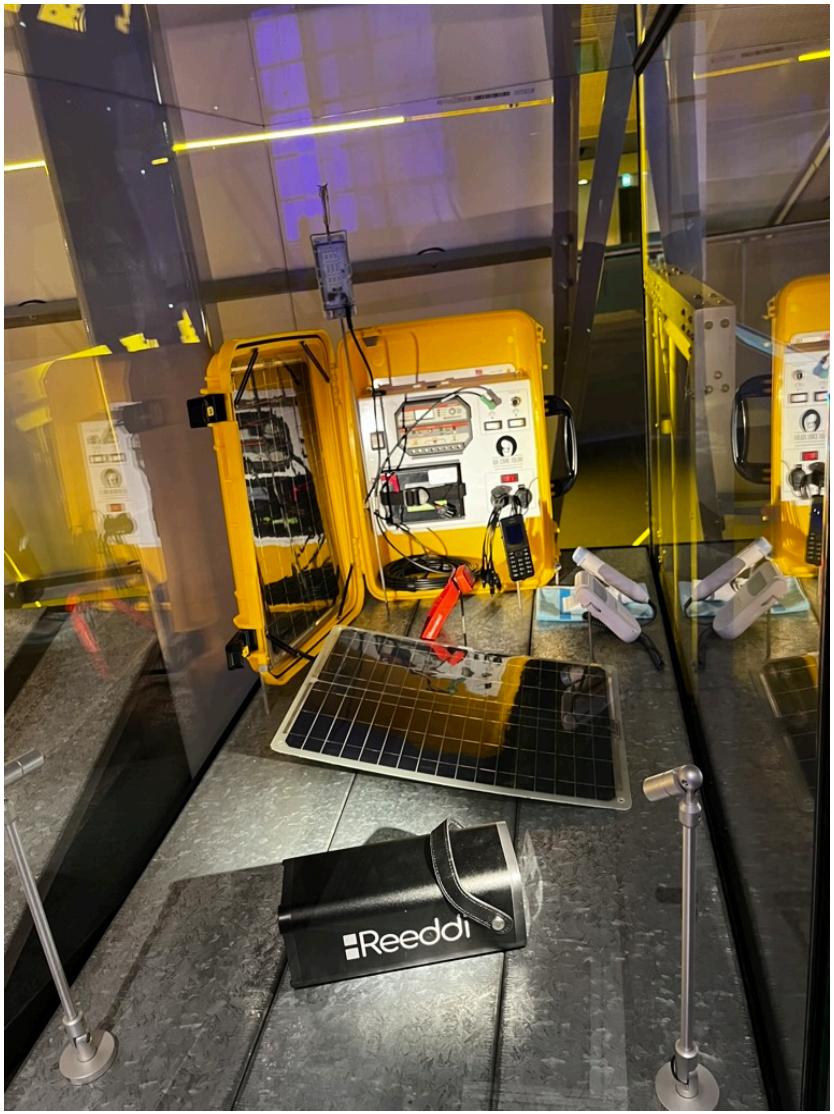

Figure 1.4. CoolANT Passive Cooling Façade (2023), displayed in *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Source: photograph by the author, 17 June 2024.

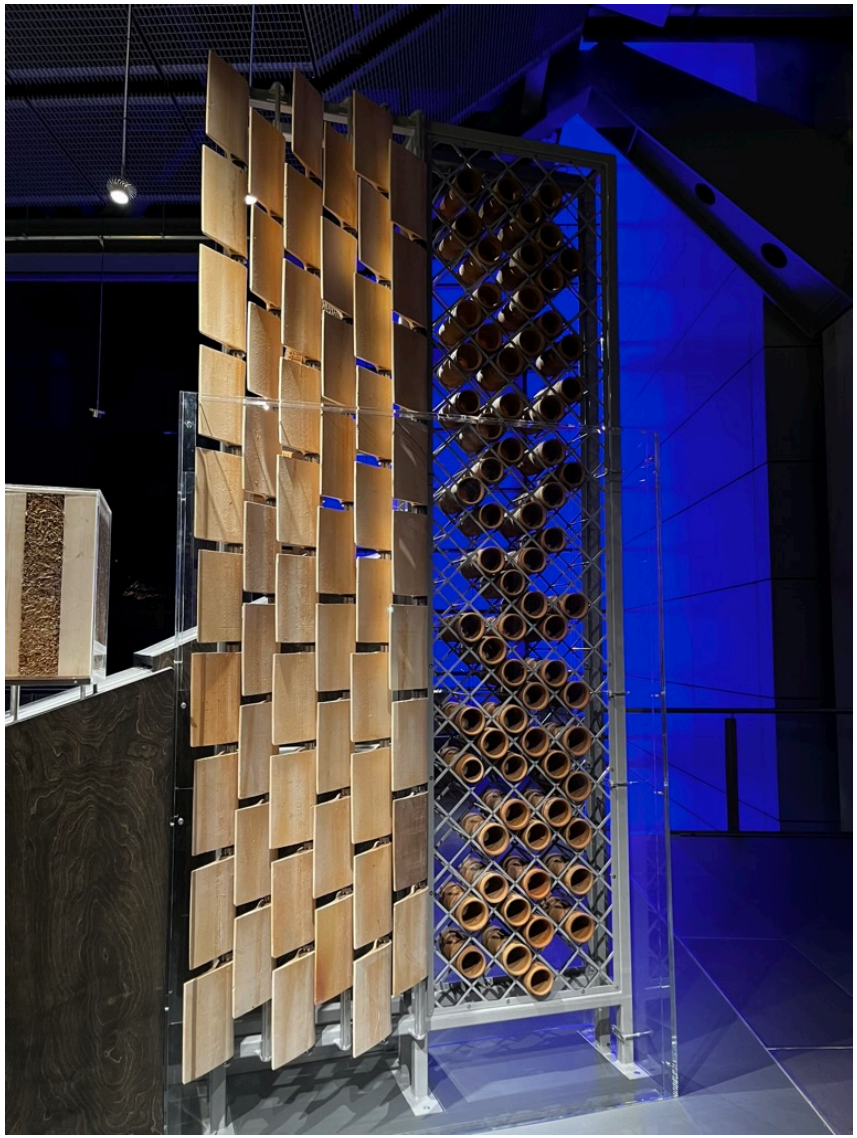

Figure 1.5. Mechanical Tree Prototype Designed by Klaus Lackner (2017), displayed in *Our Future Planet*, Science Museum. Source: photograph by the author, 24 August 2022.

Figure 1.6. Climeworks Carbon Collector Unit (2013), displayed in *Our Future Planet*, Science Museum. Source: photograph by the author, 24 August 2022.

Figure 1.7. 'Carbon Core' Containing Carbon Mineral Deposits Fixed in Basalt (2014), displayed in *Our Future Planet*, Science Museum. Source: photograph by the author, 24 August 2022.

Figure 1.8. Global Youth Climate Strike Posters (2019), displayed in *Our Future Planet*, Science Museum. Source: photograph by the author, 31 July 2021.

Figure 2.1. *Find Your Future*, Thinktank. Source: photograph by the author, 2 November 2024.

Figure 2.2. 'Measuring Climate' Display Case, *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Source: photograph by the author, 17 June 2024.

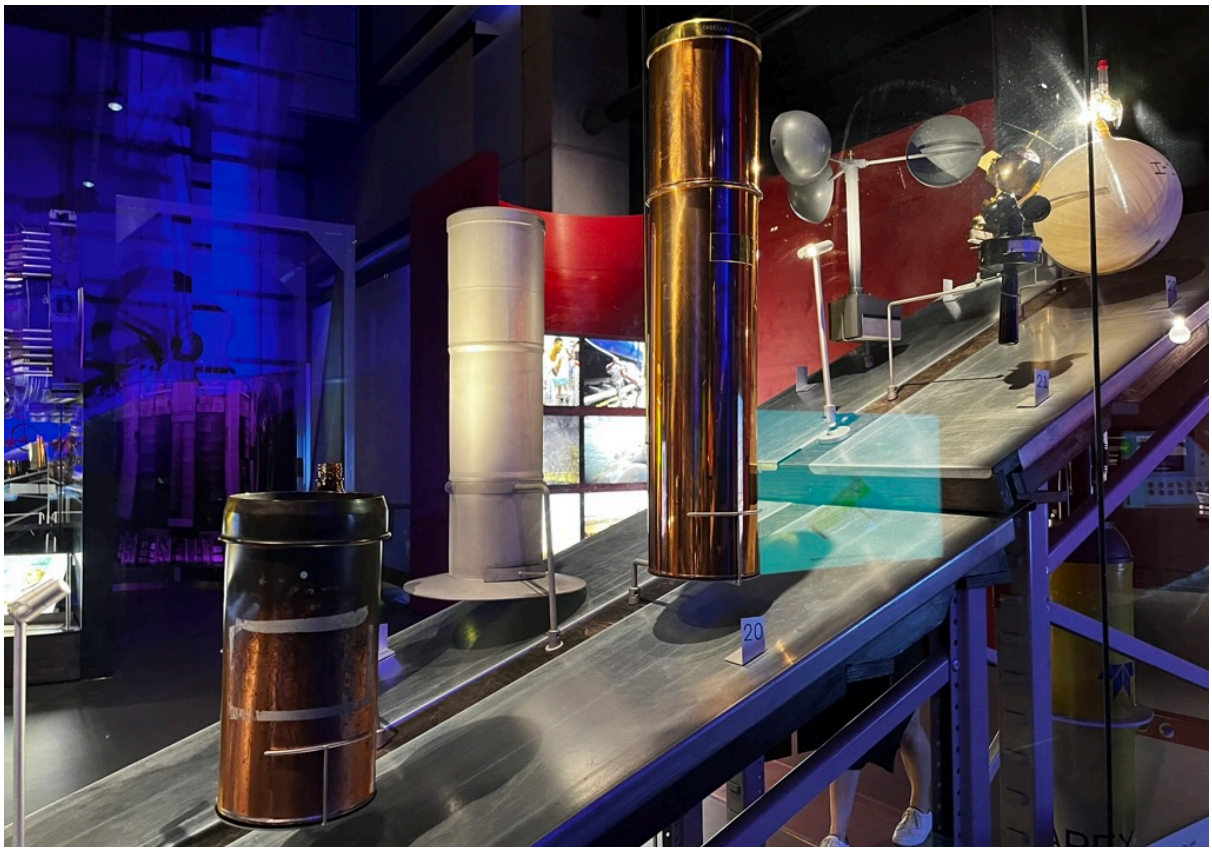

Figure 2.3. Parabolic Trough Mirror and Receiving Tube from a Concentrated Solar Power Plant Array (2022), displayed in *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Source: photograph by the author, 17 June 2024.

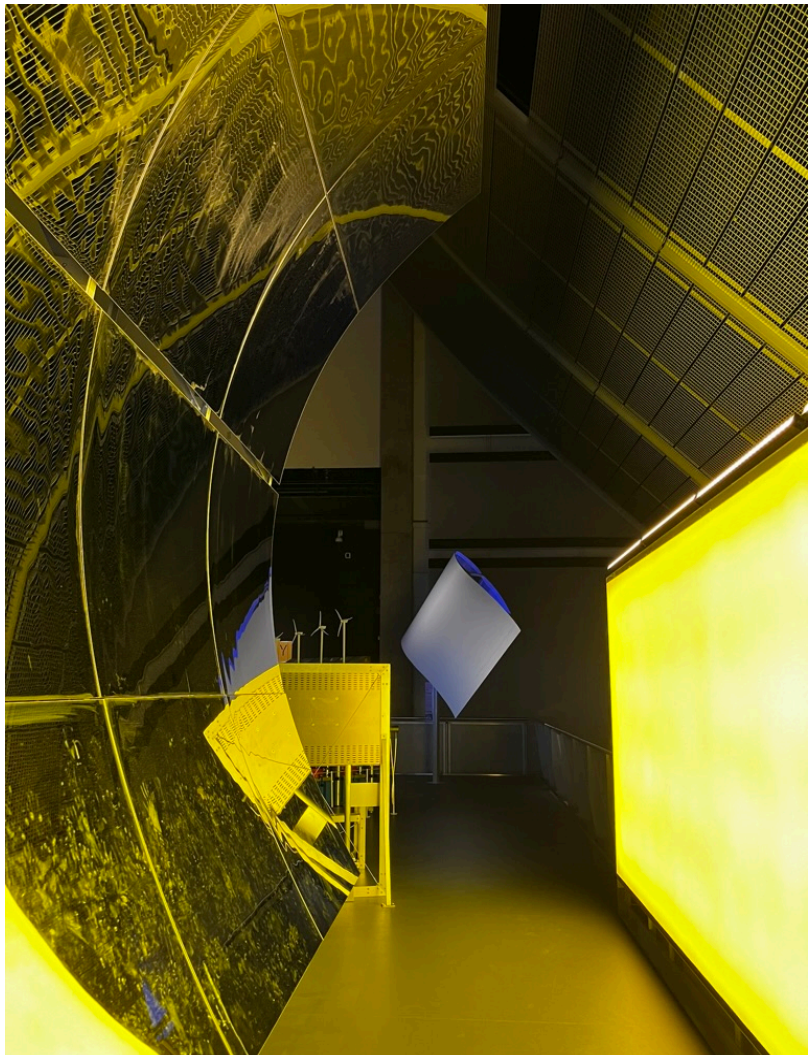

Figure 2.4. Piece of Zero Energy Thermonuclear Assembly (ZETA) Nuclear Fusion Experiment (1957), displayed in *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Source: photograph by the author, 17 June 2024.

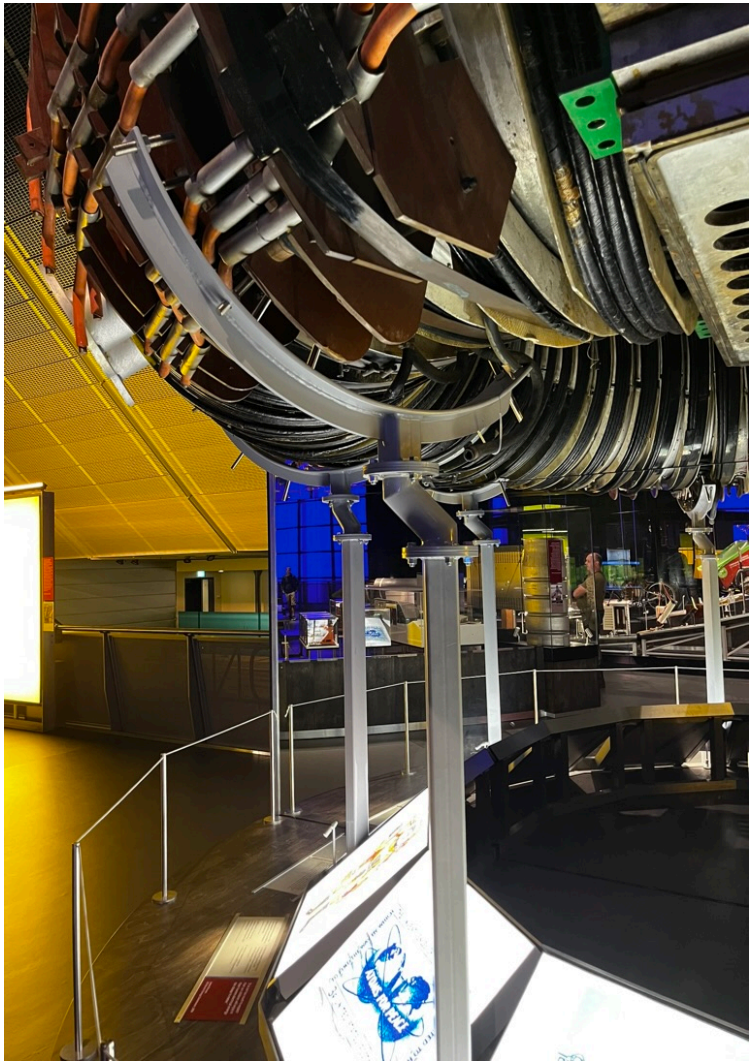

Figure 2.5. Islabikes Joni Bicycle Designed for People with Disproportionate Dwarfism (2022), displayed in *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Source: photograph by the author, 17 June 2024.

Figure 2.6. Posters and T-Shirt for Solar Giraffe (2022), displayed in *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Source: photograph by the author, 17 June 2024.

Figure 2.7. Dover Sun House, *Popular* Science Magazine (1949), displayed in *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Source: photograph by the author, 17 June 2024.

Figure 2.8. 'Prehistory', *Our Changing Planet*, Thinktank. Source: photograph by the author, 2 November 2024.

Figure 2.9. 'The Colombian Exchange', *Our Changing Planet*, Thinktank. Source: photograph by the author, 2 November 2024.

Figure 2.10. 'The Industrial Revolution', *Our Changing Planet*, Thinktank. Source: photograph by the author, 2 November 2024.

Figure 2.11. 'The Age of Plastics', *Our Changing Planet*, Thinktank. Source: photograph by the author, 2 November 2024.

Figure 2.12. 'The Great Acceleration', *Our Changing Planet*, Thinktank. Source: photograph by the author, 2 November 2024.

Figure 2.13. Green Sea Turtle (*Chelonia mydas*), displayed at the entrance to *Our Changing Planet*, Thinktank. Source: photograph by the author, 2 November 2024.

Figure 2.14. Bronze-Age Gold Torc (right), displayed in *Our Changing Planet*, Thinktank. Source: photograph by the author, 2 November 2024.

Figure 2.15. Model of a Traditional Fijian Double Canoe (c.1870), displayed in *Energy Revolution: The Adani Green Energy Gallery*. Source: photograph by the author, 17 June 2024.

Figure 2.16. Bersey Electric Taxi Cab (1897), displayed in *Energy Revolution: The Adani Green Energy Gallery*. Source: photograph by the author, 17 June 2024.

Figure 2.17. Model of Solar-Powered Classroom (2023), displayed in *Energy Revolution: The Adani Green Energy Gallery*. Source: photograph by the author, 17 June 2024.

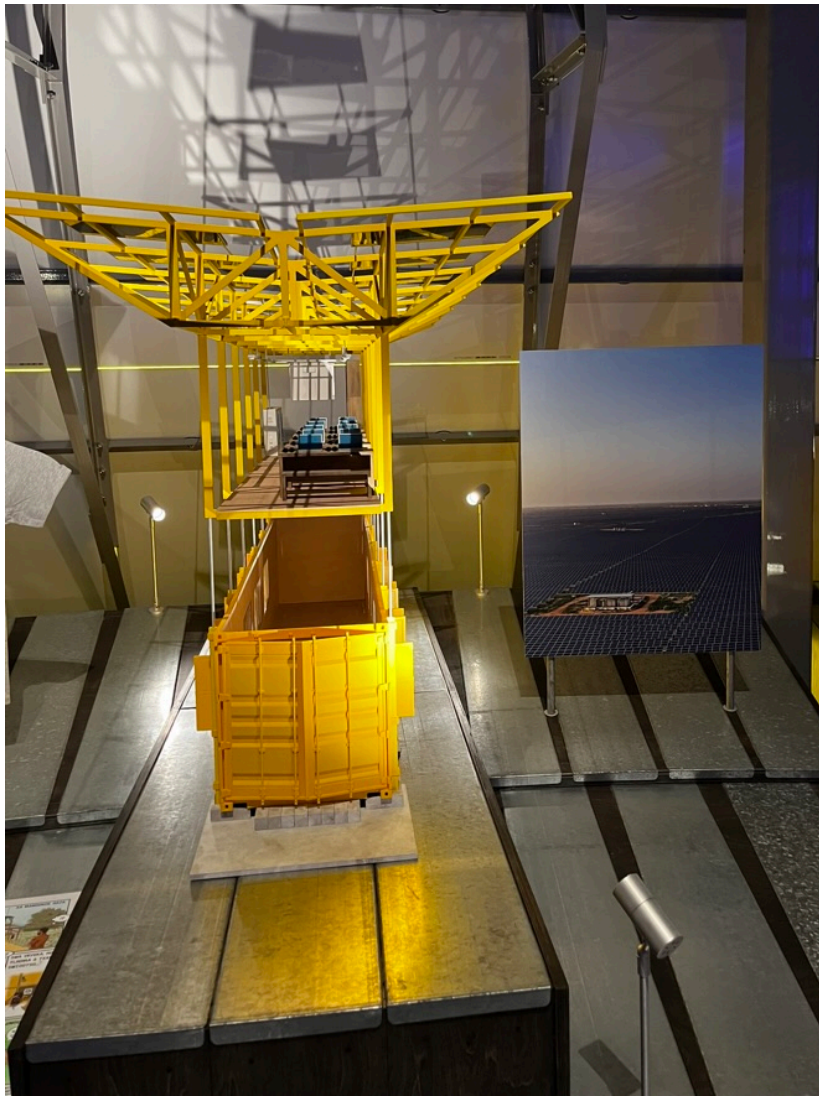

Figure 2.18. Prototype Steam Locomotive by William Burdoch (1784), displayed in *Our Changing Planet*, Thinktank. Source: photograph by the author, 2 November 2024.

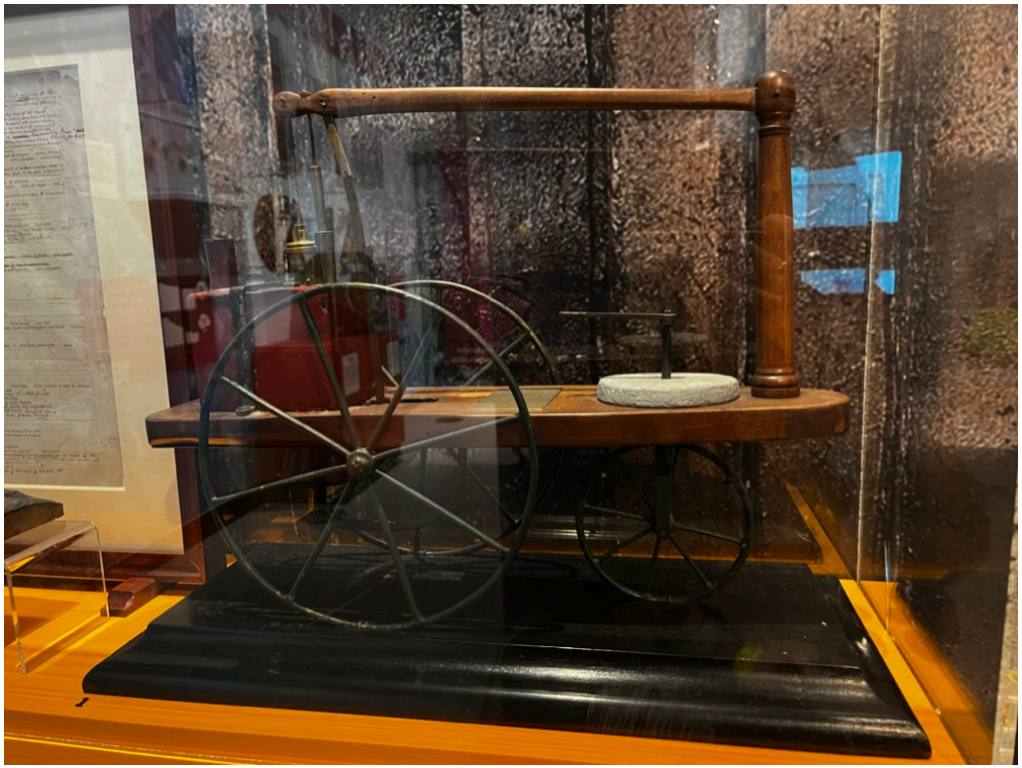

Figure 2.19. Industrial Machinery, displayed in *Power Up*, Thinktank. Source: photograph by the author, 2 November 2024.

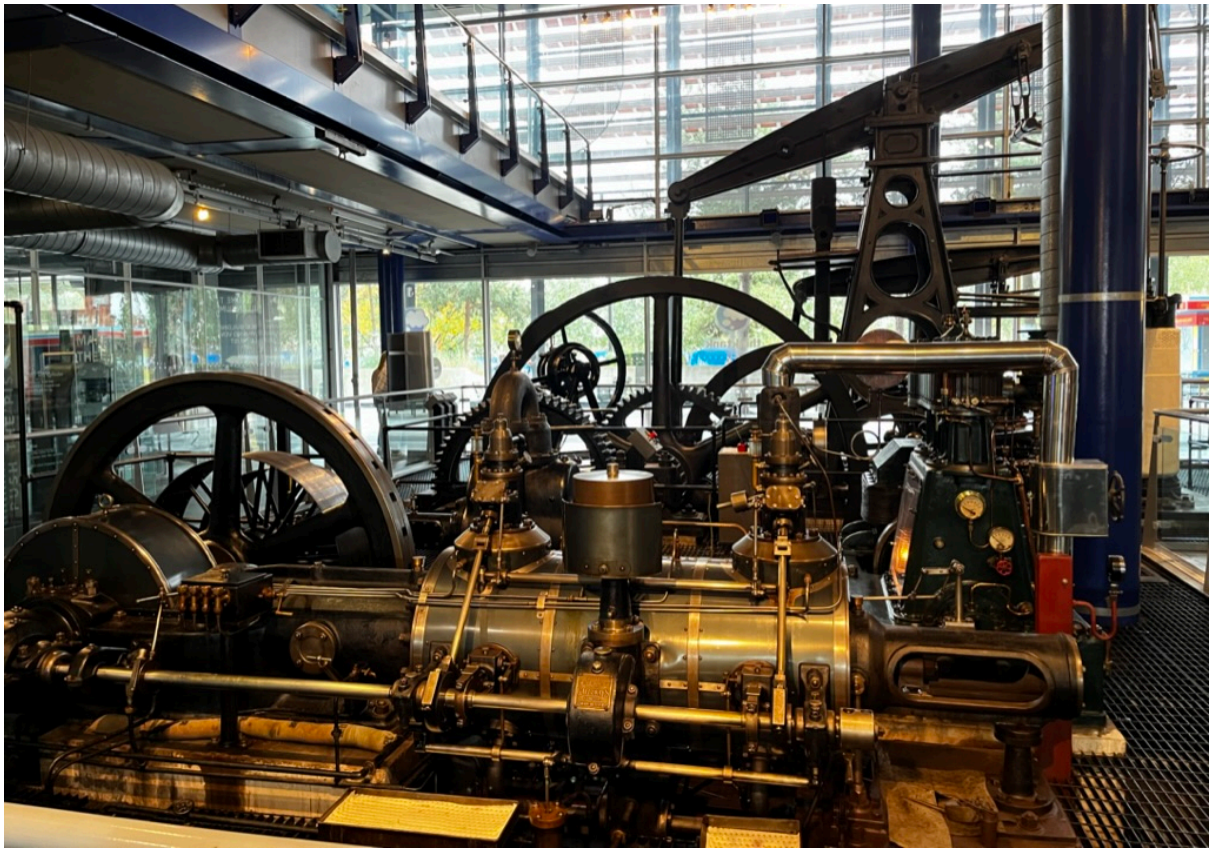

Figure 3.1. *Our Future Planet*, Science Museum. Source: photograph by the author, 24 August 2022.

Figure 3.2. Newspapers Published the Day After the Release of Working Group I's Contribution to the Sixth Assessment Report, displayed in *Our Future Planet*, Science Museum. Source: photograph by the author, 24 August 2022.

Figure 3.3. Fossilised Plant Material in Coal, displayed in *Our Future Planet*, Science Museum. Source: photograph by the author, 24 August 2022.

Figure 3.4. Tree Cross Sections from Ancient Woodland, displayed in *Our Future Planet*, Science Museum. Source: photograph by the author, 24 August 2022.

Figure 3.5. (Top: left to right) Soil Respiration Apparatus, Soil Core Extractor and Soil Cores. (Bottom: left to right) Tape Measure and Tree Stem Dendrometer, displayed in *Our Future Planet*, Science Museum. Source: photograph by the author, 24 August 2022.

Figure 3.6. Carbon XPRIZE Objects: Yoga Mat, Toothpaste, Cutlery, Sunglasses, Crayons, Pen and Sandal, displayed in *Our Future Planet*, Science Museum. Source: photograph by the author, 24 August 2022.

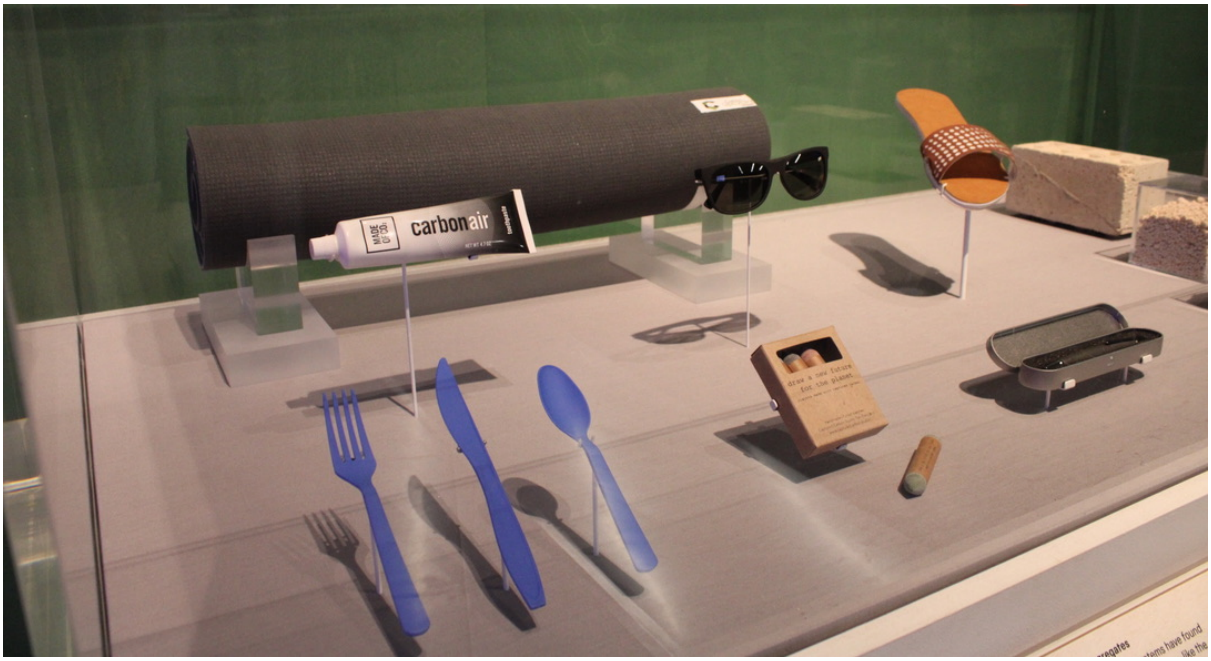

Figure 3.7. *Powering the Future*, Glasgow Science Centre. Source: photograph by the author, 28 February 2023.

Figure 3.8. *Idea No59*, Glasgow Science Centre. Source: photograph by the author, 28 February 2023.

Figure 3.9. 'Coal' Text Panel, *Powering the Future*, Glasgow Science Centre. Source: photograph by the author, 6 December 2023.

Appendix A

Charting and Contextualising Museological and Curatorial Engagement with the Changing Planet (UK and Overseas)

Year	Exhibitions, Galleries, Displays & Events	Organisations & Networks	Changing Planet: Science & Research	Changing Planet: Weather Events, Natural Disasters & Pandemics	Changing Planet: Activism & Campaigns	Changing Planet: Governance & Policies
1987			**October. The World Commission on Environment and Development (WCED) published *Our Common Future***. The report introduced the concept of 'sustainable development'.	**October. The Great Storm, UK**. One of the worst storms in the UK in the 20th century, with winds of up to 100mph. 18 people were killed, and millions of trees were blown down.		**September. The Montreal Protocol was signed**. An international treaty to phase out chemicals that damaged the ozone layer.
1988			**The Inter-governmental Panel on Climate Change (IPCC) was established** by the United Nations Environment Programme (UNEP) and World Meteorological Organization (WMO).			

1990			**The IPCC completed the first assessment report**. The report studied the link between anthropogenic emissions and increased CO_2 concentrations, noting an increase in mean surface air temperature by 0.3-0.6ºC over the last 100 years. It recommended international cooperation, leading to the foundation of the UNFCCC.		**April. The first international celebration of Earth Day**. Prior to that, Earth Day had been observed in the USA since it was established, in 1970.	
1992	**May-January 1993. *Global Warming: Understanding the Forecast*, American Museum of Natural History (New York) (travelling)**. Created jointly with the Environmental Defense Fund. Divided into four sections: 'Past Climates', 'Causes', 'Impacts' and 'Choices'.					**May. The Text of the UN Framework Convention on Climate Change (UNFCCC) is agreed** at the UN Headquarters.
	October-January 1993. *Ozone: A Covery Story*, Science Museum (London). A 'Science Box' exhibition providing information on the depletion of the ozone layer: its causes and impacts, and how society has responded.					**June. UN Earth Summit in Rio de Janeiro**. The UNFCCC and the Convention on Biological Diversity (CBD) were opened for signature.

	***Environment: Man and Technology on Planet Earth*, permanent exhibition at Deutsches Museum (Munich)**.					
1994	**May-October. *City Limits?*, Science Museum**. A Science Box exhibition that examined the growing unsustainability of cities, and explored solutions that could help make cities more sustainable.					
1995			**The IPCC completed the second assessment report**. Its scientists were more certain of the link between greenhouse gas emissions and atmospheric CO2. It concluded that there is substantial evidence that the global climate is changing.			**March-April. COP1, Berlin**. The first Conference of the Parties that signed the UNFCCC. The Parties agree to meet annually to discuss global warming and make commitments to stabilise greenhouse gas concentrations.
1997						**December. COP3, Kyoto**. Parties signed the Kyoto Protocol, which was the first major international, legally binding agreement to reduce greenhouse gas emissions.

1998			**April. The 'hockey stick' graph was first published**. While its science is disputed, the graph is emblematic of anthropogenic global warming. It shows that during the period 1000-1900, there was little variation in global temperatures, but since the start of the 20th century, temperatures have soared dramatically.			
2000			**February. Paul Crutzen declared that the 'Anthropocene' should replace the 'Holocene'** at a meeting of the International Geosphere-Biosphere Programme (IGBP) in Cuernavaca, Mexico.			
			May. Paul Crutzen and Eugene Stoermer published their proposal for the Anthropocene epoch in the *IGBP Newsletter*.			

2001		**Cape Farewell was founded by the artist David Buckland**. It is an interdisciplinary project bringing scientists together with artists, writers and other creators to embark on expeditions and produce cultural responses to climate change.	**May. The IPCC released the third assessment report**. It contained new and stronger evidence of anthropogenic climate change.			**June. George W. Bush removed the USA from the Kyoto process**. He argued that it put too much of a burden on industrialised nations compared to industrialising countries.
2002	**March-September. *Climate Change: The Burning Issue*, Science Museum**. An 'Antenna' exhibition comprising of interactives and text panels to explore issues of climate change—scientific evidence, causes and solutions—in a journalistic tone.					
	November-September 2003. *Climate: The Experiment with Planet Earth*, Deutsches Museum. An exhibition that explored the intersections between nature, climate, society, technology and politics mostly with a focus on current climate change, but also with a historical review of past climatic events and their impacts on human societies.					

2003	**October-March 2004. *The Weather Project* by Olafur Eliasson, Tate Modern**. An installation in which the artist recreated the sun.			**August. European heatwave**. Many countries experienced their highest ever temperatures. Tens of thousands of excess deaths occurred as a result of the extreme heat.		
2005	**October-December. *Groundworks: Environmental Collaboration in Contemporary Art*, The Regina Gouger Miller Gallery, Carnegie Mellon University (Pittsburgh)**. An exhibition project that explored the role of art in building socio-ecological relationships.			**August. Hurricane Katrina, USA**. One of the most devastating storms in US history. Nearly 2000 people were killed, hundreds of thousands of homes were destroyed, and over a million people were displaced.		
2006	**June-September. *The Ship: Art & Climate Change* by Cape Farewell, Natural History Museum (London) (travelling)**. An exhibition of the works by creators who had been travelling for the last five years with Cape Farewell to the High Arctic.		**October. *The Economics of Climate Change: The Stern Review* was published**. Commissioned by the UK Government and carried out by the economist Nicholas Stern, the report assessed and forecasted the impact of climate change on the world economy.		**Al Gore's film, *An Inconvenient Truth*, was released**. This highly successful documentary, which formed the basis of his travelling lecture tour, did much to raise public awareness of climate change and bring it onto the public agenda.	

2007	**September-December.** ***Weather Report: Art and Climate Change*****, Boulder Museum of Contemporary Art**. An exhibition that explored the contribution of artists to understanding climate change and galvanising climate action.	**'Julie's Bicycle' was founded in the UK as a not-for-profit organisation** supporting the arts and culture sector to take climate action and embrace sustainability.	**May. The IPCC published the fourth assessment report**. It declared that evidence of warming in the climatic system was unequivocal.			
	October-April 2008. ***Can Algae Save the World?*****, Science Museum**. An Antenna exhibition which explored different technological solutions to cutting greenhouse gas emissions and mitigating climate change.					
2008	**May-October.** ***Does Flying Cost the Earth?*****, Science Museum**. An Antenna exhibition which discussed how aviation contributes to climate change as well as investigated new technologies that could make flying more sustainable.					**November. The UK Government passed the Climate Change Act**. It made the UK legally obliged to carry out an 80% reduction in carbon emissions by 2050 compared to 1990 levels.

	April-November. ***The Science of Survival: Your Planet Needs You*****, Science Museum**. An interactive exhibition that was premised on the question of what human survival and livelihoods will look like in 2050. It considered how the changing planet could impact *drinking*, *eating*, *enjoying*, *moving* and *building*.					
	October-August 2009. ***Climate Change: The Threat to Life and a New Energy Future*****, American Museum of Natural History (New York)**. An exhibition that explained the science of climate change, analysing causes, impacts and solutions.					

2009	**May-August.** ***Climate Change: Our Future, Our Choice*****, Australian Museum (Sydney) (travelling)**. An exhibition that allowed visitors to explore two different future worlds: one where no action was taken, and one where action was taken on the changing planet. The introduction laid the groundwork for the science of climate change.	**June. Klimahaus Bremerhaven opened**. A 'Climate Experience Centre' that journeys through different climate zones on Earth and explores how they are being impacted by human activities.	**November. Climategate**. Emails from the Climatic Research Unit (University of East Anglia) were hacked, and climate change denialists falsely accused scientists of manipulating climate data. The controversy led to widespread public scepticism and denialism.			**December. COP15, Copenhagen**. It was anticipated to create an impactful climate agreement to be a successor to the Kyoto Protocol, but this time involving developing countries (especially BRICS). But the conference only resulted in the Copenhagen Accord, which contained non-binding targets to reduce emissions.
	June-October. ***Radical Nature: Art and Architecture for a Changing Planet 1969-2009*****, Barbican (London)**. An exhibition centred around the Land Art movement, highlighting its resonances and revival in a time of climate change.		**The Anthropocene Working Group was established by the Subcommission on Quartnary Stratigraphy (SQS)** to examine the evidence for the Anthropocene epoch.			
	October-November. ***C Words: Carbon, Climate, Capital, Culture*****, Arnolfini (Bristol)**. An exhibition by artist-activist group PLATFORM to coincide with COP15 which spotlighted the climate justice movement and the intersectionality between capitalism, climate change, racism and global inequality.					

	October-January 2010. ***Prove It! All the Evidence You Need to Believe in Climate Change*****, Science Museum**. An exhibition that sought to demonstrate the unequivocal evidence that climate change is happening and that it is caused by human activities. It was opened to coincide with COP15 and encouraged visitors to take political action by providing a platform to send a message to the UK Government.					
	December-January 2010. ***Earth: Art of a Changing World*****, Royal Academy of Arts (London)**. An exhibition of artworks by renowned contemporary artists responding to the issues and themes of the changing planet.					
2010	**March-September.** ***Sustainable Futures: Can Design Make a Difference?*****, Design Museum (London)**. An exhibition that showcased design and architecture projects that promoted sustainable practice. It was divided into 'Cities', 'Energy and Economies', 'Materiality', 'Creative Citizens' and 'Food (for Thought)'.				**January. Liberate Tate is formed**. They engaged in creative acts of protest against Tate's sponsorship by BP. In 2016, Tate announced that it would end its 26-year relationship with the corporation.	

	October-March 2011. *London Futures*, Museum of London. An exhibition of images that reimagine London landmarks in an environment transformed by climate change and the sustainable transition.					
	December-March 2022. *Atmosphere*, Science Museum. An interactive permanent museum gallery which the Science Museum believed to be the first of its kind to focus solely on climate change. Its aim was to provide clear, accurate, up-to-date information on climate science to counteract widespread public mistrust and scepticism.					
2011	**September-June 2012. *Water Wars: Fight the Food Crisis*, Science Museum**. An Antenna exhibition that considered the impacts of future water scarcity caused by climate change and population growth. It highlighted possible techno-fixes to maintain water supply to crops.					**November-December. COP17, Durban**. The Parties agreed on a roadmap towards a legally-binding agreement in 2015 that would commit them to reduce emissions and limit global warming.

	July-December. ***Conversations with the Earth: Indigenous Voices on Climate Change*****, National Museum of the American Indian (Washington, DC)**. A multimedia exhibition that accentuated Indigenous perspectives on the changing planet, drawing attention to Indigenous science and the environmental injustices faced by Indigenous communities.					
2012					**April. BP or Not BP?** Shortly after being founded, the activist group staged their first protest performance at the Royal Shakespeare Company, denouncing their sponsorship by fossil fuel company, BP.	**November-December. COP18, Doha**. The Parties agreed to the Doha Amendment to the Kyoto Protocol. This extended the commitment period to reduce greenhouse gas emissions.

2013	**May-July. *Tipping Point*, Wolverhampton Art Gallery**. An exhibition of contemporary artists' responses to the changing planet. It sought to underline the role of artists in provoking dramatic shifts in public thinking and behaviour, emphasising the 'cultural voice' in climate action beyond the voice of politicians and scientists.	**The Museums and Climate Change Network was established** at the American Museum of Natural History. They are an international community that share ideas and resources for addressing climate change across the museum, culture and heritage sector.				
		December. The Jockey Club Museum of Climate Change (Hong Kong) was opened. Based in the Chinese University of Hong Kong, the museum' interactive and multimedia exhibitions engage with issues of the changing planet.				

2014	**December-January 2016. *Welcome to the Anthropocene: The Earth in Our Hands*, Deutsches Museum**. The aim of this exhibition was to shed light on the Anthropocene concept, analysing the diverse ways in which humankind is impacting the planet. Using historical and contemporary objects, it explored the past, present and future of humanity.		**November. The IPCC published the fifth assessment report**. It concluded that human influence over the climate was clear and its impacts on the Earth were growing. It warned that mitigation was not the only issue; countries would have to starting *adapting* to climate change.	**2014 was the warmest year on record since 1880**, according to scientists in the USA.		
2015	**December-present. *Powering the Future*, Glasgow Science Centre**. An interactive gallery exploring different approaches to generating energy that frames the energy crisis through the trilemma of affordability, sustainability and security.	**July. The Climate Museum (New York) was established**, being granted a charter by the state government. The nonprofit organisation has so far engaged audiences with pop-ups and events that formed the basis of its arts and cultural programming. But in 2025, it was granted a permanent home (in development).		**2015 surpassed 2014 as the warmest year on record**.		**September. The 2030 Agenda for Sustainable Development** was agreed upon by Member States of the UN at the Sustainable Development Summit. The Agenda comprises 17 Sustainable Development Goals (SDGs) that aim to end poverty and global inequality while tackling climate change.

		December. The Museum of Tomorrow (Rio de Janeiro) formally opened. The museum is structured around 5 existential questions. The Anthropocene provides the focus for section 3, 'where are we?'. Rather than objects, the museum centres around immersive and interactive experiences.				**November-December. COP21, Paris**. The Parties agreed on a legally binding treaty—the Paris Agreement—to reduce emissions and limit global warming to well below 2ºC, with a target of 1.5ºC warming compared to pre-industrial levels. It provides a key legal framework for net zero.
2016	**June-September. *Climate Control*, Manchester Museum**. The exhibition was divided into 'Explore the Past' and 'Explore the Future', containing a mix of objects, interactive experiences, question prompts. Along the central wall, visitors could share their ideas and perspectives.	**July. GroundWork Gallery was opened in King's Lynn (Norfolk) under the directorship of Veronica Sekules**. It is dedicated to exhibiting contemporary art that engages with nature, the environment and the changing planet.		**2016 surpassed 2015 as the warmest year on record**.		
	July-present. Six new galleries were opened at the National Museum of Scotland (Edinburgh). One of these, *Energise*, explores the past and future of energy generation in Scotland. It highlight's the country's rich potential for sustainable forms of energy.	**October. Culture Unstained was founded** by Chris Garrard and Jess Worth. It is a UK-based campaign organisation that aims to end fossil fuel sponsorship in the arts and culture sector.				

2017	**October-April 2018.** ***We Are Nature: Living in the Anthropocene*****, Carnegie Museum of Natural History (Pittsburgh)**. Using specimens and other objects in the collection, the exhibition explored the impact of humankind on the Earth and other species. It formed part of the Museum's embrace of the Anthropocene concept as a major strategic theme.	**The Coalition of Museums for Climate Justice was founded** in Canada that support museums to advocate for climate and environmental justice.				**June. Donald Trump announced that he would remove the USA from the Paris Agreement**.
						November. COP23, Bonn. The first COP to be presided over a small island developing state: Fiji. The Parties launched the Talanoa Dialogue: an international process of conversation around how to achieve the Paris Agreement.

2018	**April.** ***Pollution Pods*** **by Michael Pinsky, Somerset House (London) (travelling)**. An installation of domes that simulated the air pollution from London, Beijing, São Paulo, New Delhi and Tautra (Norway).	**The Climate Heritage Network was founded** during the Global Climate Action Summit. It works to mobilise and support the culture and heritage sector to contribute to the Paris Agreement and support communities' transition towards sustainability.	**October. The IPCC released its Special Report on Global Warming of 1.5ºC**. It was initiated by the Paris Agreement to explore possible impacts of 1.5ºC warming and to recommend emissions reduction pathways.	**February-March. The Beast from the East**, which was a prolonged period of freezing temperatures and widespread heavy snowfall across the UK and Ireland.	**August. The 15-year-old Greta Thunberg went on her first school strike** outside the Swedish parliament during Sweden's hottest ever summer. At first her strike was daily, before she switched to Fridays, instigating the Fridays for Future movement.	
	April. ***International Symposium on Climate Change and Museums*****, University of Manchester**. The dialogue from the symposium formed the basis of a submission to the Talanoa Dialogue from the museum sector.			**June-August. European drought and heatwave**. A period of very hot weather that resulted in record-breaking temperatures and wildfires across Europe.	**October. The Launch of the 'Declaration of Rebellion'** outside the UK parliament by Extinction Rebellion (XR).	
	June. ***Made from Light: The Art and Science of Renewable Energy*****, Tate Liverpool**. A series of talks and workshops that delved into the art, science and history of renewable energy.				**November. 'Rebellion Day'**. XR protesters blocked 5 bridges in central London, aiming to bring the capital to a standstill.	

	December-December 2020. *Heritage Futures*, Manchester Museum. An exhibition that culminated from the Heritage Futures research project. It explored the relationship between heritage, waste and loss on a changing planet.					
	***General Ecology*, Serpentine (London)**. A long-term, ongoing project of research into complexity, more-than-humanism, climate justice and environmental balance.					
2019	**June-August. *Beat Plastic Pollution*, Horniman Museum (London)**. A pop-up display in the Horniman's Aquarium wherein single-use plastic was inserted into the water tanks, highlighting how plastic pollution is a major threat to marine life.	**Curating Tomorrow was established by Henry McGhie** as a UK-based consultancy for museums, culture and heritage, providing resources and advice to support climate action and nurture human rights under the blueprint of UN frameworks.	**August. The IPCC released a Special Report on Climate Change and Land**. One of its findings was that shifting to plant-based diets could contribute drastically to mitigating and adapting to climate change.	**Late 2019-early 2020. Black Summer, Australia**. An intense and devastating bushfire season that lasted across the summer months in Australia. 33 people were killed, thousands of homes were destroyed and millions of hectares were ravaged by fire.	**March. Global Strike for Climate**. Over 1 million school students around the world went on strike in a coordinated day of protest on 15 March.	**May. The UK Government declared an environmental and climate emergency**, being the world's first national parliament to do so. Declaring an emergency was one of the key demands of XR, and followed in the wake of many towns and cities making declarations.

	June-September. *Fragile Earth: Seeds, Weeds, Plastic Crust*. Middlesbrough Institute of Modern Art. An exhibition of artworks from the 1970s to the present day exploring the relationship between humans, plants and animals in a time of planetary change.	**December. Climate Museum UK was registered as a Community Interest Company**. Founded by Bridget McKenzie, it is a distributed network of creative practitioners that work together as an experimental museum.		**In 2019 alone, enough ice melted in Greenland to raise the average global sea level by over a millimetre**. The region experienced record-breaking temperatures and subsequent loss of ice.	**April. Culture Declares Emergency was founded**. Managed in the UK, it is an international network of cultural organisations and practitioners that take action after first declaring a climate and ecological emergency.	**June. The amendment to the UK's Climate Change Act** means that the nation, by law, must bring emissions to net zero by 2050 (a reduction of 100% compared to 1990 levels). The policy framework to achieve this is called 'Build Back Better'.
	July-September. *Inheriting the Anthropocene*, Manchester Museum. An installation co-curated with the Museum's 'Young Adventurers', engaging them to respond to the Anthropocene concept.				**April. XR protests shut down London**, starting on 15 April, when activists blocked roads at Marble Arch. They went on to occupy many sites in central London. Their 3 key demands to the UK Government: declare an emergency, commit to net zero by 2050 and create a citizens' assembly.	
	August-November. *Polly Higgins* XR Boat, National Maritime Museum. One of the boats used by XR protesters was loaned to the Museum to be displayed outside the building.				**April. XR staged a die-in at the Natural History Museum** to raise awareness about the threat of mass extinction.	

	September. V&A Friday Late: ***Anthropocene***. An event featuring talks and workshops that examined the Anthropocene concept and the way that it is being addressed in art and design.					
	September. XR Takeover day at Oxford University Museum of Natural History. A day of activities organised in collaboration with XR Oxford.					
	October. ***Sustainable and Ethical Museums in a Globalised World*****, Museums Association conference**, which explored the climate crisis as its central theme. The decision to do this was prompted by the Museum Association's pledge of support for Culture Declares.					
	November-January 2020. ***Meltdown: Visualising Climate Change***. An exhibition of works that explored the importance of the cryosphere while also documenting the world's vanishing glaciers.					

	November-February 2020. ***Eco-Visionaries: Confronting a Planet in a State of Emergency*****, Royal Academy of Arts (London)**. An exhibition of works that explored how architecture, art and design are adapting themselves to address the changing planet.					
2020	**October-February 2021.** ***Arctic: Culture and Climate*****, British Museum (London)**. An exhibition that explored the history, culture, perspectives, experiences and resilience of Arctic Peoples, especially in the face of environmental and climatic upheaval.	**June. Klimahuset (Climate House) opened as part of the University of Oslo's Natural History Museum**. It is an exhibition space dedicated to shows and events that engage with the climate and environment.		**The Covid-19 pandemic brought the world to a standstill**. As a virus that was spread to humans as a result of their encroachment of animals' habitats, it was emblematic of the problematic relationship between humans and their environment.	**May. Police in Minneapolis murdered George Floyd, which sparked worldwide protests in support of Black Lives Matter**. The movement triggered public dialogue around systemic racism and racial injustice, which fed into discourse on climate injustice.	**April. The COP Bureau of the UNFCCC announced the postponement of COP26 to 2021**.

2021	**May-August 2022. *Our Broken Planet: How We Got Here and Ways to Fix It*, Natural History Museum**. An exhibition in which the Museum collections, through the voices of Museum scientists, are harnessed as evidence of humans transforming every aspect of the planet. But they also revealed how the natural world offers solutions.		**August. The IPCC released Working Group 1's contribution to the sixth assessment report**, concerning the scientific evidence of changes taking place across planetary systems.	**May. Museums reopened after Covid Lockdowns**. Following the UK Government's roadmap to ease restrictions, museums were legally permitted to reopen from 17 May.	**August. XR activists held an overnight sit-in at the Science Museum** in protest against *Our Future Planet* being sponsored by Shell.	**October-November. COP26, Glasgow**. After being delayed by Covid-19, the UK Government hosted COP26 in partnership with Italy. Parties agreed on the Paris Rulebook, which supplies guidelines on delivering the Paris Agreement.
	May-May 2022. *Meat the Future*, Oxford University Museum of Natural History. An exhibition on the environmental and health impacts of eating meat, exploring alternative diets on a changing planet.			**August. Wildfires in Greece**. Multiple wildfires across Greece killed 3 people and burned dozens of homes after a historic heatwave for the country, with the highest temperatures reaching 47ºC.		
	May-September 2022. *Our Future Planet*, Science Museum. The first major exhibition in the UK to spotlight carbon capture and advocate for its activities as legitimate and viable approaches to mitigating climate change (drawing on IPCC model pathways).			**2020 tied with 2016 as the hottest years on record.**		

	May-present. *Our Changing Planet*, Thinktank (Birmingham). A gallery that examines history through the lens of the Anthropocene, bringing together diverse objects spanning 10,000 years of humans transforming their environment.					
	June-November. *Reimagining Museums for Climate Action*, Glasgow Science Centre. An exhibition developed by the Museums for Climate Action team as a contribution to the COP26 Green Zone. Through 8 'concepts', it speculated how museums of the future could take radical climate action.					
	July-September. *Seedscapes: Future-Proofing Nature*, Royal Albert Memorial Museum (Exeter). An exhibition in which five contemporary artists responded to the rapid decline in plant diversity, highlighting efforts to save plants from extinction.					

	July-December. ***A World of Good*****, Wakefield Museum**. An exhibition of sculpture, sound and video inspired by the work of 19th-century environmentalist Charles Waterton, who created the world's first nature reserve from his home.					
	September-March 2022. ***Scotland's Climate Challenge*****, National Museum of Scotland**. An exhibition that spotlighted the work of scientists and engineers in Scotland who are studying the impacts of climate change and developing solutions to help reach net zero.					
	October-February 2022. ***We Are History: Race, Colonialism and Climate Change*****, Somerset House**. An exhibition that spotlighted artists with connections to Africa, South America and the Caribbean which underlined the intersections between climate change, colonialism and systemic racism.					

	October-February 2022. ***Waste Age: What Can Design Do?*****, Design Museum**. An exhibition that showcased the work of designers who draw on the ideal of the circular economy and reimagine the role of waste in the production of fashion, food, electronics, construction and packaging.					
	November. The Royal Ontario Museum appointed its inaugural Curator of Climate Change: Soren Brothers.					
2022	**January. Jenny Newell assumed the role of Curator of Climate Change at the Australian Museum on the opening of its Climate Solutions Centre.**		**February. The IPCC released Working Group 2's contribution to the sixth assessment report**, concerning the impacts of climate change, the vulnerability of natural and man-made systems, and efforts to adapt.	**March. Heatwave in India and Pakistan**, with record high temperatures reaching up to 49.5ºC.	**February. Just Stop Oil was founded**. They are an activist group who carry out high-profile acts of civil disobedience with the aim to stop the UK approving new fossil fuel projects.	

	February-present. *Climate Justice*, Manchester Art Gallery. The second gallery in the institution to be redisplayed to harness historic and contemporary artworks to address the big issues of today. The curators worked alongside activists and artists to engage with the subject of climate justice and the colonial history of climate change.		**September. The IPCC released Working Group 3's contribution to the sixth assessment report**, concerning climate change mitigation and target sectors for emissions reductions and decarbonisation.	**June-August. European heatwaves**. Persistent heatwaves across areas of Europe caused evacuations, droughts, fires and heat-related deaths. In the UK, temperatures surpassing 40ºC were recorded for the first time.	**October. Just Stop Oil activists threw tins of tomato soup over Van Gogh's *Sunflowers* in the National Gallery**. Gluing themselves to the wall beside the painting, they asked, 'what is worth more, art or life?'	
	March-August. *Rooted Beings*, Wellcome Collection (London). Through art commissions, specimens and historic works, the exhibition foregrounded the importance of plants and fungi for human and planetary health.					
	March. *Museums and Galleries Responding to the Climate and Ecological Crisis* conference convened by the National Museum Directors' Council at the Whitworth, Manchester.					

	March-September. ***Butterflies Through Time*****, Cambridge University Museum of Zoology**. A display of butterfly specimens spanning 200 years of collecting that demonstrated how species have responded and adapted to their shifting environment.					
	May-August. ***Our Time on Earth*****, Barbican**. An exhibition of multimedia artworks that brought together diverse perspectives on the changing planet, offering multiple visions for sustainable futures.					
	May-September. ***Radical Landscapes*****, Tate Liverpool**. An exhibition that showcased British landscape art, exploring how artists and activists have engaged with landscapes as sources of inspiration and sites of radical action.					
	May-October. ***In the Air*****, Wellcome Collection**. An exhibition of contemporary artworks and historic objects that explored the history of human relationships with the air and the fight against air pollution.					

	June-September. *Once Upon a Planet*, Tullie House (Carlisle). An exhibition project that brought together Tullie House's historic Natural Sciences collections with interactives to examine human impacts on plants, animals and habitats.					
	June-September. *Back to Earth*, Serpentine. A multi-site exhibition of artistic responses to the changing planet, offering perspectives from around the world.					
	July-November. *Waste Land*, Oxford Museum of Natural History. An exhibition of the aerial photography of J. Henry Fair which visualised the devastating environmental impacts of waste and industrial pollution on landscapes.					
	July-present. The Museums Association launched its ongoing campaign: *Museums for Climate Justice*. It advocates for museums to engage with the climate emergency through the lens of social justice, providing resources and examples of good practice.					

	October-April 2023. *Landscape Rebels*, Christchurch Mansion (Ipswich). Bringing together historic and contemporary artworks and objects, the exhibition explored how people in Suffolk have documented and responded to their changing environment.					
	October. The Sainsbury Centre (Norwich) appointed its inaugural Curator of Art and Climate Change: John Kenneth Paranada.					
2023	**February-May. *Earth Spells: Witches of the Anthropocene*. Royal Albert Memorial Museum**. An exhibition of works by 8 contemporary artists that examined the spiritual and otherworldly resonances of the Anthropocene through the lens of contemporary witchcraft.					
	February-October. *Connected Planet*, Oxford University Museum of Natural History. An exhibition that examined the interconnections and mutual-co-existence between the different systems that maintain the Earth.			**2023 overtook 2016 and 2020 as the hottest year on record.**		**November-December. COP28, Dubai**. For the first time, Parties to the UNFCCC agreed explicitly to 'transition away' from fossil fuels, calling for the 'beginning of the end' of fossil fuels.

	June-September. *Dear Earth: Art and Hope in a Time of Crisis*, Hayward Gallery (London). With contributions from 15 contemporary artists, the exhibition showcased artworks that seek to reimagine humankind's relationship with the Earth, united by a focus on practices and ideas of 'care'.			**February-January 2024 was the first 12-month period to exceed an average warming of 1.5ºC.**		
	July-March 2024. *How to Build a Low-Carbon Home*, Design Museum. An exhibition that foregrounded the work of architects in repurposing familiar materials—stone, wood and straw—to design sustainable homes nad buildings.					
	July-December. *Carbon Ruins*, Manchester Museum. An exhibition that imagined how people in 2050—when net zero has been achieved—would look back on their past and make sense of the changes that led to the decarbonisation of society. Objects were selected in collaboration with schools and students.					

	July-December. ***Museum of Climate Hope*****, Oxford University Museums**. A digital trail across Oxford's Gardens, Libraries and Museums that highlighted objects and stories across the sites that speak to the changing planet. They were selected to represent themes of transformation, innovation and resilience.					
	August-March 2024. ***Rising Tide: Art and Environment in Oceania*****, National Museum of Scotland**. An exhibition that drew attention to the perspectives of Indigenous Australian and Pacific Island communities and artists, showcasing their resilience and responses to the changing planet.					
	September-March 2024. ***Planet For Our Future: How Do We Adapt to a Transforming World*****, Sainsbury Centre (Norwich)**. The gallery's inaugural season where it harnesses art to address a big societal question. It featured the exhibitions *The Stuff of Life	The Life of Stuff* and *Sediment Spirit: The Activation of Art in the Anthropocene*.					

	September. The Fixing Our Broken Planet: Community of Practice was launched by the Natural History Museum. This is a UK network of museum, heritage and cultural practitioners who meet to discuss and share case studies of practice.					
	October. The First Museum COP, organised by the NMDC and hosted by Tate Modern. Representatives from UK museums, funders and cultural organisations met to form an agreement on how the sector should approach decarbonisation and what action it should take to mitigate the climate and ecological crises.					
	October-January 2024. ***Re/Sisters: A Lens on Gender and Ecology*****, Barbican**. An exhibition of artworks that critiqued the changing planet through the radical philosophical lens of ecofeminism.					

	October-January 2024. ***Storm Warning: What Does Climate Change Mean for Coastal Communities?*****, Focal Point Gallery (Southend) and Newlyn Art Gallery & The Exchange (Penzance)**. A collaborative exhibition project that invited artists to explore the impacts and responses to climate change amongst coastal communities in Essex and Cornwall.					
	December. ***Collecting Sustainable Technology*** **symposium, National Museum of Scotland**. A conference for museum and cultural practitioners to share examples of practice in collecting around the changing planet, exploring the challenges and opportunities in such work.					
2024	**March-April 2025.** ***Planet Ocean*****, The Box (Plymouth)**. An exhibition that highlighted Plymouth's contribution to global marine research that is shaping climate policy. It explored the entanglement of human life, society and culture with the ocean.					

	March-present. *Energy Revolution: The Adani Green Energy Gallery*, Science Museum. Replacing *Atmosphere*, this gallery analyses the past, present and future of energy systems and showcases technologies from around the world that are working together to achieve decarbonisation across energy generation, energy storage, construction and transport.		**March. The SQS voted against the designation of our current geological epoch as the Anthropocene**. While they will not use it in an official stratigraphic capacity, the SQS recognised that the Anthropocene is a valuable term to employ in other contexts.	**2024 surpassed 2023 as the hottest year on record.**	**July. Just Stop Oil activists received the longest ever sentences in the UK for nonviolent protest**. They were found guilty of conspiring to cause gridlock on the M25, and received prison sentences of 4-5 years.	
	July-October. *A World of Care: Turner and the Environment*, Turner's House (Twickenham). An exhibition that re-examined Turner's art with a lens on the socio-environmental changes that he was bearing witness to.			**Most days in 2024 exceeded 1.5ºC warming.**		
	June-June 2025. *Wild*, Manchester Museum. An exhibition that brought natural history collections together with artworks, audio, film and interactives to examine humankind's understanding of 'wildness' and highlighting stories of action to rebuild and repair relationships with nature.					

	July-July 2026. *Steam to Green: A North East Energy Revolution*, Discovery Museum (Newcastle). An exhibition that focuses on the contribution of scientists, engineers, technologies and industries in the North East that are working towards the decarbonisation of energy systems.					
	November. *Contemporary Collecting and Sustainable Technologies* symposium, National Museum of Scotland. An online seminar delving into three case studies of practice in collecting and interpreting stories of the changing planet, with a particular focus on decolonisation and the energy transition.					
	November-March 2025. *Waters Rising*, Perth Museum. An exhibition that spotlighted stories of flooding from Scotland and across the globe. The project created a community sourced collection of photographs and accounts of lived experiences of flooding.					

	November-May 2025. ***Vital Signs: Another World is Possible*****, Science Gallery London**. An exhibition of artworks that explored how human survival, health and wellbeing is underpinned by the health and wellbeing of planetary systems and other species on Earth.					
2025	**January-April.** ***Soil: The World at Our Feet*****, Somerset House**. An exhibition that united multiple perspectives—including artists, writers, gardeners and scientists—to highlight the hidden beauty and importance of soil in sustaining human and planetary health.					
	February-April. ***The Shape of Things: Our Place in a Changing Climate*****, Penlee House Gallery and Museum (Cornwall)**. A community-curated exhibition of historic artworks and photography wherein local environmental groups selected and interpreted works in ways that speak to the impacts of climate change in Cornwall.					

	March-October, *Can the Seas Survive Us?*, Sainsbury Centre. A season at the art museum that draws attention to the power of the oceans over human lives and imaginations and asks what needs to be done to restore health to the seas. It featured the exhibitions *A World of Water, Yuki Kihara: Darwin in Paradise Camp* and *Sea Inside*.					
	April. *Fixing Our Broken Planet*, Natural History Museum. A gallery that spotlights the Museum's natural collections and the work of its scientists, exploring the changing planet and advocating for solutions through the themes of energy, health, materials and food.					
	June. *Climate Justice* Late Event, Pitt Rivers Museum (Oxford). An evening of film screenings and panel discussions centred around the justice issues of climate change and biodiversity loss.					

	July-October. ***More Than Human*****, Design Museum**. An exhibition that spotlights art, architecture and design that engage with 'more-than-human' perspectives, decentring humans as the primary beneficiaries of design.					
	July-January 2026. ***Future of Food*****, Science Museum**. An exhibition exploring the past, present and future of food systems. It adopts a dual focus on 'ecological' and 'engineered' approaches, highlighting the innovations taking place across both to make food production and consumption more sustainable.					
	July-ongoing. ***Carbon Garden*****, Royal Botanic Gardens, Kew (Surrey)**. A permanent garden that is designed to be resilient to the changing climate, which accentuates the crucial role of plants and fungi in carbon sequestration.					

Appendix B

Statement of Ethical Approval

All interviews undertaken for this research were reviewed by the UEA's Research Ethics Body and approved by the HUM Ethics Committee (S-REC). The application ID from Ethics Monitor for this project (following amendments) is: ETH2425-1924.

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