PARADIGM SHIFT TO ILLUMINATE THIS DISRUPTED PLANET

Emlyn Koster, PhD

Emlyn Koster is an adjunct professor in Marine, Earth and Atmospheric Sciences at North Carolina State University, has been at the helm of the Royal Tyrrell Museum of Paleontology, Ontario Science Centre, Liberty Science Center, and North Carolina Museum of Natural Sciences, and was the inaugural chair of ICOM's working group on the Anthropocene for natural history museums.
koster.emlyn@gmail.com

Resembling the form-follows-function approach in architectural and industrial design, a paradigm shift refers to a change in an organization's practices in response to a change in its surrounding circumstances. Ideally, the cause and consequence of each shift are widely shared because they are potential turning points in the organization's culture and relevance. However, consensus and momentum are demanding pursuits and may prove elusive.

Regarding the whirlwind of history in 2020, environmental and societal activist Arundhati Roy observed, "Historically, pandemics have forced humans to break with the past and imagine their world anew. This one is no different. It is a portal, a gateway between one world and the next."[1] The FrameWorks Institute, a social-action think tank, opined, "Creating progressive social change is not like marketing a product.... It's about understanding problems. It's about seeing solutions. It's about building a will to support those solutions."[2] A cultural strategist advised: "On a tactical level, museums – and the cultural sector in general – need to advocate more effectively for their own relevance, not only in lofty rhetoric but in the language of facts."[3] This trio of statements provides the context for this article.

A century ago, John Cotton Dana urged museums to align with the needs of their communities.[4] My journey as a geologist, museologist, and humanist has informed a major application of Dana's advocacy. Now is the time for museums – with their singular attributes and much greater potential – to not only publicly minimize their carbon footprints, which has begun to occur, but through a fresh approach to changing exhibitions to concertedly illuminate the environmental and societal crises shaping a perilous future for the Earth and all life.[5]

Relevance

The following brief examples are reminders of the museum sector's appetite – sometimes thwarted by unforeseen hurdles – for paradigm shifts aimed at greater external relevance. During World War II, a presentation at the 1942 AAM Annual Meeting expressed the challenge of responding to societal change: "The very subject of our discussion shows the painful anxiety and uncertainty with which we search for our proper function in the national struggle for a better future."[6] And yet the museum sector's heightened search for relevance, inspired by such international crises as world wars or the Great Depression, often faded when the crisis passed. As

museum commentator Marjorie Schwarzer noted, "When the funds began to flow again, museums quickly forgot the shock of the Depression as well as their moments of innovation on behalf of the public.... An opportunity to be societal role models for the wisest possible use of resources and talent was lost."[7] Sixty years ago, the director of the American Museum of Natural History noted, "The natural history museum has reached a stage in the evolution of its relationship with society when the generally prevailing opportunistic vagueness of intentions is becoming a liability."[8] Three decades ago and creatively using a "trouble in paradise" metaphor, an AAM article by Robert Sullivan, an associate director at the National Museum of Natural History, called for a replacement of traditionally separate galleries for different animal groups by explanations of ecosystems to convey a holistic view of nature.[9] This stance underscored the declaration from a 2012 national convening at the Smithsonian Institution which began, "Humanity is embedded in nature and we are at a critical moment in the continuity of time."[10] The daunting challenge of a worldwide paradigm shift is illustrated by the efforts of ICOM to update its mission statement for the sector. Vigorous debate at its 2020 General Assembly in Kyoto prompted an article in *TIME* which began, "At the heart of the matter is an attempt to outline exactly what a contribution to broader society could look like for museums today."[11]

Paradigm shifts are key steps in the pursuit of relevance, an often used but seldom defined word that means relating to the matter at hand. Having assembled 88 thought-provoking essays from two decades or so, museum practitioner Gail Anderson described the "reinvention" of museums as an "evolving paradigm shift."[12] Between her two editions and in his last article, Stephen Weil, the Smithsonian's emeritus scholar, lamented, "The awkward matter remains that, for a variety of reasons, the museum field has never agreed – and until recently, has scarcely even sought to agree – on some standard by which the relative worthiness of its constituent member institutions might be measured."[13] Robert Janes, a Canadian commentator on the pulse of museums, expressed a similar view: "The majority of museums, as social institutions, have largely eschewed on moral grounds, a broader commitment to the world in which they operate."[14] Jane Neilsen, a museologist based in the United Kingdom, concurred that the concept of relevance has rarely been defined.[15]

In several articles published between 2011 and 2015, the sector pondered whether museums should be "just nice" or "necessary."[16] However, in the face of 2020's crises, this reflection may already be passé. As the COVID-19 pandemic spread, the vexing question as to which museum staff positions are essential and which are nonessential also surfaced.[17] Shock over the televised brutal murder of George Floyd by police renewed outcries from near and far against racial injustice. The AAM intensified its attention to diversity, equity, accessibility, and inclusion. Existential crisis became a popular phrase, a term describing both moments when individuals question their sense of purpose and when social norms are disrupted. Time will tell if and how reopened museums that define success as the reestablishment of their pre-pandemic persona will survive.

Framework

As our experience with hurricanes has clearly shown, the naming of an

imminent grave danger is invaluable for public education, warning, and memory purposes. This logic equally applies to the 'Anthropocene,' which was proposed in 2002 as an addition to the Geologic Timescale. This term (pronounced anthro-po-cene; anthropo, as in anthropology, meaning human and cene, as in Pleistocene, meaning a period in Earth history) was coined to draw attention to "a new phase in both humankind and of the Earth, when natural forces and human forces become intertwined so that the fate of one determines the fate of the other."[18] This new term recognizes a dreadful truth: that humanity, a uniquely remarkable species, has ecologically detached itself in a geological nanosecond from the environment and the rest of life with which we originated, in turn endangering the future of both.

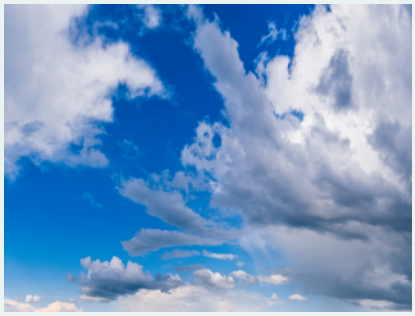
This warning soon turned into an alarm. "A growing body of evidence," cites a 2015 report by the Rockefeller Foundation-Lancet Commission on Planetary Health, "shows that the health of humanity is intrinsically linked to the health of the environment, but by its actions humanity now threatens to destabilize the Earth's key life-support systems."[19] As several medical professionals have recently pointed out, "the challenge posed by this conjunction is essential if we are to devise effective and equitable strategies to protect and improve health."[20] In 2014, proponents of The Anthropocene Project, dedicated to building awareness about humanity's impact on the Earth, aspired to the term becoming a household word.[21] And scholars in the environmental humanities have framed the scope of this challenge:[22] from Loyola University, "Debated, denied, unheard of, encompassing, the Anthropocene is a vexed topic and requires interdisciplinary imagination;"[23] and from Princeton University, "Can the grand Anthropocene story, which highlights humanity as an exceptional actor in planetary morphology, help provoke a greater sense of human responsibility?"[24]

Although the Anthropocene term was embraced by editorials and articles in several principal newspapers and magazines a decade ago, it has yet to be adopted by popular culture as have other Geologic Timescale terms like Cretaceous and Jurassic. Also, its use has yet to be formalized by the International Union of Geological Sciences. It is however firmly entrenched as transdisciplinary shorthand for humanity's exponential disruption of the Earth System since the mid-20th century.[25] There have been scientific journals titled *Anthropocene* and *The Anthropocene Review* since 2013 and 2014, respectively, and a public subscription magazine titled *Anthropocene, Innovation in the Human Age* began in 2016. Also in 2016, the Anthropocene was added to a pocket-book series with over 550 summarized topics.[26] In March 2020, the *Journal of Museum Education* had a thematic issue titled *"The Climate is Changing. Why Aren't Museums?"* with this optimistic opening statement: "Humans have driven the planet and its systems past the point of return, but we can slow the rate of change."[27]

Increasingly referred to as the climate crisis or climate emergency, climate change has, to date, been almost the only aspect of the Anthropocene illuminated by museums. As is evident from Figure 1 though, climate change is only one of a myriad anthropogenic changes to the Earth System. Museums have tended to avoid difficult contemporary subjects, but to avoid the perilous human disruption of the Earth System – a fundamental term that refers to this planet's

Fig. 1. Between the air we breathe and the ground beneath our feet, the Earth System is a naturally evolved giant ecosystem composed of concentric shells, as summarized here. Since the mid-20th century, the interdependent processes of these shells have been increasingly disrupted by human activities. Scientists refer to the trends as the Great Acceleration and the cumulative results as the Anthropocene. Any of the impacts listed in this summary could become topics for museum exhibitions and programs to illuminate the linked environmental and societal impacts of humanity's unecological course that imperil the future for all.

Anthropogenic Changes to the Earth System and Potential Topics for Museum Exhibitions



Atmosphere

NATURAL FEATURES

Includes the troposphere, the lower most layer up to the elevation where jet planes fly and which contains weather systems and habitats for air-breathing life and photosynthesis.

HUMAN IMPACTS

- ☐ Widespread and locally severe pollution
- ☐ Overall warming due to burning of fossil fuels
- ☐ Hurricane intensification and other extreme weather causing floods, wildfires, and droughts
- ☐ Altered averages of season length, temperature, and precipitation patterns

Hydrosphere

NATURAL FEATURES

Oceans and seas contain 96.5 percent of the world's water. The remaining 3.5 percent is fresh water in ice sheets and glaciers or in lakes, rivers, and groundwater which provides all drinking water (except from desalination plants in arid coastal regions).

HUMAN IMPACTS

- ☐ Widespread and locally severe pollution
- ☐ Ocean warming
- ☐ Reduction of year-round Arctic and Antarctic sea ice
- ☐ Ecosystem shifts
- ☐ River flow disruptions
- ☐ Ubiquitous plastic debris
- ☐ Global sea-level rise due mainly to melting ice sheets, ice caps and glaciers, locally exacerbated by coastal subsidence

Cryosphere

NATURAL FEATURES

Subset of the hydrosphere encompassing all frozen areas, including those with permafrost ground and those covered by glacial ice. The Antarctica ice sheet and Greenland ice cap contain the equivalents of approximately 190 and 25 feet of worldwide sea-level rise.

HUMAN IMPACTS

- ☐ Melting of permafrost with methane emissions
- ☐ Accelerated melting of glacial ice, often a vital source to river flow and water for piedmont communities and agriculture

Biosphere

NATURAL FEATURES

Life-supporting habitats on, just below, and above land and ocean surfaces, including the virosphere (which is the world of virus diversity, such as COVID-19). Biodiversity refers to the intricate totality of evolved animal and plant life. Only about a quarter of the estimated 8.7 million species have been identified and described.

HUMAN IMPACTS

- ☐ Widespread and locally severe pollution
- ☐ Disruptions of ecosystems and food chains
- ☐ Trophy hunting
- ☐ Overfishing
- ☐ Coral reef bleaching
- ☐ Sharply reduced biodiversity in all major faunal and floral groups, including invasive species and extinctions

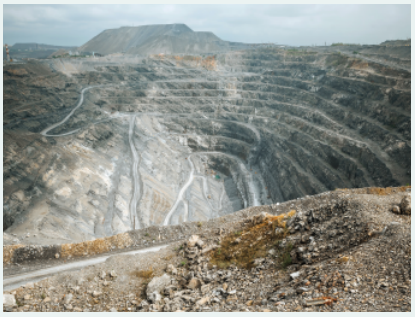
Humanosphere

FEATURES

Subset of the biosphere referring to all areas inhabited by us, *Homo sapiens*, the predominant species whose adverse impacts have disrupted all other shells of the Earth System. Human population is approaching eight billion: it took over two million years to reach one billion and only 200 years more to reach seven billion.

CHANGES

- ☐ Marginalization of surviving indigenous peoples
- ☐ Differentiation of society into affluence and poverty
- ☐ Systemic racism
- ☐ Wars and asylum seeking
- ☐ Climate refugees
- ☐ Nativism
- ☐ Existential crises including widespread detachment from the natural world



Lithosphere

NATURAL FEATURES

Crustal layer in which plate tectonics and seafloor spreading occur, volcanic activity and earthquakes originate, and where mining occurs. The pedosphere is its widespread thin surface layer of agriculture-enabling soil. Another subset, the archeosphere, is a proposed term for the altered and highly varied surface layer of the lithosphere containing evidence of historic and current human activities.

HUMAN IMPACTS

- ☐ Burial of radioactive waste
- ☐ Pollution of groundwater
- ☐ Alteration of aquifers
- ☐ Impacts of hydraulic fracturing for enhanced recovery of hydrocarbons
- ☐ Predicted imminence of "peak oil" which refers to the maximum rate of global production from remaining reserves

concentric atmosphere-to-subsurface shells – is surely irresponsible. Another hurdle to a fulsome Anthropocene approach is the concept of sustainability. It became popular three decades ago in a sustainable development context of safeguarding the resource needs of future generations.[28] However, because the Earth's carrying capacity either has been or is about to be exceeded, the traditional notion of sustainability looms as an overly ambitious pillar of ICOM's vision which is tied to the UN's Sustainable Development Goals.[29]

Exhibitions

Several reasons render conventional temporary and permanent approaches to exhibitions as generally unsuitable for the enormous, urgent, multifaceted, and evolving scope of the Anthropocene. Foremost, this future-encompassing subject is too vital to be left to marketplace whims and featured sporadically. Second, with museums traditionally sourcing their exhibitions from collections, specimens, and artifacts to illuminate the future-focused Anthropocene may not exist. Third, to only address climate change ignores the numerous interrelated dynamics of the Earth System.

All temporary and with Anthropocene in their title, to date there have just been a few exhibitions in nature and science museums and about a dozen in art museums. Each provides an angle of inspiration for the concerted journey of the museum sector.

Faced with the daunting challenge of exhibiting the Anthropocene, in 2014 the University of Wisconsin at Madison hosted a slam of artists, activists, humanists, and scientists to consider which objects would best exhibit this subject.[30] This experience informed the pioneering 2014–16 exhibition *Welcome to the Anthropocene, The Earth in Our Hands* at Germany's Deutsches Museum in cooperation with its Rachel Carson Center for Environment and Society.[31] In turn, this led to the 2016 *Stories of the Anthropocene Festival* at Stockholm's Environmental Humanities Laboratory, which challenged participants to imagine how to engage a diverse audience.[32] Other exhibitions were *Objectif Terre, Vivre l'Anthropocène* (Objective Earth: Living in the Anthropocene) at the Musée de la nature du Valais in Switzerland in 2016–17 and *We are Nature, Living in the Anthropocene* at the Carnegie Museum of Natural History in 2017–18. Those involved with the Pittsburgh and Valais exhibitions opine that the Anthropocene "provides a conceptual framework that traces historical causes, possible futures, and fundamental questions of human responsibility, values and purpose in a changing world."[33]

Art museum pioneers with Anthropocene exhibitions, also all temporary, were the Art Gallery of Ontario and the National Gallery of Canada in 2018 as the initial partners of The Anthropocene Project, a rentable multimedia art, photography, film, virtual reality, and augmented reality spectacle about humanity's alterations of the Earth's surface.[34] In pondering whether art can spur appreciation of nature, journalist Alina Tugend cited efforts by several galleries around the United States.[35] Other examples of exhibits about the Anthropocene include those at the A. Alfred Taubman Gallery at the University of Michigan; Bates College Museum of Art in Maine; Hart Museum of Art at the University of Florida; South Carolina Academy of Design in Savannah; and Art Gallery of Windsor in Ontario. A best-of-2019 feature about art museums in

New York City began with this emphatic comment: "Culture, like climate, demands assessment at a global scale – and if art has any objective in the Anthropocene, it's to dissolve our ecocidal self-absorption and find our reflections in the lives of those unlike us."[36]

To build on these forerunners, we need to think differently about how exhibitions are developed for clear return-on-investment outcomes specific to the needs of the Anthropocene. "The longer I work in museums, the more I feel that most exhibition development is stuck in the old and the tried – and the tired," remarked museum practitioner Kathleen McLean in the 2004 book she co-edited, *Are we there Yet? Conversations about Best Practices in Exhibition Development*. "Real innovation tends to appear sporadically and in very small doses."[37] The Anthropocene demands our attention – and exhibits that can be done nimbly, with clarity, and, if necessary, without collections. This begs the questions: Are large-scale exhibition designs that incorporate sophisticated interactive technologies with high costs and lengthy timelines, the norm for many large museums, the best way to be nimble? Are dense configurations of multimedia, interpretive panels, objects, and interactives, accompanied by dense, hierarchical information, the best way to convey key messages quickly and with impact? Are collections really necessary to tell a story that must be told at the peril of our own survival?

For nature and science museums in particular, which often fill their temporary exhibition spaces with pricey traveling shows that may or may not be closely related to mission, probably the quickest and most message-efficient way to engage society in the Anthropocene is to redeploy those spaces into changing, expo-like experiences with clearly conveyed aims reinforced by online and programmatic resources. Figure 1 serves as a checklist of Anthropocene themes and topics. Tied to local, regional and/or global issues, each could provide a topical angle for a museum's marketing and communications as well as pave the way for a reinforcing renewal sequence in permanent galleries repurposed into changing exhibits on the Anthropocene.

Instead of relying on collections or perhaps by only using iconic objects, these expositions could be comprised of themed audiovisual and digital multimedia experiences that aim to straightforwardly capture the senses,[38] an approach that has been shown to source long-lasting memories with considerable impact.[39] Promotion for the Global Association for the Attractions Industry's 2020 conference declared, "Immersive technology is one of the most exciting, and continuously evolving sectors within the attractions industry, as it continues to shape and refine the guest experience."

An example of a gallery-scale experience more expo-like than museum-like is Iceland's acclaimed Lava Centre, with immersive installations to explain the nature and impacts of nearby volcanoes.[40] Designers of The Anthropocene Project at the Art Gallery of Ontario sought to know if and how visitors would "resonate emotionally" with the "exhibition's vivid imagery." Ninety percent of just under 150,000 visitors gave these on-screen rankings: 58 percent felt worried, sad, or angry; 24 percent felt informed or motivated; 18 percent felt suspicious

or unconcerned.[41] These results build confidence that design of emotional experiences about environmental issues can influence visitors to reflect on the adverse impacts of humanity.

Intentionality

Two decades ago, the National Museum of Science and Industry in London exclaimed, "We want to provide the means for the expert to explain and the audience to challenge and understand.... We want everything we do to provoke, cajole, ignite."[42] Indeed, being boldly intentional lies at the core of successful transformations.[43] A decade ago, when discussing how museums increase their external value for a chapter in *Hot Topics, Public Culture, Museums*, I pointed out that "every step taken that is neutral or contrary to the greater good makes it that much more difficult for the museum to start or regain a strengthening reputation of relevance."[44] A visionary institution can be guided by these sequential interdependencies: meaningfulness + popularity = relevance and relevance + renewal = sustainability.[45] Museums may also find value in the cone-of-plausibility approach used by futurists to consider the three main classes of futures – possible, probable, and preferable – to visualize their ideas evolving along different paths.[46]

To be effective and efficient resources about the Anthropocene and its mounting perils, museums need leaders familiar with prevailing environment-and-society issues and adept at shaping mission-driven teamwork. A vital new insight is the degree to which discretionary tastes of each post-pandemic visitor category have changed with the onset of existential crises. Faced with new norms of internal stringency, valuing all staff and volunteers as a vital team, and with unequivocal institutional relevance, how well a museum navigates its new territory – ultimately whether it will thrive or atrophy – hinges on visionary approaches to exhibitions as well as programming, curators, collections, and more. The urgently needed paradigm shift needs to start by our sector openly embracing the Anthropocene term. An early example of progress is the curator of the Anthropocene position at the Carnegie Museum of Natural History.[47]

In advance of his address at the 2011 AAM Annual Meeting, astrophysicist Neil deGrasse Tyson projected that "if in 2050 we were delivering the same messages, either we've failed at affecting change in society and still needed to give those messages, or we just got left behind and we were no longer on the frontier of what mattered in society."[48] At the close of 2020, András Szántó, an arts, media, and philanthropy consultant, laid out six bold recommendations for needed institutional change: "expand mission, rethink posture, rethink offerings, confront entrenched inequities, connect to audience in new ways, and remodel the business."[49] These may well prescribe the largest paradigm shift the museum sector has ever known. Arguably more than ever, museums are as accountable for the subjects they illuminate as much as for what they omit. ▮

Acknowledgements

The author thanks the Journal's editor Ellen Snyder-Grenier, this article's reviewers, as well as Roy Campbell, Audrey Chang, Randi Korn, and Robert West for their helpful comments as this article developed.

1 Arundhati Roy, "The Pandemic is a Portal," *Financial Times*, April 3, 2020, https://www.ft.com/content/10d8f5e8-74eb-11ea-95fe-fcd274e920ca.

2 See the FrameWorks Institute's website: www.frameworksinstitute.org/.

3 András Szántó, "A New Kind of Museum is Emerging – Here's What the Future Holds," *The Art Newspaper*, November 22, 2020, https://www.theartnewspaper.com/comment/future-of-museums.

4 William Peniston, ed., *The New Museum: Selected Writings of John Cotton Dana* (Newark, NJ and Washington, DC: Newark Museum Association and American Association of Museums, 1999).

5 Christophe Bonneuil and Jean-Baptiste Fressoz, *The Shock of the Anthropocene: The Earth, History and Us* (London: Verso, 2016); George Steinmetz and Andrew Revkin, *The Human Planet: Earth at the Dawn of the Anthropocene* (New York: Abrams, 2020).

6 A. E. Parr, "The Wartime Duties of Natural History Museums," *Museum News* (September 1, 1942): 6–8.

7 Marjorie Schwarzer, "Bringing it to the People: Lessons from the First Great Depression," *Museum* (May–June 2009): 49–54.

8 A. E. Parr, *Mostly about Museums* (New York: American Museum of Natural History, 1959).

9 Robert Sullivan, "Trouble in Paradigms," *Museum News* (January–February 1992), 41–44.

10 Bill Watson and Elizabeth Werb, "One Hundred Strong: A Colloquium on Transforming Natural History Museums in the Twenty-First Century," *Curator: The Museum Journal* 56, no. 2 (2013): 255–265.

11 Sujin Haynes, "Why a plan to redefine the meaning of 'museum' is stirring up a controversy," *TIME* (September 9, 2019), https://time.com/5670807/museums-definition-debate/. Also, in 2006, the need to feature topical content was a focus of an invited article for AAM, written by the author, about ways to put theory into action. See: Emlyn Koster, "The Relevant Museum: A Reflection on Sustainability," *Museum News* (May/June, 2006), https://rka-learnwithus.com/wp-content/uploads/2017/02/aam-museum-2006-emlyn-koster.pdf.

12 Gail Anderson, ed., *Reinventing the Museum: Historical and Contemporary Perspectives on the Paradigm Shift* (Lanham, MD: AltaMira Press, 2004); Gail Anderson, ed., *Reinventing the Museum: The Evolving Conversation on the Paradigm Shift* (Lanham, MD: AltaMira Press, 2012).

13 Stephen Weil, *Making Museums Matter* (Washington, DC: Smithsonian Institution Press, 2002); "Beyond Management: Making Museums Matter," *ICOM International Committee on Management Study Series* (2006): 12, 4–8.

14 Robert Janes, *Museums in a Troubled World: Renewal, Irrelevance or Collapse* (New York: Routledge, 2009).

15 Jane Neilsen, "The Relevant Museum: Defining Relevance in Museological Practices," *Museum Management and Curatorship* (2015): 30, 364–378.

16 Charlie Trautman, "Nice to Necessary: The Path to Significance and Support for Science Centers,'" *Informal Learning Review* (November–December 2011), 1-6; Jeanne Vergeront, "The Nice and Necessary of Museums," *Informal Learning Review* 120 (May–June 2013): 24, 15, 22–23; Steve Friesen, "Is Your Museum Necessary?" *Informal Learning Review* (November–December 2015): 13–18.

17 Dan Spock, "Museums: Essential or Non-Essential," *Wunderkammer*, May 8, 2020, https://wunderkammer.blog/2020/05/07/museums-essential-or-non-essential/.

18 Jan Zalasciewicz, Mark Williams, Will Steffen, et al., "The New World of the Anthropocene," *Environmental Science and Technology* 44, no. 7 (2010): 2228–2231, https://doi.org/10.1021/es903118j.

19 Sarah Whitmee, Andy Haines, Chris Beyrer, et al., "Safeguarding Human Health in the Anthropocene Epoch: Report of The Rockefeller Foundation-Lancet Commission on Planetary Health," July 16, 2015, https://www.thelancet.com/commissions/planetary-health.

20 Renée Salas, James Schultz and Caren Solomon, "The Climate Crisis and Covid-19: A Major Threat to the Pandemic Response," *New England Journal of Medicine* (September 10, 2020), https://www.nejm.org/doi/10.1056/NEJMp2022011.

21 Shiralee Hudson Hill, "A Terrible Beauty: Art and Learning in the Anthropocene," in *The Climate is Changing. Why Aren't Museums?* Sarah Sutton and Cynthia Robinson, eds., *Journal of Museum Education* 45, no. 1 (2020): 74–90.

22 Noel Castree, "The Anthropocene and the Environmental Humanities: Extending the Conversation," *Environmental Humanities* 4, no. 1 (2014): 233–260, https://doi.org/10.1215/22011919-3615496.

23 Christopher Schaberg, *Searching for the Anthropocene: A Journey into the Environmental Humanities* (London: Bloomsbury Academic, 2019).

24 Rob Nixon, "The Anthropocene and Environmental Justice," in Jenny Newell, Libby Robin and Kirsten Wehner, eds., *Curating the Future: Museums, Communities and Climate Change* (New York: Routledge, 2017): 23–31.

25 Emlyn Koster, "Anthropocene: Transdisciplinary Shorthand for Human Disruption of the Earth System," *Geoscience Canada* 47 (2020): 59–64, https://doi.org/10.12789/geocanj.2020.47.160.

26 Erle Ellis, *Anthropocene: A Very Short Introduction* (Oxford: Oxford University Press, 2018).

27 Sarah Sutton and Cynthia Robinson, eds., "The Climate is Changing. Why Aren't Museums?" *Journal of Museum Education* 45, no. 1 (March 2020), https://doi.org/10.1080/10598650.2020.1722513.

28 Volker Hauff, ed., World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987).

29 "Ted Nordhaus, "The Earth's carrying capacity for human life is not fixed," Aeon, July 5, 2018, https://aeon.co/ideas/the-earths-carrying-capacity-for-human-life-is-not-fixed; "The Sustainable Development Goals: Helping Transform Our World Through Museums," ICOM, January 21, 2020, https://icom.museum/en/news/

the-sustainable-development-goals-helping-transform-our-world-through-museums/.

30 Libby Robin, "Anthropocene Cabinets of Curiosity: Objects of Strange Change," in Gregg Mitman, Marco Armiero, and Robert Emmett, eds., *Future Remains: A Cabinet of Curiosities for the Anthropocene* (Chicago: University of Chicago Press, 2018): 205–218, www.kth.se/en/abe/inst/philhist/historia/ehl/ehl-events/2.74812/programme-1.664960.

31 Nina Möllers, Christian Schwägerl and Helmuth Trischler, eds., *Welcome to the Anthropocene: The Earth in Our Hand* (Munich: Deutsches Museum and Rachel Carson Center for Environment and Society, 2015), https://www.si.edu/object/siris_sil_1059908.

32 "Stories of the Anthropocene Festival," KTH Environmental Humanities Library, September 28, 2016, https://www.kth.se/en/abe/inst/philhist/historia/ehl/ehl-events/2.74812/stories-of-the-anthropocene-festival-1.664943.

33 Gil Oliveira, Eric Dorfman, Nicolas Kramar et al., "The Anthropocene in Natural History Museums: A Productive Lens of Engagement," *Curator: The Museum Journal* (2020), https://doi.org/10.1111/cura.12374.

34 The Anthropocene Project, https://theanthropocene.org/.

35 Alina Tugend, "Can Art Save the Planet?" *The New York Times*, March 19, 2019, https://www.nytimes.com/2019/03/12/arts/art-climate-change.html.

36 "A Look Back at Some of 2019's Most Timely and Indelible Impressions: Art for the Moment," *Cafeyn*, December 10, 2019, https://articles.cafeyn.co/ce976e/the-new-york-times-international-edition/2019-12-10/art-for-our-moment.

37 Kathleen McLean, "Introduction: Best Practices Should be a Tool, Not a Rule," in Kathleen McLean and Catherine McEver, eds., *Are We There Yet? Conversations about Best Practices in Exhibition Development* (San Francisco: Exploratorium, 2004), 2–4.

38 Erik Bär and Stan Boshouwer, *Worlds of Wonder: Experience Design for Curious People* (Amsterdam: BIS Publishers, 2019).

39 David Anderson and Hiroyuki Shimizu, "Recollections of Expo 70: Visitors' Experiences and the Retention of Vivid Long-Term Memories," *Curator: The Museum Journal* 50, no. 4 (2007), 435-454, http://blogs.ubc.ca/ewayne/files/2010/02/Anderson-Shimizu-2007-Recollections.pdf.

40 "Volcanoes: The Inside Story and the Experience," LAVA, https://lavacentre.is/the-experience/.

41 Shiralee Hudson Hill, "A Terrible Beauty."

42 National Museum of Science and Industry, "*In the 21st Century What Role Should a Museum Play?*" (London: National Museum of Science and Industry, 2002).

43 Randi Korn, *Intentional Practice for Museums: A Guide for Maximizing Impact* (Lanham, MD: Rowman & Littlefield, 2019).

44 Emlyn Koster, "The Evolution of Purpose in Science Museums and Science Centers," in Fiona Cameron and Lynda Kelly, eds., *Hot Topics, Public Culture, Museums* (Newcastle-upon-Tyne: Cambridge Scholars Publishing, 2010), 76–94.

45 Emlyn Koster, "North Carolina Museum of Natural Sciences" in Gail Anderson, ed., *Mission Matters: Relevance and Museums in the 21st Century* (Lanham, MD: Rowman & Littlefield, 2019), 89–94.

46 For more on this approach, see Joseph Voros, "Big History and Anticipation: Using Big History as a Framework for Global Foresight," *Handbook of Anticipation: Theoretical and Applied Aspects of the Use of Future in Decision Making*, R. Poli, ed. (New York: Springer International), doi:10.1007/978-3-319-31737-3_95-1.

47 "Carnegie Museum of Natural History Welcomes First Curator of the Anthropocene," Carnegie Museum of Natural History, September 12, 2018, https://carnegiemnh.org/press/carnegie-museum-of-natural-history-welcomes-first-curator-of-the-anthropocene/.

48 American Association of Museums, "The Future is in the Stars: An Interview with Neil deGrasse Tyson," *Museum News* (March–April 2011): 47–51.

49 András Szántó, "A New Kind of Museum is Emerging."