ARTEFACTS XXVIII

“Wide-Angle and Long-Range Views” Official Report

第28回 ARTEFACTS 年次集会報告書

National Museum of Nature and Science, Tokyo
October 8-10, 2023

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Foreword

Shigekazu Yoneda
Director
Department of Science and Engineering
National Museum of Nature and Science

The Artefacts consortium is an international association for historians of science and technology working in museums and academic institutions. It was established in 1996 by curators from the Deutsches Museum, Science Museum in London, and the Smithsonian Institution, and connects researchers and museum experts who use material culture in historical study and public displays. From October 8 to 10, 2023, the National Museum of Nature and Science, Tokyo, Japan, had the honor of hosting the very first Artefacts meeting outside of Europe and North America.

Over the three-day period, the museum welcomed 53 participants from eight different countries and across Japan. Attendants participated in discussions and presentations of research, deepening their understandings and connections with colleagues and peers. On the afternoon of the 9th, the second day of the meeting, the general public were invited to attend lectures by notable researchers from Japan and aboard at a public symposium. The lectures were supported by simultaneous interpretation, and proved to be incredibly popular with 120 people applying to join. Unfortunately, due to the seating capacity, only 37 people—chosen at random—were able to attend in-person, but 345 participants joined for the live broadcast, with 187 concurrent viewers at one point during the lectures.

The National Museum of Nature and Science was established in 1877. Initially founded as a museum for science and technology, more specifically industrial technology education, it has since developed into a museum for natural history and the history of science and technology. Now, almost 150 years since our establishment, we stand as a unique museum that brings together the history of science, the history of technology, human history, and natural history. We are committed to being the foremost destination for reflecting on the development and evolution of humanity over the Earth's long natural history. It is my hope that hosting the first Artefacts meeting in Asia will prove to be an invaluable contribution to toward this effort.

In closing, I extend my heartfelt thanks to all who have contributed to the conference. I am profoundly grateful to all our participants, especially those who journeyed from abroad, and to those who resonated with the event's objectives and lent their support and cooperation. I also wish to express my appreciation to the dedicated staff whose efforts resulted in the smooth execution of the event. I look forward to the continued growth and success of the Artefacts community.

■はしがき

国立科学博物館　理工学研究部長　米田成一

「Artefacts」はドイツ博物館、ロンドン科学博物館、スミソニアン協会のキュレーターによって 1996 年に設立された技術史と科学史の国際的な研究共同体です。設立以降、世界中の研究者や博物館の専門家が集まり、物そのものや物質文化に焦点を当てた研究を共有してきています。2023 年 10 月 8 日（日）から 10 日（火）までの 3 日間、ヨーロッパや北米以外では初となる Artefacts の会合が、国立科学博物館の主催により東京・上野で開催されました。

日本を含めて 9 か国 53 名の参加者があり、様々な研究発表や議論を通して国際的な交流を深めることができました。また、9 日午後には内外の著名な研究者にご講演をお願いして日英同時通訳付きの公開シンポジウムを開催いたしました。一般からの聴講者も募集し、120 名の応募をいただきましたが、講堂の収容人数の制限のため抽選を行って、37 名の方が参加されました。同時にライブ配信も行い、最大同時接続者数 187 名、延べ 345 名の接続がありました。

国立科学博物館は 1877（明治 10）年に設立され、当初は科学技術あるいは産業技術教育のための科学館、それから、人の営みの証を記録する科学博物館、さらには、自然史博物館の役割を果たすなど色々な役割を持ちながら自然科学系博物館として発展をしてきました。間もなく 150 年になりますが、科学史・技術史・人類史・自然史を扱うユニークな国立の博物館として今後も「長い自然の『歴史』の中で人間の営みを振り返るのに最適な場所」（開催趣旨より）として発展して行くことが期待されています。今回の国際研究集会の開催がその一助となることを願っています。

末筆になりましたが、参加者の皆様、特に遠く海外からご参加いただいた研究者の方々、また、趣旨にご賛同いただいてご後援、ご協力いただいた各位、そして運営に携わったスタッフの皆様に感謝申し上げます。

Contents

1. Overview

Nobumichi Ariga (Chair of Program Committee)
Associate Professor, Graduate School of Language and Society, Hitotsubashi University;
Affiliated Researcher, Department of Science and Engineering,
National Museum of Nature and Science

Artefacts is a consortium of academic and museum-based scholars, mainly those in Europe and North America, who study the history of science, technology and medicine by using artificial objects in research and public display. The network was established in 1996 by curators from the Deutsches Museum, Science Museum in London, and the Smithsonian Institution and since then has held annual conferences and published a volume series based on them. For the first time in its history, the twenty-eighth annual meeting of Artefacts was held outside of Europe and North America, and the National Museum of Nature and Science in Tokyo (hereafter *Kahaku*, the abbreviation of the Japanese name) hosted it.

The conference was held from October 8 to 10, 2023, at the museum's auditorium as its venue. A Program Committee made up of domestic and international curators and researchers was responsible for the program, while the Department of Science and Engineering at *Kahaku* took charge of the management and operation of the meeting. The afternoon of the second day, the 9th (Monday and a national holiday), was designed somewhat independently as an "International Symposium" open to the public. The entire meeting was supported by ICOM Japan, and it was generously sponsored by the SECOM Science and Technology Foundation and the Total Media Development Institute Co., Ltd. and supported by Japan National Tourism Organization.

Each year, Artefacts' annual meeting has its own theme. This year's theme was "Wide-Angle and Long-Range Views," whose aim and scope were stated in Call for Papers as follows:

> A gathering in Japan, where "Western" science and technology have been transferred to the unique culture of a long tradition, must provide an opportunity to reflect on the processes and consequences of globalization once again after the severest years of COVID-19. In addition, the Japanese National Museum of Nature and Science comprises both natural history and the history of science and technology, and, if combined, it will be an ideal place to reflect on human activities in much longer "history" of nature. When the authors of *The History Manifesto* insisted on long-term thinking,[1] one of the

commentators contributing to *Isis* pointed to the absence of museums in their discussion, concluding that "we urgently need the wide-angle, long-range views only historical museums can provide."[2] In a broad interpretation, we will pursue this possibility based on museum objects and other artefacts.

What follows is a brief description of the contents of the meeting. On the first day, I gave a general introduction, and Hiroto Kono, Curator of physics and the historian of science at *Kahaku*, introduced the museum's materials related to the history of science and technology. This was followed by a keynote session in which Ulrich Kernbach, Head of Exhibitions and Collections at the Deutsche Museum, and Margaret A. Weitekamp, Director of Space History at the Smithsonian National Air and Space Museum, each delivered a lecture. The full text of these two papers is included in this report. Scott Anthony, Deputy Head of Research and Public History at the Science Museum in London, commented on the two lectures.

The PhD Candidates/Students session, held after a break, consisted of four presentations by young researchers who have not yet obtained their doctorate degrees (it was the first of its kind at Artefacts meetings). For an overview of each paper, please see the abstracts included in this report. *Kahaku* subsidized a portion of the travel expenses for these young researchers and presenters from developing countries. This measure was particularly highly appreciated by those involved in the Artefacts consortium and, I believe, was one of the major factors that led to the success of this year's conference.

After the PhD session, we held an exhibition tour, which is customary at Artefacts meetings. Among the permanent exhibitions, we toured the "Navigators on the History of Earth" on the 1st floor of the Global Gallery, "Investigation Technology for the Earth" and "Progress in Science and Technology" on the 2nd floor, and "Techniques in Observing Nature" on the 1st floor of the Japan Gallery. Also, we visited "The Great Kanto Earthquake 100th Anniversary Special Exhibition," which was currently being held. After the tour, a reception was held to which all participants were invited, and the first day ended with an opportunity for interaction among the participants.

A symposium open to the public was held in the afternoon of the second day of the conference, which will be described elsewhere in this report. Excluding this part, the second and third days were mainly devoted to general research presentations. In total, we had four regular sessions and one special session, with a total of 15 presentations (originally 16 were planned, but one was cancelled). This report contains the entire contents of two of these presentations, which are the results of joint research conducted by *Kahaku* and the Total Media Development Institute Co., Ltd. For other papers, please see the abstract.

At the end of the conference, there was a "round robin," which can be described as a "traditional event" at Artefacts meetings. In this event, all participants take turns briefly describing the current status of their institution. At this year's meeting, there were

participants from institutions that had never participated before, and we were able to exchange useful information.

In fact, this meeting brought together an even more diverse group of participants than ever before. Particularly, participation from China and the Philippines was a direct result of the fact that it was the first meeting in Asia. A total of 47 proposals were received for the Call for Papers, probably the highest number ever. The Program Committee considered shortening the presentation time and including more papers, but in the end, we decided to respect the spirit of the Artefacts meeting of allowing ample time for questions and discussion, leading to regrettably rejecting about half of the proposals. In selecting papers, we prioritized those related to museum practice and considered the geographic and organizational diversity of speakers. As a result, we had no choice but to reject a great number of very interesting historical studies by university scholars.

For my own part, I first participated in Artefacts meeting in 2015, when I was working as a curator at *Kahaku*. It was the twentieth meeting held at the Museo Nazionale della Scienza e della Tecnologia Leonardo da Vinci in Milan, Italy. After participating several times, I proposed hosting the conference at *Kahaku*, but I had no idea how many speakers and participants there would be. In addition, due to the spread of the COVID-19, the possibility of holding a face-to-face meeting was uncertain. The meeting at *Kahaku* was originally scheduled for 2022 but was postponed by one year to 2023. Despite all these, we received a large number of paper proposals, which far exceeded our expectations, and I was extremely pleased to be able to welcome so many participants from Japan and abroad.

The Tokyo meeting was made possible through the cooperation of many people. I would like to thank members of the Program Committee, Juan-Andres Léon (Science Museum in London), Johannes-Geert Hagmann (Deutsches Museum), Teasel Muir-Harmony (Smithsonian Air and Space Museum), Yoshimi Takuwa (Tokyo Institute of Technology), and Hiroto Kono (National Museum of Nature and Science), for their very helpful advice in considering the purpose of the meeting and organizing the timetable and program. Everyone who was willing to chair each session did an excellent job of facilitating the entire program, with almost no delays. Equally important was the behind-the-scenes work of my former colleagues at the Department of Science and Engineering at *Kahaku*, who did a huge and diverse range of work, including setting up the venue, preparing meals, providing travel assistance and invitation procedures, arranging simultaneous interpretation and live streaming for the public symposium, and managing the budget. Those involved in museums must understand the work behind the scenes determines the success or failure of things. I would like to note here that I received many compliments from overseas colleagues regarding the excellence of their preparations.

ARTEFACTS XXVIII, which was held in Asia for the first time, foreshadowed new developments for Artefacts in many ways. I expect that museums in Japan and East Asia,

including *Kahaku*, will further develop by participating in Artefacts meetings and through deepening exchanges with institutions in Europe and the United States. Through this, I also hope that research and exhibitions on the history of science and technology using objects, or artefacts, will be further deepened in various places.

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[1] Jo Guldi and David Armitage, *The History Manifesto*, Cambridge: Cambridge University Press, 2014.
[2] Thomas Söderqvist, "The Muse(um) Is Political," *Isis* 107 (2016): 342–344, on p.344.

■　開催報告

プログラム委員長　有賀暢迪
（一橋大学大学院言語社会研究科准教授／国立科学博物館協力研究員）

「Artefacts」は、欧米の科学技術博物館のキュレーターを中心としたコンソーシアムであり、モノ（人工物）を用いた歴史研究や展示に取り組む科学史・技術史・医学史関係者の集まりである。1996 年にドイツ博物館、ロンドン科学博物館、スミソニアン協会のキュレーターによって設立され、研究や実践について発表する会合を毎年開催しているほか、それにもとづいた論文集の刊行などをおこなっている。2023 年の年次研究集会「ARTEFACTS XXVIII」は、東京・上野の国立科学博物館がホストとなり、28 回目にして初めて、ヨーロッパと北米以外の場所で開かれた。

研究集会は 2023 年 10 月 8 日（日）から 10 日（火）までの 3 日間、上野の日本館講堂を会場として開かれた。プログラムについては国内外のキュレーター・研究者からなるプログラム委員会が責任を持ち、会場の運営は国立科学博物館の理工学研究部が担った。ただし会議 2 日目の 9 日（月・祝）午後については、一般公開の「国際シンポジウム」として、いくらか独立した形で計画・実施した。なお開催にあたっては、ICOM（国際博物館会議）日本委員会の後援を受けたほか、公益財団法人セコム科学技術振興財団および株式会社トータルメディア開発研究所の助成と、独立行政法人国際観光振興機構の協力を受けた。

Artefacts の年次集会では毎年、何らかのテーマを設けている。今回設定したテーマは、"Wide-Angle and Long-Range Views"　であった。この趣旨は、発表募集の文書から引用すれば、次の通りである：

> 長い伝統を持つ独特な文化的土壌に「西洋」の科学・技術が移植されてきた日本で集会を持つことは、新型コロナウイルス感染症による最も厳しい数年間を経た今、グローバリゼーションの過程とその帰結についてあらためて考える機会となるはずです。加えて、国立科学博物館は自然史と科学技術史の両方から構成されており、これらを組み合わせると、より長い自然の「歴史」の中で人間の営みを振り返るのに最適な場所となる

でしょう。*The History Manifesto* の著者たちが長期的思考を主張したとき[1]、*Isis* 誌に寄稿したコメンテーターの一人はその議論の中に博物館が出てこないことを指摘し、「我々が喫緊に必要としているのは、歴史性を持つ博物館だけが提供できる広角な、長期的な視点である」と結論していました[2]。私たちはこれを広く解釈し、博物館資料をはじめとするモノに基づいて、その可能性を追求したいと思います。

以下、研究集会の内容を簡単に紹介する。初日はまずイントロダクションとして、筆者が趣旨説明を、国立科学博物館の河野洋人氏（理工学研究部研究員）が博物館の科学技術史関係資料の紹介をおこなった。続いて基調講演セッションがあり、ドイツ博物館で展示・コレクション部門長を務める Ulrich Kernbach 氏と、スミソニアン航空宇宙博物館で宇宙開発史部門長を務める Margaret A. Weitekamp 氏が、それぞれ問題提起をおこなった。この 2 本の講演については全文を本報告書に収録している。会場ではこれを受けて、ロンドン科学博物館の研究およびパブリック・ヒストリー部門で副代表を務める Scott Anthony 氏から、二つの講演に対するコメントがなされた。

休憩を挟んでおこなわれた PhD Candidates/Students のセッションは、Artefacts の研究集会では初めての試みとして、博士号取得前の若手研究者による 4 件の発表で構成された。それぞれの概要は、本報告書に収録した要旨をご覧いただきたい。なお国立科学博物館では、これらの若手研究者や、発展途上国から参加する発表者に対して、旅費の一部を支援した。この点は Artefacts コンソーシアムの関係者からも特に高く評価され、今回の会議の成功をもたらした大きな要因の一つとなった。

PhD セッションのあと、この研究集会では恒例の展示ツアーを実施した。見学したのは、常設展示のうち地球館 1 階「地球史ナビゲーター」、地球館 2 階「科学技術で地球を探る」「科学と技術の歩み」、日本館 1 階「自然をみる技」と、開催中の関東大震災 100 年企画展「震災からのあゆみ」である。このツアーのあと、参加者全員を招待するレセプションを開き、参加者間の交流をはかって初日が終了した。

会議 2 日目の午後には一般公開によるシンポジウムを実施したが、これについては本報告書の別のところで述べる。この部分を除く 2 日目・3 日目は、主として一般の研究発表にあてられた。全体では通常セッションを 4 つ、特別セッションを 1 つ設定し、計 15 件の発表がなされた（当初は 16 件の予定であったが、1 件は残念ながら不参加となった）。本報告書にはこのうち、国立科学博物館が株式会社トータルメディア開発研究所とおこなっている共同研究の成果である 2 件について、発表内容全体を収録した。これら以外の発表については、要旨で概要をご覧いただきたい。

会議の最後には、Artefacts の研究集会の「伝統行事」と言うべき「ラウンド・ロビン」があった。これは参加者全員が順番に、所属する館の近況について、手短に述べるというものである。今回の研究集会では、これまでに参加したことのない館からも参加があり、有益な情報交換をおこなうことができた。

事実、今回の研究集会はこれまで以上に、多彩な顔ぶれの集まりになった。とりわけ中国やフィリンピンからも参加があったのは、アジアで初めての開催だったことの直接的な成果であ

ろう。発表募集に対する応募は全部で 47 件あり、おそらく過去最多であった。プログラム委員会では、報告時間を短くして多くの発表を含めることも考えたが、最終的には、議論する時間を長く取るという Artefacts 研究集会の精神を尊重し、断腸の思いでおよそ半分を不採択とした。選択に際しては、博物館の実践に関わる内容を優先するとともに、発表者の地理的・組織的な多様性を考慮した。結果として、大学所属の研究者による非常に興味深い歴史研究の多くを不採択とせざるを得なかった。

私事になるが、筆者が初めて Artefacts に参加したのは、国立科学博物館に理工学研究部の研究員として在職していた 2015 年、イタリアのレオナルド・ダ・ヴィンチ国立科学技術博物館で開かれた第 20 回の研究集会であった。その後、数回の参加を経て、国立科学博物館でホストすることを提案したのだが、どのくらいの発表者・参加者があるのか、まったく予想できなかった。とりわけ新型コロナウイルス感染症の流行により、対面での研究集会の実現は一時、不透明になっていた。国立科学博物館での開催それ自体も、当初は 2022 年の予定であったのが、1 年延期して 2023 年になった経緯がある。それだけに、予想をはるかに上回る数の発表申込をいただき、国内外から多数の参加者を迎えることができたのは望外の喜びである。

今回の研究集会は、多数の方々の協力によって初めて可能になった。プログロム委員会の方々、すなわち Juan-Andres Léon 氏（ロンドン科学博物館）、Johannes-Geert Hagmann 氏（ドイツ博物館）、Teasel Muir-Harmony 氏（スミソニアン航空宇宙博物館）、多久和理実氏（東京工業大学）、河野洋人氏（国立科学博物館）には、集会の趣旨の検討や、タイムテーブルとプログラムの編成にあたり、たいへん有益な助言をいただいた。当日の各セッションでの座長を快く引き受けてくださった方々は、どなたもすばらしい進行をしてくださり、プログラム全体がほとんど遅れることなく実施できた。さらにこれらと並んで重要だったのは、国立科学博物館理工学研究部の関係者の方々による、いわゆる裏方としての働きである。会場の設営、食事の準備、旅費の補助や招へいに関する手続き、公開シンポジウムにおける同時通訳とライブ配信の手配、そして予算の管理に至るまで、膨大かつ多岐にわたる大変な仕事をしていただいた。博物館関係者であれば、裏方の働きこそが物事の成否を決めることをよく知っているに違いない。海外から参加した方々から、準備のすばらしさに対して多くの賛辞をいただいたことを、ここであえて記しておきたい。

初めてのアジア開催となった「ARTEFACTS XXVIII」は、さまざまな面で、Artefacts の新たな展開を予感させるものとなった。今後、国立科学博物館をはじめとする日本ならびに東アジアの博物館が、Artefacts への参加を通じて欧米の博物館とも交流を深め、ますます発展していくことを期待したい。そしてそれを通じて、モノ（人工物）を用いた科学技術史の研究や展示が、各地で一段と深められることを願っている。

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[1] Jo Guldi and David Armitage, *The History Manifesto*, Cambridge: Cambridge University Press, 2014. 平田雅博・細川道久（訳）『これが歴史だ！　21 世紀の歴史学宣言』刀水書房、2017 年。

[2] Thomas Söderqvist, “The Muse(um) Is Political,” *Isis* 107 (2016): 342-344, on p. 344.

2. Timetable and Program

1) Timetable

October 8, 2023 (Sun)

12:00–	Check-in
13:15–13:45	Introduction
13:45–14:45	Keynote Session [2 × 20 min. talk + 20 min. discussion]
14:45–15:15	Coffee Break
15:15–16:45	PhD Candidates/Students Session [4 × 15 min. talk + 30 min. discussion]
16:45–18:15	Guided Tour
18:30–20:30	Welcome Reception

October 9, 2023 (Mon; National Holiday)

9:30–11:30	Regular Session 1 [4 × 20 min. talk + 40 min. discussion]
11:30–13:00	Lunch
13:00–18:10	Public Session (International Symposium)

October 10, 2023 (Tue)

9:00–11:00	Regular Session 2 [4 × 20 min. talk + 40 min. discussion]
11:00–11:20	Coffee Break
11:20–12:00	Special Session [2 × 15 min. talk + 10 min. discussion)
12:00–13:00	Lunch
13:00–14:30	Regular Session 3 [3 × 20 min. talk + 30 min. discussion]
14:30–15:00	Coffee Break
15:00–16:30	Regular Session 4 [3 × 20 min. talk + 30 min. discussion]
16:30–17:00	Coffee Break
17:00–18:00	Round robin, Wrap-up, and Farewell

2) Program

October 8, 2023 (Sun)

Keynote Session

Chair: **Osamu Kamei (National Museum of Nature and Science, Tokyo)**

Ulrich Kernbach (Deutsches Museum):

Has There Ever Been a Long-range Perspective at the Deutsches Museum, and When Did It Got Lost?

Margaret A. Weitekamp (Smithsonian National Air and Space Museum):

Remaking Museums: Examining the Scholarly and Intellectual Frameworks for the Material Heritage of Science and Technology as Seen in Museum Renovations

*Discussant: **Scott Anthony (Science Museum, London)**

PhD Candidates/Students Session

Chair: **Carola Dahlke (Deutsches Museum)**

Katy Duncan (University of Cambridge):

The Earth and the Electrometer: Measuring Atmospheric Electricity 1850–1930

Irina Fedorova (Friedrich-Alexander-Universität Erlangen-Nürnberg):

EcoMuseum in Kazakhstan: The Dark Aspects of the Soviet Scientific and Technological Achievements

Lufeng Xu (École des hautes études en sciences sociales):

Museography of Technical Objects: André Leroi-Gourhan's Museum Work on the Technical Milieu of the Eurasia

Sandrine Welte (Ca' Foscari University):

Circulating Civilisation: Venetian Glass Beads as Agents of Global (Ex)Change

October 9, 2023 (Mon; National Holiday)

Regular Session 1: *Transdisciplinary Exhibitions*

Chair: **Elisabeth Berry Drago (Science History Institute)**

Tsuyoshi Hosoya (National Museum of Nature and Science, Tokyo):

Special Exhibition "Poison": An Epochal Exhibition Held in the National Museum of

Nature and Science

Kristen Frederick-Frost & Carlene Stephens (Smithsonian National Museum of American History):

Going Wide: Exhibiting Elephants and Ivory

Carola Dahlke (Deutsches Museum):

Exhibiting Seaman's Yarn: A Pirate, a Cipher, and the Fiery Cross of Goa

Ayumi Terada (The University Museum, the University of Tokyo):

Exploring Methods for Re-evaluating ArtScience Collections: Experiences with Botanical Art Exhibition at the University Museum

Public Session (International Symposium)

"Where Do We Come From, and Where Are We Going?": Retelling the Story of Humans and Nature and Exploring the New Roles of Science Museums

*Conducted with simultaneous interpretation in Japanese and English, as well as live streaming on the internet

Plenary Talk:

Seigow Matsuoka (Director of Editorial Engineering Laboratory and Kadokawa Culture Museum)

Leap Through Science: The Reversible Time Machines

Lectures:

Yasushi Suto (The University of Tokyo):

Pondering on the Unknown World Beyond the Pale Blue Dot

Keiko Nakamura (JT Biohistory Research Hall):

Human as a Living Thing in Biohistory

Mariko Hasegawa (Japan Arts Council):

Modern Human Environment from Evolutionary Perspectives

Sayaka Oki (The University of Tokyo):

Revisiting the Past: The Role of the Science Museum in the Formation Process of Modern Nation-State

Fabienne Will (Munich Science Communication Lab and Deutsches Museum):

How to Think the Anthropocene: Exploring Deep-time Through Interscalar Objects

Teasel Muir-Harmony (Smithsonian National Air and Space Museum):

The New Role of Museums in an Extraterrestrial Context

Panel Discussion:

What kind of (museum) "objects" can be utilized to tell the story of humans and nature, reflecting the results of the current scientific inquiry? What are the meaning and risks of presenting a larger story that transcends the boundaries of disciplines? What would be the new roles of museums?

Facilitator: **Nobumichi Ariga (Hitotsubashi University)**

Panelist: **Yasushi Suto, Mariko Hasegawa, Fabienne Will, Teasel Muir-Harmony, and Osamu Kamei (National Museum of Nature and Science, Tokyo)**

October 10, 2023 (Tue)

Regular Session 2: *New Role of Artefacts in Science Communication*

Chair: **Andrew K. Johnston (Adler Planetarium)**

Yoshikazu Ogawa (Rissho University) and Collaborators:

Development of a Program Framework Responding to Global Contemporary Issues in Japanese Science Museum Setting

Jonel Maria Caba (Mindanao State University) and Bulkhia U. Panalondong (Central Mindanao University):

Communicating Science in the Peripheries: Role of Artifacts at University Museums in Northern Mindanao

Zheran Wang (Tsinghua University/Tsinghua Science Museum):

Learning from Scientific Artefacts: Teaching Practices at Tsinghua Science Museum

Reiji Takayasu (Fukuoka City Science Museum) and Collaborators:

Science Communication Activities in the Metaverse Space Using Artifacts

Special Session

Chair: **Scott Anthony (Science Museum, London)**

Claudio Giorgione (Museo Nazionale Scienza e Tecnologia Leonardo da Vinci):

Leonardo da Vinci and Propaganda: The 1939 Milan Exhibition and the Invention of a

Brand

Yoshimi Takuwa (Tokyo Institute of Technology):

Reconsidering Past Exhibitions: Leonardo da Vinci's Scientific and Technological Exhibits in Japan

Regular Session 3: *Global/Transnational Histories of Artefacts*

Chair: **Kristen Frederick-Frost (Smithsonian National Museum of American History)**

Elisabeth Berry Drago (Science History Institute):

Exploring Global Dye Histories in "Bold: Color from Test Tube to Textile"

Elisa Palomino (Smithsonian National Museum of Natural History, Arctic Studies Center):

The Role of Ainu Fish Skin Artefacts in Communicating Indigenous Traditional Science and Technology Promoting the Circulation of Knowledge among Arctic Communities

[Cancelled]

Regular Session 4: *Challenges of the Old and the New*

Chair: **Teasel Muir-Harmony (Smithsonian National Air and Space Museum)**

Alexander Sigelen & Andreas Gundelwein (TECHNOSEUM: Landesmuseum für Technik und Arbeit in Mannheim):

Back to the Future: Potentials of Historical Objects in Museums for the Communication of Contemporary Technologies and Future Trends

Katie Boyce-Jacino (Adler Planetarium):

"The Splendor of Returning Light": Recreating a Magic Lantern Show

Petrina Foti (Rochester Institute of Technology):

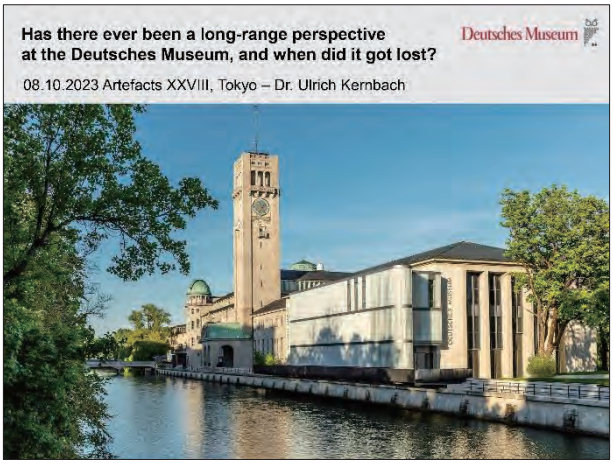
Artefacts of the Intangible: Quantum Computing in Museum Environments

3. Keynote Lectures

1）Has There Ever Been a Long-range Perspective at the Deutsches Museum, and When Did It Got Lost?

Ulrich Kernbach (Deutsches Museum)

This year, the Artefacts Consortium is meeting for the first time ever in Asia, at the National Museum of Nature and Science in Tokyo. Following up on a long tradition of meetings in Europe and the USA, not only have the organizers contributed to widening our geographical reach: Their careful and clever choice of this years' theme leads us to think of history in multiple extended dimensions – spatial, temporal but also cultural – through the prism of artefacts and museum studies. When transitioning for the usual line of thinking following the microcosm of biographies spanning from individual objects that we cherish in our collections, this choice truly is a challenge for many of us – and looking at the list of papers in this meeting, I want to express my appreciation and congratulation to the organizers for their remarkable work in putting together this exciting program.



Being first to speak at the start of this meeting, I cannot nearly pretend to be able to address this multitude of perspectives or to attempt to sketch their theoretical framework.

What I hope to review together with you, is a mode of self-inspection and inquiry - relating to the transformation of the exhibition and collection portfolio of the Deutsches Museum over the course of the more than 100 years of its existence, which in turn will give rise to some more general questions that we possibly can discuss in the context of other institutions as well.

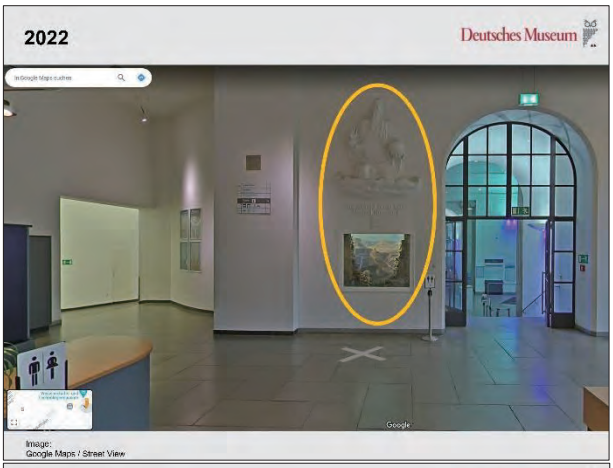
To start with, let me take you on a tour a visitor to the entrance of the museum would have seen until June 2022. Imagine a chilly and rainy day in fall in Munich, you finally made it through the crowds and the doors to the museum, and the first thing you want to do - now that you are inside - is to hang your coat before heading to the exhibitions.

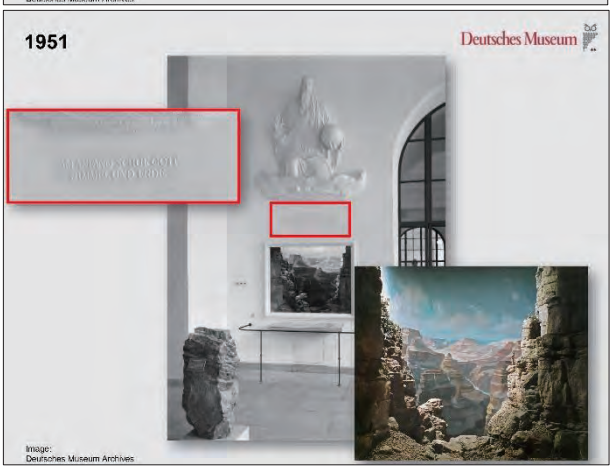
You can still see this today on Google Maps and Street View, and this is an image what the cloak room would have looked like: hangers, lockers, tables and seats, and on the side wall to the entrance hall, something different: a diorama embedded in the wall, straight above it a plaster figure with an inscription. Not bad for a cloak room, or when we come to think of it, rather strange for a functional space like this one, don't you agree?

If you now would look even more closely at this strange decoration of a coat room, you'd find out that both of them have been there since 1951. The inscription below the plaster is Genesis 1 verse 1: *"In the beginning God created the heavens and the earth"*, and the diorama shows the geological formations of the landscape of the Grand Canyon in the United States.

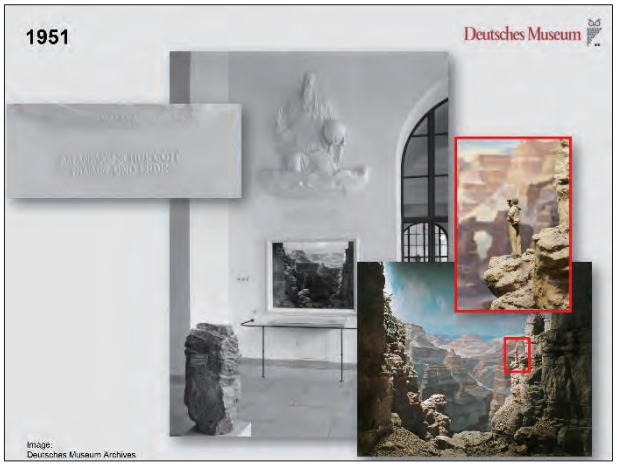
These exhibits are in fact relics of an exhibition long gone – the natural resources exhibition that constituted both the physical and the intellectual starting point to the Deutsches Museum for more than 80 years since its creation. In fact, geology was the cornerstone to the museum exhibition in the conception of its founders.

The presence of God in this exhibition and the Grand Canyon show that the initial curatorial concept at least had an ambition to cover time scales relating to the age of the earth, that is deep time and billions of years, or the age of geological formations such as





the Grand Canyon (millions of years).



Man appears in this landscape through the artist's portrait of the explorer, looking towards the landscape aided by the technical device of a binocular. The presence of such artefacts in the exhibition halls of the Deutsches Museum is an invitation to the more general question and theme of my talk:

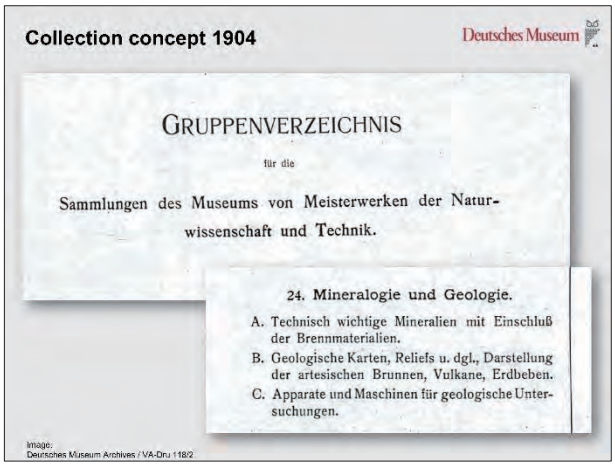
Has there ever been a long-range perspective at the Deutsches Museum, and when did it got lost?

To the first part of the question, the answer is an ambiguous yes and no. As I will outline in my talk, yes, we find the ambition of the museum founders in the original concept of the museum, and no, museum practice overrode the objectives in the phases of renewal and renovation. For the specific loss of geology as subject and its long temporal scales in the exhibition portfolio, we show the strong orientation towards policy driven exhibitions on contemporary problems in science and technology led to its replacement. Coincidentally, the natural resources exhibition as the front runner to the mining department was sacrificed to the first permanent gallery on the environment and pollution in the beginning of the 1990s as part of a broader turn of the museum towards embracing societal questions and issues.

Let us return to the starting point. The Deutsches Museum was founded in 1903 on the initiative of the electrical engineer Oskar von Miller. Miller, who had visited other institutions and admired the accomplishments of the South Kensington Museum and the Musée des Arts et Métiers, envisioned a pantheon of German science and technology elevating the admiration and the social status of the scientist and engineer at the beginning of the 20th century.

In his collection concept, with 36 collection groups, von Miller gave strong emphasis on the development of what he called "exact natural sciences" – which one may consider roughly

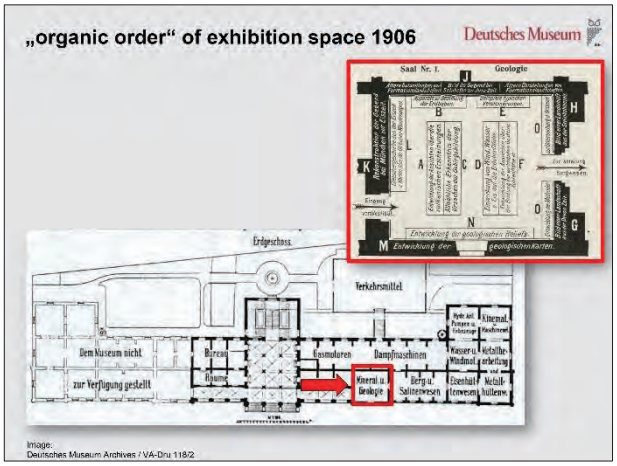
equivalent to modern science - and their impact on technology while excluding other collection areas



In 1904, he set out

"The scientific areas that impact technology and therefore shall be represented in our museum are limited to the so-called exact natural sciences, such as mathematics, physics, chemistry and so on, whereas the descriptive natural sciences, such as botanics, zoology that are already shiningly displayed in natural history museums, shall only considered by exception if they are of direct relevance to technology, such as mineralogy."

While other collection groups included pre-modern technology related to human activity and thus set out to document what we today might call the history of knowledge, collection group 24 formed to represent geology and mineralogy took the longest temporal range to cover beyond human life on earth.



The museum founders intended to display the collection groups in succeeding exhibition space that should follow "*an organic order*" that visitors would have to follow through a linear succession of rooms. The starting room for the museum visit – marked on the floor map of the provisional museum building used from 1906 on – was indeed the mineralogy and geology section. The representation of the forces of nature that according to the museum curators guided human life and hence the progress of science and technology, formed what they would call the "pinnacle" group.

The first geology gallery – shown here – was packed with material. It included both local geochronological descriptions on the formation of mountains near Munich during the Ice Age or fossil inclusions near Sonthofen during the Jurassic, but also showed generic themes of mineralogy and

geological including seismic activity and rock formation. The geology hall was followed by the mining department that, following the logic of the museum curators, would show how to exploit those natural resources.

A small detail from this image which I can't help but highlight it to you: After the visitor would have entered the exhibitions, there would be no return as prescribed by the no exit sign on the front door – once you were in you would have to go on walking, whether you liked it or not.

The museum and its collection moved into its dedicated building only in the year 1925. From the large and representative entrance, the beginning of the tour again started with the geology gallery, whose large premises now also hosted large relief models on land topography.

Representations of the structure of the earth would now integrate most recent seismographic evidence on the distances of the earth's core from the surface while of course lacking the still unaccepted continental drift theory.

While the museum explicitly integrated geochronology time scales through a dedicated exhibition on geology, it also set out to connect the development of technology to its pre-modern history. Due to the lack of original artefacts for the majority of subjects to cover, such as the history of metal production, ship building or musical instruments, it reverted to a historical projection through the theory of evolutionism. Evolutionism states that the cultural development of mankind is following universal principles and therefore follows the same steps and schemes in all nations. By consequence, the cultures of non-western societies at the time

of the creation of the museum were considered as time capsules of earlier development that had also occurred in Europe.

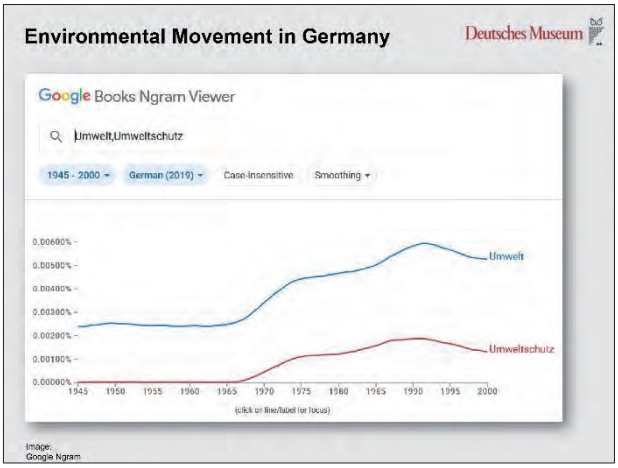
For documenting and collecting of what the museum considered to be relics of pre-modern technological development, the museum relied on both diplomatic channels and traders connected to colonies outside Europe. The image shown here documents the exhibition on iron extraction from ore opened in 1925. It included oven models created from material gathered in a German expedition in the colony of Cameroon in 1913/1914 as examples of primitive – and by consequence early - technology. Provenance research by one of our scientific staff members, Dr. Bernhard Wörrle, has evidence that this practice of evolutionism occasionally continued in exhibition curated until the 1950s, despite the fact that ethnological research had by long refuted these ideas dating back to the 19th century.

During World War II the exhibition was severely damaged and many of the models destroyed. The gallery reopened in 1951, shown on the images here, with more space and less density, now also featuring the newly commissioned diorama of the Grand Canyon, built by the museum workshops and the Munich Günter Vogelsamer. The plaster of the Holy Father was created by the Munich sculptor Franz Mikorey. According to the museum directors, not all mysteries of nature can be solved by men, and the plaster should be a reminder that where science is facing boundaries, there would be room for belief.

This position was not without controversy. Shortly after the opening of the new gallery, critical voices publically asked to remove the plaster from the gallery, criticizing its position in the museum as well as its poor artistic quality. To make a longer story short: The criticism faded away, and the plaster of father God remained in its present position under varying circumstances and uses of the room.

For many countries, the 1970s are marked by the rise of a civic movement for environmental

protection. This also includes Western Germany and ultimately led to the gain of political power at a regional and later a national level in the 1980s. At the same time, the concepts of earth system sciences were seeking to take a data driven systematic view on environmental problems and its symptoms. At a heuristic level, this can for example be seen in the usage of the German term "Umweltschutz" – environmental protection" which gained traction from the late 1960s.



Historians have pointed to the year 1970, the so-called European Conservation Year, as the onset of environmental awareness in politics and society. Proclaimed in 1966 by the Council of Europe, the year triggered a large number of campaigns in European countries, including small travelling exhibitions like the one seen on this picture in Britain. In West Germany alone, more than 500 events contributed to a large public awareness on the pressing problems of the environment. Also in 1970, Bavaria created the first ministry for environment in Germany with Minister Max Streibl at its head.

Increasing consciousness in Germany did not halt before the museum's entrance doors. The museum had to react on a changing societal and political climate on problems of the environment of the present, without at first much thinking on how these could fit into the representation of earth sciences in its galleries.

One of its first attempts to respond to environmental concerns through exhibitions was realized in 1972, the year of the Olympic Games in Munich. The decision to hold the games in Munich had significantly changed the transportation infrastructure: large investments were made to extend the subway transportation system including the so-called

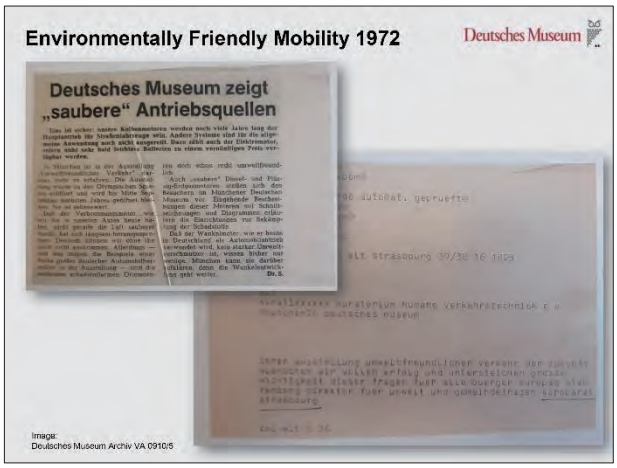
Olympia line U3.

Yet, the message the museum conveyed the time seemed to mirror the voices of politics and the industry. In August 1972, through the generous support of the Bavarian Minister for the environment Max Streibl and the German automobile industry, the museum opened a special exhibition on the subject of "environmentally friendly mobility".

The exhibition put emissions and pollution by traffic at its center, and discussed solutions that also included modern alternatives, like concepts for magnetic levitation and electro mobility especially for public transportation. Public transportation however, as the curator of the exhibition Max Rauck would argue, was no solution for the wish of the public to freely choose the time and the itinerary.

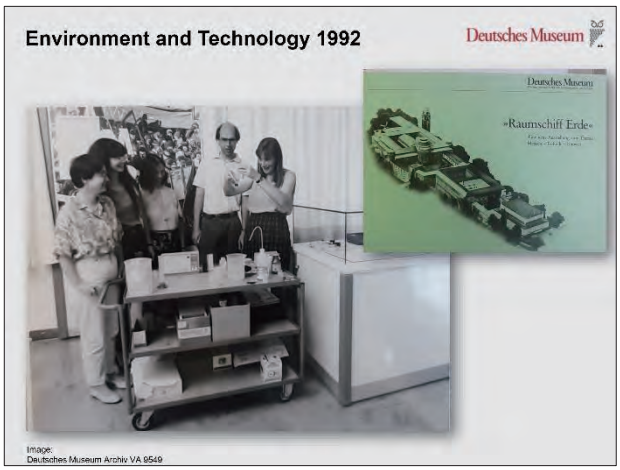
Quite remarkably, Rauck, a mechanical engineer and historian, even went on to draw conclusions to advise policy. The press release of the exhibition ends with his statement, probably very much in line of the direction that the development departments of German automobile industry were taking, that *"there is no doubt that the piston engine will remain to be the main driver for street vehicles [...] All our hope must be focused on clean and quite combustion engines."*

The exhibition was greeted by politics, with letters of congratulations arriving e.g. from the European Council shown here on the right. The curator's message apparently also was relayed by the press: The daily newspaper Sueddeutsche Zeitung in its short but very positive review wrote "piston engines for many years will remain to be the main driver for street vehicles." Sounds familiar, doesn't it?



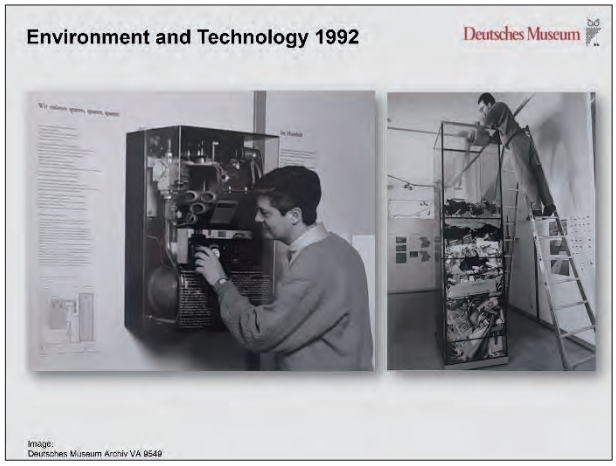
Moving beyond temporary installations, the museum management eventually decided in the mid-1980s that it needed a new dedicated and permanent gallery on environmental protection, and eventually sacrificed the geology hall to make room for an "environment" gallery that opened in November 1992. Its curator, Alexander Klein, was connected to activist groups in environmental protection, and chose to tackle the issues from the perspective of the most pressing contemporary problems, aided by a large scientific advisory board constituted by more than 15 university professors and engineers. The exhibition included hands-on models,

aimed at school-classes and family visitors, to educate the public on the impact of daily routines on the environment.



Unfortunately, the opening coincided with the festivities for a second temporary exhibition at the museum: models of public infrastructure made by the Spanish-Swiss architect Santiago Calatrava, which in contrast to the environment gallery, received national wide media attention. Moreover, geologist lobby organizations complained to the Bavarian government that the gallery with which they identified had been permanently removed.

The curators of the environment exhibition had formulated two ambitious goals: First, that the theme of the environment and environmental problems should, in the future, be addressed in all exhibitions as an interdisciplinary subject. Second, the contemporary but permanent exhibition would require frequent updated information by more recent research and data. Looking back, it is fair to say that both of these objectives were not fully met. While the environment gallery eventually moved to new spaces and did receive occasional updates, no conceptual restart was attempted by the museum for this permanent gallery.

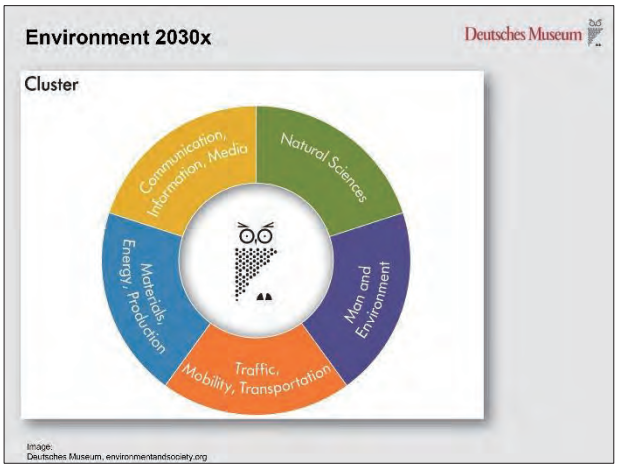


Moving two decades forward, the need to newly conceptualize and reinterpret earth system science was clearly demonstrated by the museum through its special exhibition "Welcome to the Anthropocene" that opened in 2014 and remained on display for almost two years. The exhibition, curated by Nina Möllers, Helmuth Trischler and their team, placed the long-term perspective of the fingerprint of human activity on earth in its center. Among the many exhibits that stood out and gave a powerful long-durée message was

a prototype of the so-called “clock of the long now”, seen above on the right. It is a clock design to operate for 10.000 years and thus possibility in the absence of the presence of humans if humanity becomes extinct.

Where are we heading in the near future?

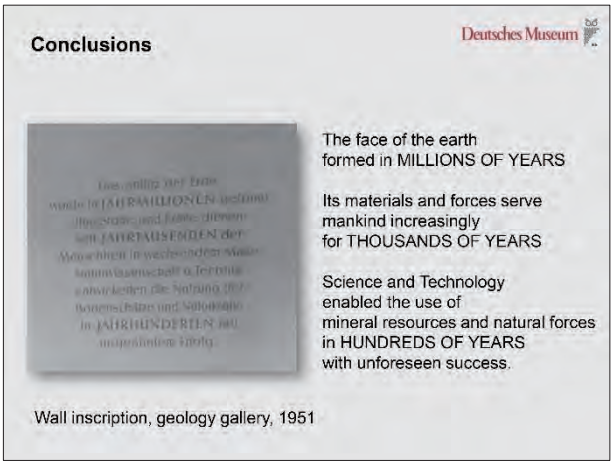
Since 2015, the Deutsches Museum is undergoing its largest renovation since its foundation. The entire building needing new infrastructure, all of the permanent galleries have been cleared and will be renewed. The reorganization also gives us a unique opportunity to analyze and rethink the development of the scientific organization of our exhibitions, and to define what it should look like for a museum in the 21st century.



In 2022, the museum opened 19 new galleries – the first half of its new portfolio that is organized in 5 exhibition clusters. Among these clusters, a permanent gallery of about 800 square meters on the subject of environment is to become part of the purple cluster. However, it is unclear when the museum will be able to realize this gallery, as it is presently not financed within the renovation project. Our present predictions therefore go beyond the year 2030 until an environmental gallery will be part of the museum experience again.

It is time to wrap up, let me conclude:

In the story I have outlined to you, an exhibition on a pressing contemporary and socially relevant subject killed the long-term view of earth history in the museum – Is it really as simple as this and does it have to be this way?

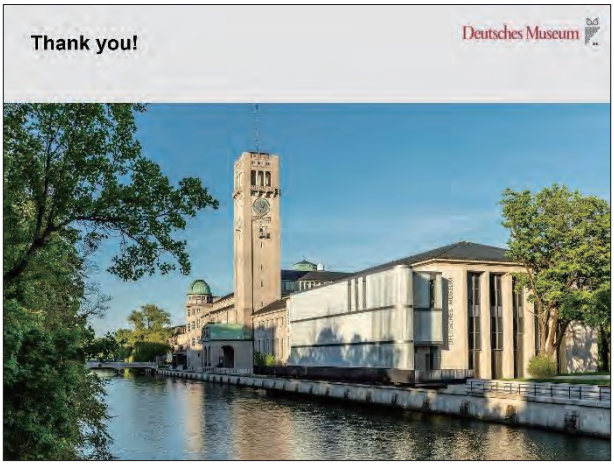


To answer my initial questions:

Did the Deutsches Museum ever have a long-term perspective? Yes - on and off. Exhibitions included longue-durée views including geology or the Anthropocene, others accentuated contemporary views such as the permanent gallery on the environment opened in the 1990s.

To the second part of the question: How did it get lost? In my view there are two

mechanisms at play here: For one, temporary exhibitions such as the Anthropocene by their very nature disappear, this is no surprise.



For the permanent gallery though, the educational goals led curators to playing off the didactical over the historical roots of environmental sciences. In other words, the desire to get the message through and to stress interdisciplinarity won over the contextualization in its long-term disciplinary roots. From this perspective, history, as general director Otto Mayr stipulated the 1980s, was primarily a method and not subject of the presentation. Engaging the visitor to form attitudes and opinion shifted the focus of exhibitions to the contemporary and immediate.

Where do we go in the near future? For the future the museum will need to assure a balance in its portfolio: addressing the expectations to inform about the problems of the here and now as well as serving a global educational mission.

The Anthropocene exhibition has proved that it is possible to combine both missions, and we hope to do so in the future. However, given the need of financial support for the next gallery, the question when again the museum will take a long term perspective is an open question for the future.

■ドイツ博物館に長期的視点はあったのか、そしてそれはいつ失われたのか？

ウルリヒ・ケルンバッハ（ドイツ博物館）

今年度の Artefacts の研究集会は東京の国立科学博物館で行われ、初のアジア開催となりました。本集会はこれまで長年にわたりヨーロッパとアメリカで開催されてきましたが、今回は主

催者様のご尽力により他の地域での開催が叶いました。また、今回選ばれたテーマも思慮深く賢明なものです。人工物と博物館学を通して、空間、時間、文化などの側面から、歴史を多次元かつ立体的に考えさせるものとなっています。博物館の大切な個々の収蔵品から広がる小宇宙の歴史――これを一般的な文脈に当てはめようとするとき、どのようなテーマを選ぶかということがどれほど難しいかは想像に難くありません。今回の研究集会の講演一覧を見ますと、このような大変興味深いプログラムを企画された主催者様のすばらしい仕事ぶりに改めて感謝とお祝いの意を表したいと思います。

今集会の最初の演者として、これほどの多様な視点への言及や、理論的な枠組みを描くことは出来そうもありませんが、今日皆さんと一緒に見ていきたいのは、自己点検と探求のありようです。ドイツ博物館の展示や収蔵品のポートフォリオが、100 年以上の歴史の中でどのように変化してきたかについて論じることで、他の博物館の文脈でも議論ができる、より一般的な問題について提起することができると思います。

まずは皆さんをドイツ博物館の入り口へご案内しましょう。2022 年 6 月まで来館者が目にしていた光景です。ミュンヘンの秋、肌寒い雨の日を思い浮かべてみてください。人混みをかき分け、ようやくドイツ博物館の扉の前へとやってきました。館内へと足を進めたら、展示室へ向かう前にまずはコートを預けます。

現在でも Google マップのストリートビューで確認できますが、こちらが以前のクロークルームです。ハンガーやロッカー、テーブル、ベンチシートがありますが、エントランスホール側の壁は少し様子が違っています。壁に埋め込まれたジオラマ、その真上には石膏像があり、文字も刻まれています。悪くはないですが、考えてみるとクロークルームのような機能的な空間にこうしたものがあるのは少し違和感がありますね。

これらの奇妙な装飾をよく見ると、どちらも 1951 年からここにあったことに気付かされます。石膏像の下には創世記第 1 章 1 節の「初めに、神は天地を創造された」という言葉が刻まれており、ジオラマにはアメリカのグランドキャニオンの地層が再現されています。

実を言えば、これらの展示物はかつての展示の名残りなのです。天然資源の展示は、ドイツ博物館創立以来 80 年以上にわたり、空間的にも知的な意味でも館内見学のスタート地点となっていました。実際、当館の創設者らは、地質学を展示の要と考えていました。

地質学の展示における神の存在とグランドキャニオンから、当初のキュレーション構想では、地球の年齢に関わる時間尺度、つまりは数十億年にわたるディープ・タイムや、グランドキャニオンの形成など数百万年単位の地質学的な時間尺度を取り入れようとしていたことが窺えます。

ジオラマには制作者による「探検家の肖像」を表現した人物が登場し、技術的な装置である双眼鏡を使って景観を眺めています。ドイツ博物館の展示室にあるこのような人工物の存在に

よって、より大きな文脈での疑問が浮かび、今回の私の発表テーマを考えるきっかけとなりました。すなわち、「ドイツ博物館に長期的視点はあったのか、そしてそれはいつ失われたのか？」というテーマです。

最初の問いに対する答えは、イエスでありノーでもあります。発表の中で説明していきますが、「イエス」の理由は、当館の創設者らの当初の構想ではそうした意図があったことが明らかなためです。そして「ノー」の理由は、リニューアルや改修に伴い、そうした目的よりも実際上の問題が優先されていったためです。地質学というテーマとその長い時間尺度が展示のポートフォリオからなくなったのは、現代の科学技術の課題を扱った、政策主導の展示への強い指向によるものです。また、1990 年代初頭には、社会的な問題や課題が博物館のテーマとなり、環境汚染に関する最初の常設展示のために、鉱業部門の目玉である天然資源の展示は撤去されました。

スタート地点に戻りましょう。ドイツ博物館は、1903 年に電気技師であるオスカー・フォン・ミラーの呼びかけにより創設されました。サウス・ケンジントン博物館やパリ工芸博物館などを訪れてその功績に感銘を受けたミラーは、20 世紀初頭、科学者と技術者への敬意や社会的地位を高める、ドイツ科学技術の殿堂を作ろうと考えました。

ミラーは、その収集方針において、36 に分類された収集分野のうち、自身が「精密自然科学」と呼ぶもの、すなわち現代科学とほぼ同等とされる分野の展開と、この分野が技術発展に与える影響を特に重視し、その他の領域は収集の対象から外しました。

1904 年、ミラーは次のように述べています。

「技術に影響を与えるものであり、したがって当館が展示対象とする科学分野は、数学、物理学、化学などのいわゆる『精密自然科学』に限定されます。植物学や動物学など、すでに自然史博物館に輝かしく展示されている記述的な自然科学については、鉱物学など技術に直接関連する分野のみを対象とします。」

他の収集分野が人間の活動に関連する前近代的な技術を含み、今日で言うところの「知の歴史」を記録することが目的となっているのに対し、地質学と鉱物学から成る収集分野 24 番は、地球上に人類が誕生する以前からの最も長い時間範囲を取り入れていました。

当館の創設者らは、来館者が展示室を直線的にたどる「有機的秩序」に基づき、連続した展示スペースに各収集分野を並べようとしました。1906 年から暫定的に使用していた博物館施設のフロアマップには、見学のスタート地点として、まさに鉱物学と地質学のセクションが記されています。キュレーターたちは、大自然の力が人間の生活を導き、ひいては科学技術の進歩をもたらしたとし、この展示分野は彼らの間で「頂点」と呼ばれるようになりました。

当館初の地質学ギャラリーは、この画像からも分かるとおり、展示物で埋め尽くされていました。氷河期におけるミュンヘン近郊の山地形成や、ゾントホーフェン周辺のジュラ紀の化石含有物など、特定の地域の地質年代学について説明するものもあれば、鉱物学や、地震活動・

岩盤形成などを扱う地質学といった包括的なテーマに沿った展示物もありました。キュレーターの論理に基づいて、地質学ギャラリーの次は鉱業分野の展示へ進むようになっており、こうした天然資源をどう活用するのかを示すという流れになっていました。

細かいことですが、ここで指摘しておきたい点があります。ギャラリーの入口扉には「出られません」という掲示があり、引き返すことができません。来館者は一度入室したら、展示物に興味があろうとなかろうと進み続けるしかありませんでした。

博物館とその収蔵品が専用の建物に移動したのは、1925 年になってからのことです。広々としたエントランスが特徴で、ここでも館内見学のスタート地点は地質学ギャラリーとなっていました。広い展示空間には大きな立体地形模型も設置されました。

地球内部の構造に関する展示演出には、地表から地核までの距離について最新の地震学的証拠が取り入れられるようになりましたが、当時まだ受け入れられていなかった大陸移動説についての言及はもちろんありませんでした。

地質学に特化した展示によって地質年代の時間尺度を明確に取り込む一方、当館では前近代の歴史と技術の発展に関連性を持たせようとしました。しかし、金属生産や造船や楽器の歴史など、扱うべきテーマのほとんどに実物資料がなかったことから、進歩主義による歴史の投影に逆戻りしています。進歩主義では、人類の文化的発展は普遍の原理に基づいており、したがってどの国でも同じステップやスキームを辿るとされています。そのため、当館が創設された当時の非西洋社会の文化は、ヨーロッパで起こった過去の発展を収めたタイムカプセルであると考えられていました。

前近代の技術発展の遺物だとするものを記録・収集するにあたり、当館では、ヨーロッパ外の植民地とつながるための外交ルートと貿易商の両方を頼りました。こちらの画像は 1925 年にオープンした展示の様子で、鉱石から鉄を取り出しています。原始的な――それゆえ初期の――技術の例として炉の模型が設置されていますが、これは 1913 年から 1914 年にかけてドイツがカメルーンの植民地でおこなった探検で集めた資材から作られています。当館の科学職員であるベルンハルト・ヴェルレ博士が実施した来歴研究によると、進歩主義を実践した展示は、民族学的研究によって 19 世紀からの長期にわたり否定されてきたにもかかわらず、1950 年代まで断続的に続いていたことが分かっています。

第二次世界大戦により、地質学ギャラリーの展示物は深刻な被害を受け、多くの模型が破壊されました。ギャラリーは 1951 年に再開し、こちらの画像にあるとおり空間の余白を増やして密度を下げ、さらに、当館の工房とミュンヘンの芸術家ギュンター・フォーゲルスマーによって制作されたグランドキャニオンのジオラマが新たに設置されました。石膏の神像は、ミュンヘンの彫刻家フランツ・ミコライによって制作されたものです。当時の館長らはこの石膏像について、自然の謎はすべて人類によって解明されるわけではなく、科学が限界に直面したと

き、そこには信仰の余地があることを思い出させてくれるものだと説明しました。

このスタンスが物議を醸します。ギャラリーが再開してまもなく、博物館における本像の位置付けや芸術的な質の低さが批判され、ギャラリーから石膏像を撤去するよう求める声が公然と上がりました。結論から言うと、そうした批判は次第に消えていき、父なる神の石膏像は、さまざまなギャラリーの状況や用途の変化を経て、現在の位置に留まることとなったのです。

1970 年代には、多くの国々で環境保護を求める市民運動の高まりが見られました。西ドイツも例外ではなく、最終的には地方レベルでの政治的な力の獲得につながり、1980 年代には国家レベルにまで至りました。同じ頃、地球システム科学という概念は、環境問題やその兆候に関するデータに基づいた体系的な視点を取り入れようとしていました。発見的手法のレベルでは、このことは、ドイツ語の単語「Umweltschutz（環境保護）」の使用が 1960 年代から急増していることから見て取れます。

歴史の専門家らは、政治と社会において環境への意識が高まり始めたきっかけとして、1970 年のいわゆる「欧州自然保護年」があると指摘しています。1966 年に欧州評議会によって宣言され、1970 年に開始したこの取り組みに端を発し、イギリスで行われたこちらの画像のような小規模な巡回展など、ヨーロッパ各国で数多くの運動が巻き起こりました。西ドイツだけでも 500 以上の催しが開かれ、環境という喫緊の課題に対して、多くの人々の意識を向上させました。さらに 1970 年、バイエルン州はマックス・シュトライブル大臣を長とするドイツ初の環境省を創設しています。

ドイツ国内での意識の高まりにより、当館にもその波が押し寄せてきました。社会情勢や政治情勢の変化に対応し、現在の環境問題に取り組むことが求められましたが、当初はこうしたテーマを各ギャラリーでの地球科学の展示演出にどう組み込むかなどと考えることはあまりありませんでした。

展示物を通して環境への懸念を伝える試みは、ミュンヘンオリンピックが開催された 1972 年に初めて実現します。ミュンヘンでのオリンピック開催が決まったことで交通インフラは大きく変化し、いわゆる「オリンピア U3 線」など、地下鉄システム拡大のために巨額の投資が行われました。

しかし、当館が当時伝えたメッセージは、政治と業界の声を反映するものだったように思われます。1972 年 8 月、バイエルン州のマックス・シュトライブル環境大臣とドイツ自動車産業界からの手厚い支援を受け、「環境にやさしいモビリティ」と題した特別展が開催されました。

この特別展は交通による排気ガスや公害を中心に、特に公共交通機関における磁気浮上方式や e モビリティといったコンセプトなど、現代的な代替手段も含めた解決策について論じるものでした。しかし、この展示のキュレーター、マックス・ラウクであればおそらくこう主張したと思いますが、公共交通機関は「時間や旅程に縛られたくない」という市民の願いに応えるものではありません。

注目すべきことに、機械工学者であり歴史の専門家であったラウクは、政策に助言をするよ

うな結論まで導き出しています。特別展のプレスリリースは、ドイツ自動車産業界の開発部門が取っていた方向性と非常に一致していたであろう、ラウクの次のような発言で締めくくられています。「自動車の動力源としてピストンエンジンが今後も主流となることは間違いなく、（中略）今後はクリーンで静音な内燃エンジンに全力を注ぐべきである」

この特別展は政治的に歓迎され、画像の右側に示すとおり、欧州理事会などからも祝辞が届きました。また、キュレーターのメッセージはメディアでも伝えられたようです。日刊紙「南ドイツ新聞」には、短いながらも非常に肯定的な批評が書かれています。「自動車の動力源として、ピストンエンジンは今後も長期にわたって主流となる」。何やら聞き覚えがありますね。

環境保護の展示は一時的なものにとどまらず、ついに 1980 年代半ば、当館の経営陣の判断の下、専用の常設スペースを新たに設けることが決まりました。最終的には地質学ギャラリーを犠牲にして作ったスペースに「環境」ギャラリーが入り、1992 年 11 月に公開が開始されます。環境ギャラリーのキュレーター、アレクサンダー・クラインは、環境保護団体とつながり、15 人以上の大学教授や技術者から成る大規模な科学諮問委員会の支援を受け、火急の現代的課題という視点をもって環境問題に取り組みました。ギャラリーには学校の授業での来館や家族連れを対象とした体験型の模型が配置され、日常生活が環境に与える影響について一般の人々が学べる場となるようにしました。

しかし残念なことに、スペイン/スイスの建築家サンティアゴ・カラトラバが設計した公共インフラの模型を展示する当館の第 2 回企画展の祝典が同時に開催され、全国のメディアからの注目がそちらに集まったため、環境ギャラリーは対照的な結果となってしまいます。さらに、地質学者のロビー団体がバイエルン州政府に対し、地質学ギャラリーを完全撤去したとして不満を訴えました。

そこで、環境ギャラリーのキュレーターたちは 2 つの大きな目標を掲げます。1 つ目は、環境および環境問題に関するテーマは、多分野にまたがる議題として今後すべての展示室で取り上げること。2 つ目は、現代的課題でありながら常設されている展示については、最近の調査やデータに基づいて情報を頻繁にアップデートすること。振り返ってみると、これらの目標は 2 つとも十分には達成されなかったと言っていいでしょう。環境ギャラリーは最終的に新たなスペースに移動し、アップデートが行われることもありましたが、環境の常設展示に対する構想が再編されることはありませんでした。

それから 20 年後、2014 年から約 2 年にわたって開催された特別展「人新世へようこそ」により、地球システム科学に関する新たな概念化や再解釈の必要性が明確に示されることとなります。ニーナ・メラーズとヘルムート・トリシュラーが率いるチームが企画・運営を担当し、地球上における人間活動の痕跡という、長期的な視点が中心となっていました。画像の右上部にあるのは「ロング・ナウ時計」のプロトタイプで、たくさんの展示物の中でもひときわ目立ち、長期持続のメッセージを力強く発信していました。この時計は一万年にわたって時を刻む

よう設計されており、人類が絶滅して人間が存在しなくなる可能性を見据えています。

一方、近い将来の方向性についてはどうでしょうか。

ドイツ博物館は、2015 年より創設以来最大規模となる改修を行っています。建物全体に新たなインフラが必要となったため、常設展示は現在すべて撤去され、今後リニューアルを予定しています。この改修は、当館の展示の科学上の構成がどのように展開してきたかを分析・再考し、21 世紀の博物館の在り方を見つめ直す特別な機会となっています。

2022 年、当館では 19 のギャラリーを新たにオープンしました。これは、5 つの展示グループに分類した新たなポートフォリオの半分に相当します。環境をテーマとする常設スペースの面積は約 800 平方メートルで、展示グループのこの紫色の部分に含まれます。しかし、現状では環境ギャラリーは改修プロジェクト内での資金調達がされていないため、リニューアルがいつになるかは明確ではなく、現時点で環境ギャラリーが再開する見込みは 2030 年以降となっています。

では、そろそろまとめに入りましょう。

これまで説明してきた内容から、喫緊の現代的・社会的課題をテーマにした展示を扱うことで、博物館における地球の歴史という長期的視野が失われたことが分かりました。しかし、本当にそれほど単純なことなのでしょうか。そうなるしかないのでしょうか。

「ドイツ博物館に長期的視点はあったのか？」この最初の問いに対しては、断続的にはそうであったという意味で「イエス」と言えます。地質学や人新世などでは長期持続の概念を取り入れた展示が行われましたが、1990 年代に始まった環境をテーマにした常設展示は今日的課題に基軸を置いたものでした。

もう一つの問いである「いつ失われたのか？」に対しては、私の見解では二つのメカニズムが存在します。一つは、人新世のような企画展示はその性質上消失するということで、これは驚くことではありません。

一方で常設展示は、教育的な目的から、キュレーターたちは環境科学の歴史的ルーツよりも教訓的ルーツを重視するようになりました。つまり、メッセージを届けたいという願いや、学際性を強調することが、環境科学を長期的な学問的ルーツに即して文脈化することに勝利したのです。この視点から見ると、1980 年代に館長のオットー・マイヤーが規定したとおり、歴史というのは第一義的には手法であり、展示のテーマではなかったと言えます。来館者に自分の態度や意見を形成させるため、展示の焦点は今日的かつ身近なものへと移行していきました。

近い将来の方向性については、今後は今ここにある課題を伝えるだけでなく、グローバルな教育使命を果たすという期待にも応えながら、博物館のポートフォリオのバランスを保っていく必要があります。

人新世の展示は、この 2 つのミッションが融合可能であることを証明しました。私たちは、今後もそうであることを願っています。しかし、次のギャラリーに資金援助が必要なことを考えると、当館がいつ長期的視野を取り入れた展示を再開できるのかについては、これから考えていくことになるでしょう。

2）Remaking Museums: Examining the Scholarly and Intellectual Frameworks for the Material Heritage of Science and Technology as Seen in Museum Renovations

Margaret A. Weitekamp (Smithsonian National Air and Space Museum)

I became a museum curator more than 19 years ago, but it's in the past ten years, since 2013, that I have been thinking even more actively about the purposes of museums, how we define their goals, and how museums engage in the world by the arguments they make and the roles that they play as institutions. Within our walls, we endeavor to use artifacts to "show it, not tell it" and engage visitors by drawing them into inquisitive, insightful encounters with authentic objects. On the web and through outreach, we aim to bring the insights drawn from our scholarship and collections to inform, educate, and inspire action.

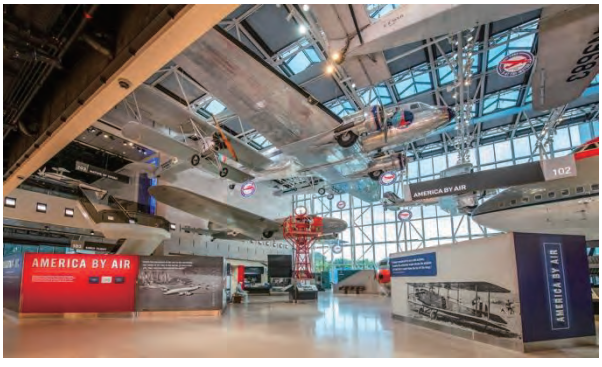
What I thought I would do this afternoon is talk to you a little bit about where the Smithsonian's National Air and Space Museum is today, how that has inspired the intellectual history that I beginning to investigate, and why this gathering seems like the perfect venue for raising these questions. What I actually proposed when I applied for this Artefacts meeting was a presentation about a potential comparative study of how national museums of science and technology, around the world, have been engaging in renovations and re-envisionings in the 21st century, a project that I am just beginning to explore. The conference organizers generously suggested that that subject could serve as a keynote address. So here we are today. I'll begin with where I began in this thought process.

In 2013, the Smithsonian's National Air and Space Museum started the project of rethinking our central hall for a major renovation, inspired by a significant donation from the aircraft manufacturer, Boeing. As my fellow curators and I worked collectively to develop the concept document defining the intentions and use of the space, I volunteered to write the executive summary for our then-Director. That led to me becoming the lead Space History curator on what was renamed as the Boeing Milestones of Flight Hall. That project involved reimagining and redesigning the central exhibit space and entranceway to the National Air and Space Museum's building on the National Mall in Washington, DC. In the end, our core team used five broad themes to guide the interpretation of the Smithsonian's collection of aviation, spaceflight, and planetary science artifacts. Obviously, we focused on Science and Technology, but also Politics and Power, People, Business and Economics, and Culture. Our thesis was that aviation and spaceflight have transformed the world, both for good and in ways that are much more complicated. That second part very much shaped how we thought,

but in execution it got summarized on the wall as simply, “Aviation and spaceflight have transformed the world.” The Hall reopened in July 2016, which was the building’s 40th anniversary and not coincidentally the United States’ 240th birthday. The Museum’s flagship building had been a bicentennial present to the United States in 1976.

“One World Connected” Exhibit (Smithsonian photo by Jim Preston) [NASM2022-06545]

We are now in the midst of a subsequent seven-year renovation. I’d like to think that the work that our team did reimagining Milestones influenced the process in which we are now immersed. It did help, I think. But the real impetus was far more practical and already in progress even before 2013. On August 23, 2011, a 5.8-magnitude earthquake occurred in Virginia, southwest of Washington DC. It caused immediate, visible damage to large structures, including the Washington Monument and the National Cathedral. When structural engineers inspected the Museum’s building for possible damage, however, they did not find new problems. What they documented instead was what those of us who worked there already knew: the building was badly deteriorating. The waterproofing barriers leaked, the heating and cooling was inconsistent at best. That’s hard on people but it’s worse for the artifacts. Most visibly, the exterior stone cladding, which had been installed when the building was built in the mid-1970s, was too thin, warping, and in danger of popping off the walls altogether. So, in 2018 (government processes can run slowly), the Museum began an immense project called revitalization and transformation. Revitalization is what we are calling the rebuilding of the National Mall building itself, using federal funds. The physical structure. Transformation is the redesigning of more than 20 galleries and public spaces using private philanthropy to fund the changes. It’s a daunting task. Almost four years into the project, half of the Museum’s building reopened to the public last fall, in October 2022, with eight new galleries. The remaining half of the building, along with all of the central and east end exhibits, will be completed in phases ending in 2026.



“America by Air” Hall (Smithsonian photo by Jim Preston) [NASM2022-06229]

I begin with this history of the National Air and Space Museum’s recent past because it strikes me that a number of national science and technology museums, many represented in this room, have followed a similar pattern in recent years. At risk of telling some of you your own histories, I will summarize a few.

In 2014, the Canada Science and Technology Museum building was abruptly closed due to structural instabilities and airborne mold. Their renovations, which cost 80.5 million Canadian dollars, were completed in 2017. They both upgraded the physical plant and re-envisioned the exhibits. I remember talking to Bryan DeWalt at the Artefacts meeting in London in 2016 about how challenging it was to rethink so many different exhibits at once, balancing creating new content and fresh artifact-rich exhibits, while also holding on to beloved objects and hallmark experiences that were signatures for their visitors.

Navigators on the History of Earth

Our host museum for this year's Artefacts meeting has done its own rethinking and rescoping. In 2004, after two phases of construction, the museum held the grand opening for the beautiful, multistory Global Gallery. Its content reflects the museum's shift, since the 1970s, to a major focus on natural history. But that is not their most recent renovation. The curators have already updated large sections of that space. In 2015, after a year of work, this museum opened the renovated north end of the Global Gallery. "Navigators on the History of Earth," welcomes visitors to encounter three broad themes: the History of the Universe, the History of Life, and the History of Humankind. Three other new exhibits – Investigation Technology for the Earth, Exploring the Structure of Nature, and a new paleontology exhibit, "Evolution of Life: Exploring the Mysteries of Dinosaur Evolution"– opened at the same time, along with a family-oriented exploration space called ComPaSS. As I learned in conversation with three of the curators who generously sat down to conversations with me on Friday, these exhibits aim to introduce "the History of Life on Earth -- human beings in coexistence with nature."

Investigation Technology for the Earth

To offer another example, also in 2015, the Deutsches Museum started a major project of renovation and modernization. You have just heard a thoughtful talk about that museum's vision. Another of the founding Artefacts member institutions, the Science Museum, London, undertook major collections relocations while also supporting new exhibit development, after the closure of Blythe House in 2019. To offer a final example that is also ongoing, the Powerhouse Museum in Sydney, Australia is constructing a new site, Powerhouse Parramatta

in Western Sydney. Calling this "one of the world's most significant new museum projects," they aim to combine "community, industry, and collection … to create a dynamic culturally engaged program that will redefine museums." Because they will be based in Parramatta, "one of Australia's fastest growing and most diverse communities," they are thinking deeply and self-consciously about the role that a museum plays in its community.

"Destination Moon" Exhibit (Smithsonian photo by Mark Avino) [NASM2022-06640]

These institutions share many other commonalities. All are all major national museums founded to preserve the material heritage of science, technology, and the natural world. Each boasts impressive artifact collections. More so, all of these institutions have professional curatorial staff who have guided these major renovations not only as operational projects but as intellectual undertakings.

Each of these museums has also evolved in scope and content from their initial origins in the 19th century. The National Museum of Canada was founded in 1842; the Smithsonian Institution dates back to 1846. The Science Museum in London lists its date as 1857 but it traces its history, in some ways, as far back as the founding in 1754 of the Society of Arts, an organization that hoped to buttress British manufacturers by encouraging the sciences and fine art. This year's Artefacts host institution first opened in 1871 to educate people about the "foundations of modern industry." The Deutsches Museum was founded in 1903 – although its origins were rooted in an electricity exhibition in 1891.

Yet these museums are all taking on bold new projects. When I survey the publications coming out of museums in recent years, I am seeing museums actively engaged in scholarly conversations regarding pressing global questions, from the Anthropocene to climate change. Exhibits are telling more diverse stories. Curators have worked to include histories of women, racial or ethnic groups, or indigenous people, whose contributions have been previously neglected or ignored. I see national museums working to incorporate more global frameworks and to illustrate the international networks that may have been obscured in favor of nationally focused stories. As always, exhibits are being shaped by intellectual questions informed by the latest scholarship in the field – and carried by artifacts, presented in conversation with interactives and experiential elements.

Whether facing the task of fundamentally relocating or rebuilding a section or all of a museum, or just building one new gallery, remaking a museum is a daunting task. Major renovations tend to be driven, not primarily by the intellectual or curatorial desire to reinterpret, but rather by the practical considerations of museum buildings, taking into

account the physical safety of people and artifacts in aging facilities. We often talk about the triangle of budget, schedule, and quality. To achieve any two of these, the third tends to suffer. Practical realities like that can constrain creative decisions. And yet, as you well know, the best exhibits represent significant intellectual and scholarly work.

"Kenneth C. Griffin Exploring the Planets" Exhibit (Smithsonian photo by Jim Preston) [NASM2022-06440]

So my keynote address this afternoon serves two purposes. The first is admittedly a bit self-serving. As I've said, I'm beginning a project comparing a handful of case studies of 21st century renovations of national museums of science and technology around the globe. In many ways, I see today's talk as much like the kind of formative analysis and evaluation done in the early phases of building an exhibit – an exploration of expectations, assumptions, and goals. The museum examples that I have outlined in the last few minutes are just some possible case studies. Part of my purpose here today, and this week, is to suss out what other examples should also be considered. I am eager to get your feedback and suggestions over the next few days.

I'm not looking to gather construction horror stories. Procedural histories of these renovations would only tell part of the story anyway. Renovations driven by practical needs are nonetheless opportunities for reflecting intellectual, scholarly, curatorial goals. Therefore, in addition to examining object choices and how that work was done within the constraints of budget and schedule, I want to take a larger view at the intellectual projects that museum embody, to investigate how curators at these museums took on the challenge of redefining the stories told. What intellectual and scholarly frameworks guided renovations? How did that affect collecting? And how are public audiences responding to the wide-angle, long-range views being presented? I kept this project prospectus as a focus in this keynote because I think, at its core, these are the kinds of questions that the Artefacts consortium has been asking since it was founded in 1996. And that the Artefacts volumes seek to gather and publish. In some ways, this project draws inspiration by the four interviews included at the end of the 11th volume of the Artefacts series, *Challenging Collections*.

My second purpose today, then, and my final point for this talk, is to articulate that provocation at the heart of the Artefacts consortium – our call to connect with other museum professionals immersed in reconceptualizing the work of museums, especially those grappling with the complex histories of science, technology, and medicine.

Whether or not your museum is immersed in a massive construction project, all of us are grappling with the larger questions of how best to take collections and institutions that may have histories that stretch back decades, and bring them effectively to 21st century

audiences, informed by our current scholarship and collecting. We are a part of living institutions with commitments both to serving our publics (whether that's in person and online), and also to serving as research institutions, using collections to drive new scientific discoveries, historical research, and cultural understanding. Our program this week will offer insights from around the world about exhibits and artifacts that will challenge us to think in new ways and to learn from each other so that we can take those insights back to our home institutions.

I am excited to get started. And I thank you for the chance to kick off these conversations.

■博物館の再生を目指して：博物館の改修における有形科学技術遺産の学術的・知的枠組みを考える

マーガレット・A・ワイテキャンプ（スミソニアン航空宇宙博物館）

私が博物館の学芸員になったのは、19 年以上も前のことです。しかし、博物館の目的や学芸員の目から見た博物館の目指すもの、提言活動を通した博物館と世界の関わり、一つの機関としての博物館の役割について積極的に考えるようになったのは、今から 10 年前の 2013 年以降になってからのことでした。当館では、館内において「語る展示ではなく、見せる展示」を心がけながら、実物資料を使用して来館者の好奇心・探究心を育む一方で、ウェブやアウトリーチ活動を介して学術活動と収蔵品の魅力を紹介するなど、情報発信、教育、行動啓発にも取り組んでいます。

本日は、スミソニアン国立航空宇宙博物館の現状や、それをきっかけとして私が始めようとしている知の歴史の研究、そしてこれらのトピックをご紹介するのにふさわしい場としてこの年次集会を選んだ理由について、少しお話したいと考えています。私は最近、世界の国立の科学系博物館が 21 世紀に取り組んできた改修・見直し作業に関する比較研究を始めました。Artefacts の年次集会に申し込んだ当初は、この潜在的な研究課題について発表を行うつもりでしたが、主催者側からぜひ基調講演でこのテーマを取り扱ってほしいとのお声がけをいただ

き、今この場に立っています。まずは、私が現在の考えに至った経緯についてお話させてください。

2013 年、スミソニアン国立航空宇宙博物館は、航空機メーカーのボーイング社から多大なご寄付をいだたいたことをきっかけに、大規模改修に向けてメインホールの見直しを行うプロジェクトを始動させました。その際、私は同僚の学芸員たちとともに展示スペースの意図や用途について説明したコンセプト資料を準備したついでに、別途自身でプロジェクトの概要書も作成し、当時の館長に提出しました。その結果、改称後の「ボーイング・マイルストーンズ・オブ・フライト・ホール」において、宇宙開発史を担当する学芸員のチーフをまかされることになったのです。プロジェクトでは、ワシントンのナショナル・モールにある国立航空宇宙博物館のメイン展示スペースと入口通路のイメージやデザインを刷新するとともに、スミソニアン協会が保有する航空・宇宙飛行・惑星科学関連の収蔵品について理解してもらうため、作業チームにおいて「科学」、「政治と権力」、「人類」、「ビジネスと経済」、「文化」という 5 つの幅広いテーマを設定しました。「航空・宇宙飛行は、良い意味でも、非常に複雑な意味でも世界を変えた」というのが私たちの考えであり、特に後半の内容は核心部分になります。ただ、実際の展示室内ではこれを要約したうえで、シンプルに「航空・宇宙飛行は世界を変えた」としました。 同ホールは、博物館創立 40 周年の 2016 年 7 月にリニューアルオープンしたのですが、博物館の本館がアメリカ合衆国の建国 200 周年にあたる 1976 年に建てられたため、当然ながら、建国 240 周年とも重なることになりました。

現在は、工期 7 年の後続工事が進められていますが、私のチームが行った同ホールの見直しが進行中の作業にも良い影響を与え、何らかの形で貢献していると信じています。一方、この一連の改修作業は、実は非常に実務的な理由から行われているもので、そのきっかけも 2013 年より前に起こったある出来事にありました。2011 年 8 月 23 日、ワシントン D.C.南西のバージニア州で M5.8 の地震が発生し、ワシントン記念塔、ワシントン大聖堂などの大型建築物が目に見える損傷を受けたのです。当館においても、建築の専門家に損傷状況の調査を依頼しましたが、新たな問題は見つかりませんでした。その代わり報告書には、当館のスタッフでもすでに把握していた内容が記載されていました――「建物がひどく劣化している」。防水層からは水漏れがあり、空調も十分に機能しないなど、人間はもちろん、収蔵品にも大きな影響を与える不具合が見られました。なかでも目立ったのが、当館が建てられた 1970 年代中頃に設置された、外壁に貼られた石材でした。薄すぎて歪んでおり、今にも剥がれ落ちそうになっていました。ただ、政府の対応は遅く、2018 年になってようやく、「再生」と「変革」をテーマにした大規模プロジェクトが行われることになったのです。そのうち、「再生」はナショナル・モールの建物そのもの、つまり物理的構造物の改築を指し、連邦基金から資金が提供されます。一方、「変革」は 20 以上のギャラリーや共用スペースのデザインの刷新を指し、民間の慈善活動で必要な資金を集めなければなりません。まさに気の遠くなるような作業です。そして、プロジェクト開始から 4 年が経過した昨年秋の 2022 年 10 月、8 つの新たなギャラリーとともに博物館の半分のエリアが再開されました。なお、中央と東側の展示スペースを含む残り半分のエリアについては、2026 年に完成する予定です。

この場にも代表者の方がたくさんいらっしゃいますが、国立の科学系博物館の多くが近年同

様の問題に直面していると実感しています。ですので、まずは国立航空宇宙博物館の最近の状況についてお話させていただきました。関係者の方ならすでにご存じかとも思いますが、ほかの博物館の状況についても簡単にご紹介します。

カナダ科学技術博物館は、建物の構造劣化と浮遊カビの被害により、2014 年に突然の閉鎖を余儀なくされた後、設備更新と展示方針の見直しのため、8,050 万カナダドルをかけて改修を実施し、2017 年に完了させました。2016 年にロンドンで開催された Artefacts の年次集会で、ブライアン・デウォルト氏とお話をしたのですが、人気の展示物や目玉の体験コーナーを含め、来館者に親しまれてきた要素を残しつつも、これまでにないコンテンツを取り入れ、新鮮かつ資料の面で充実した内容にしなければならないなど、一度に多種多様な展示を見直すのは、非常に難しい作業であるとおっしゃっていました。

ちなみに、本年の Artefacts の年次集会を主催してくださった国立科学博物館でも、見直しと再編に取り組んでおり、2 期にわたる工事を経て、2004 年に地球館がグランドオープンしています。地球館は、複数の階から成る美しい施設で、国立科学博物館が 1970 年代から注力している自然史に関連した展示が行われています。しかし、改修はこれだけにとどまりません。学芸員たちの手により、地球館の展示スペースの大部分が更新されることになったのです。そして、1 年間の作業の後、2015 年に地球館北側部分がリニューアルオープンし、宇宙史・生命史・人間史の壮大な物語をテーマにした「地球史ナビゲーター」のほか、「科学技術で地球を探る」、「自然のしくみを探る」、古生物学を取り扱った「地球環境の変動と生物の進化－恐竜の謎を探るー」の 3 つの新たな展示室、さらに「親と子のたんけんひろば コンパス」が同時に公開されました。先の金曜日に同館の 3 人の学芸員の方と座って歓談する機会があったのですが、これらの展示は「人類と自然の共存をめざして」をテーマにしているそうです。

もう一つ、別の事例をご紹介します。同じく 2015 年になりますが、ドイツ博物館で大規模な改修と刷新が行われました。ドイツ博物館のビジョンについては、先ほど詳しくご紹介いただいた通りです。一方、Artefacts の創設機関の一つであるロンドン科学博物館では、収蔵品の移転と新設展示の企画のため、2019 年にブライス・ハウスを閉鎖しています。最後の事例は、オーストラリアのシドニーにあるパワーハウス博物館です。同館では、「世界で最も大規模な博物館改修プロジェクト」と銘打ち、「地域社会、産業界、収蔵品をつなぎながら、博物館の再定義に向けてダイナミックかつ文化的価値のあるプログラムを創出すること」を目指し、西シドニーにおいて、新館となる「パワーハウス・パラマッタ」の建設を進めています。 また、オーストラリア屈指の成長性と多様性を誇るパラマッタに移転するにあたり、地域社会における博物館の役割を自身の視点から深く見つめ直そうとしています。

科学や自然に関わる有形遺産を保護するために設立された国立の機関であること、貴重な資料を収蔵していること、プロの学芸員が運営業務と知的活動を兼ねて大規模改修を推進していることを含め、これらの博物館には、ほかにも多くの共通点があります。

また、いずれの博物館も、19 世紀の設立当初と比べて規模や内容が大きく変わりしました。ちなみに、創立年はカナダ科学技術博物館（旧カナダ国立博物館）が 1842 年、スミソニアン協会は 1846 年です。ロンドン科学博物館は 1857 年の創立とされていますが、その歴史をたどると、科学と芸術の振興を通してイギリスの製造業者を支援するため 1754 年に設立された工芸振

興協会と関係していることがわかります。なお、今年の Artefacts の主催機関である国立科学博物館は、「近代産業の基礎知識」の周知を目的として 1871 年に設置されました［日本語版編注：これはむしろ、国立科学博物館だけでなく近代日本における博物館の起源となった湯島聖堂の博覧会を指している］。 このほか、1903 年創立のドイツ博物館は、1891 年の電気技術博覧会がその起源であると言われています。

古い歴史を持っているとはいえ、これらの博物館は新しい取り組みにも果敢に挑んでおり、それぞれの最近の出版物を見てみると、人新世から気候変動に至るまでの世界の喫緊の課題に対し、学術の観点から積極的に提言を行っていることがわかります。一方、展示の面においても、これまで軽視されてきた女性や人種・民族、先住民の歴史に言及するなど、多様性に配慮した内容が増えています。これは、グローバルな視点を取り入れながら、国内向けの展示では見えにくい、世界とのつながりを示そうという動きの表れだといえるでしょう。各分野の最新の学術研究から生まれた知的な疑問に基づき、さまざまな資料を通して双方向的かつ実験的な対話を図る、そのような展示が常に行われているのです。

博物館そのものの移転や建物の一部または全体の改築にしろ、一つのギャラリーを新設するにしろ、博物館の再生には多大な労力がかかります。ただ、大規模改修の場合、知的・学芸的な再解釈が主な目的となることはあまりありません。それよりも、老朽化した施設が「ヒト」と「モノ」の物理的な安全性に与える影響を考慮し、博物館の建物に関連する実務的な対策を優先することのほうが多いといえるでしょう。予算、スケジュール、質の 3 つのバランスを考えた場合、いずれか 2 つを優先すれば、残りの 1 つが犠牲になるという話をよくしますが、このような実務上の問題は、クリエイティブな意思決定の妨げになります。しかしそれでもなお、最高の展示を生み出すには、多大な知的・学術的作業が必要であることは、みなさんもご存じの通りかと思います。

この基調講演には、2 つの目的があります。そのうち、一つ目の目的は、少し個人的であると言わざるを得えません。先ほどお話した通り、私は、世界中の国立の科学系博物館が 21 世紀に取り組んできた改修事例の比較研究を始めました。期待される効果や想定条件、目標を調べるという意味で、本日の講演の内容は、展示の企画段階で行われる形式的な分析・評価と多くの点で似ているように思います。ついさっきご紹介したいくつかの博物館の取り組みは、潜在的な事例研究のほんの一部に過ぎません。ほかにも検討すべき事例があるはずですし、それを見つけることが今回の年次集会における私の目的の一つでもあります。そのため、年次集会期間中にご意見やご提案がございましたら、ぜひお知らせいただければ幸いです。

ただし、工事関連の苦労話を集めたいわけではありません。工事の過程は、あくまで改修の一部に過ぎないからです。改修は、たとえ実務上の必要性から行われる作業であったとしても、知的・学術的・学芸的な目標を反映させる良い機会であることには違いありません。そのため、展示品の選定や予算・スケジュールの調整に関する分析に加え、広い視野から博物館の知的プロジェクトを捉えることで、これまでの展示内容を再定義するという難しい課題に学芸員たちがどのように取り組んできたのかを調査したいと考えています。改修の指針となった知的・学術的枠組みにはどのようなものがあるか、改修によって収蔵活動にどのような影響があったか、博物館の広範かつ長期的なビジョンに対して一般大衆がどのように反応しているかな

ど、疑問点はたくさんありますが、これらはいずれも、Artefacts が 1996 年の創設以来問い続けてきた命題や、Artefacts の出版物の趣旨と本質的な部分で共通しているように思います。また、研究に際しては、Artefacts シリーズの第 11 巻『Challenging Collections』（困難な収蔵活動）に収録されている 4 つのインタビューからもインスピレーションをもらいました。この基調講演で、私が自身の研究課題に関する話をしているのは、このような理由からなのです。

そして、博物館活動の新たな概念の構築に向けて取り組んでこられた関係者のみなさん、なかでも科学史、技術史、医学史などの難しい分野に携わる方々が一堂に会するこの Artefacts の年次集会において、私の研究に対する強い想いをお伝えすることが、本日の私の第二の目的であり、この講演の最後のトピックです。

大規模な工事を行っているかどうかにかかわらず、この場にいるみなさんは、既存の学術・収蔵活動で得られた知見に基づき、長い歴史を有する博物館とその収蔵品を最大限に活用しながら、21 世紀の大衆に向けて効果的な展示を行うにはどうしたらいいかという大きな命題に取り組んでいます。私たちは「生きた」機関の一部であり、そこには対面やオンラインの形式で大衆に奉仕するとともに、研究機関として収蔵品を通して新たな科学的発見、歴史研究、文化的理解を促進するという理念があります。今回のプログラムでは、展示や資料に関する世界中の知見を共有する予定ですので、新たな考え方を発見し、お互いに学び合いながら、ぜひ得られたものをご自身の機関にお持ち帰りください。

どのようなプログラムになるか、今から非常に楽しみです。年次集会の皮切りとなる講演を担当させていただき、ありがとうございました。

4. Public Session (International Symposium)

On the afternoon of the second day of the research conference, October 9th (Monday, holiday in Japan), we held an "International Symposium" open to the public. After a plenary talk and six lectures, we had a panel discussion. This session's theme, purpose, timetable and program will be described below.

In addition to the participants of Artefacts XXVIII, 37 public participants selected by lottery attended the lecture at the venue. Furthermore, the entire symposium was streamed live online and viewed by 345 people who had applied in advance. For the convenience of overseas participants as well as general participants and viewers, a booth was set up within the venue to provide simultaneous Japanese-English interpretation. Speakers from Japan gave their presentations in Japanese, and speakers from overseas gave them in English. The same was true for the panel discussion.

1）Theme

"Where Do We Come From, and Where Are We Going?": Retelling the Story of Humans and Nature and Exploring the New Roles of Science Museums

2）Purpose (from the official webpage)

"Where do we come from, and where are we going?" —this fundamental question has been the

subject of investigation from various angles by scientists. Why does our universe, our planet Earth, exist? How did life originate and evolve? Why were humans born, and how did our cultures and societies emerge? Scientists have been addressing these questions from their respective specialized perspectives.

In recent years, interdisciplinary efforts to contemplate “where we come from and where we are going” have garnered attention, integrating knowledge from diverse academic disciplines. When we synthesize insights from the natural sciences to the social sciences, what kind of narrative emerges about human existence? —this topic is now fervently debated.

Scientific museums, too, have been engaged in the exploration of these questions by collecting and examining 'objects' that illustrate the cosmos, Earth, nature, life, and the history of humankind. Through careful selection and inventive presentation of these objects, museums continue to tell the story of 'Where do we come from, and where are we going?' from various perspectives, striving to comprehend and narrate the bigger picture.

In this session, hosted by a science museum, we will reexamine how we contemplate and communicate the question of “Where do we come from, and where are we going?” Scientists who study the universe, life, and humanity will share the current state of science surrounding these questions, and together, we will explore the significance of envisioning a grand narrative and the potential of storytelling especially via ‘objects.’ Our aim is to reflect human endeavor facing the fundamental questions and use it as a foundation to envision the future.

3）Timetable and Program

13:00–13:10　Opening remarks

13:10–13:40　Plenary Talk

“Leap Through Science: The Reversible Time Machines”

Seigow Matsuoka (Director of Editorial Engineering Laboratory and Kadokawa Culture Museum)

13:40–14:10　Lecture 1

“Pondering on the Unknown World Beyond the Pale Blue Dot”

Yasushi Suto (astrophysics; The University of Tokyo)

14:10–14:40　Lecture 2

“Human as a Living Thing in Biohistory”

Keiko Nakamura (biohistory; JT Biohistory Research Hall)

14:40–14:55　Break

14:55–15:25　Lecture 3

“Modern Human Environment from Evolutionary Perspectives”

Mariko Hasegawa (anthropology; Japan Arts Council)

15:25–15:55　Lecture 4

"Revisiting the Past: The Role of the Science Museum in the Formation Process of Modern Nation-State"

Sayaka Oki (history of science; The University of Tokyo)

15:55–16:10 Break

16:10–16:40 Lecture 5

"How to Think the Anthropocene: Exploring Deep-time Through Interscalar Objects"

Fabienne Will (Munich Science Communication Lab and Deutsches Museum Munich)

16:40–17:10 Lecture 6

"The New Role of Museums in an Extraterrestrial Context"

Teasel Muir-Harmony (Smithsonian National Air and Space Museum)

17:10–17:25 Break

17:25–18:05 Panel Discussion

Facilitator: Nobumichi Ariga (Hitotsubashi University)

Panelist: Osamu Kamei (National Museum of Nature and Science, Tokyo); Yasushi Suto; Mariko Hasegawa; Fabienne Will; Teasel Muir-Harmony

Theme:

What kind of (museum) "objects" can be utilized to tell the story of humans and nature, reflecting the results of the current scientific inquiry? What are the meaning and risks of presenting a larger story that transcends the boundaries of disciplines? What would be the new roles of museums?

18:05–18:10 Closing Remarks

■公開シンポジウム

研究集会の 2 日目、10 月 9 日（月・祝）の午後は、一般公開の「国際シンポジウム」として開催した。この中では記念講演および 6 件の講演のあとにパネルディスカッションをおこなった。テーマと開催趣旨、ならびにタイムテーブルとプログラムを以下に記す。

このシンポジウムでは Artefacts XXVIII の参加者に加えて、抽選により選ばれた 37 名の一般参加者が会場で聴講した。さらにシンポジウム全体をインターネットでライブ配信し、事前に申し込みをしていた 345 名が視聴した。また、海外からの参加者ならびに一般参加者・視聴者への便宜のため、会場内にブースを設けて日英同時通訳を実施した。すなわち、日本からの講演者は日本語で、海外からの講演者は英語でそれぞれ講演をおこなった。パネルディスカッションについても同様であった。

1）テーマ

『われわれはどこから来て、どこへ行くのか』――そのストーリーと新たな博物館の可能性

2）開催趣旨（公式ウェブサイトより）

「われわれはどこから来て、どこへ行くのか――」

この根源的な問いを、科学者たちはさまざまな角度から探究してきました。われわれの住むこの宇宙・地球はなぜ存在するのか。生命はどのように誕生し、進化してきたのか。ヒトはどうして生まれ、わたしたちの文化や社会はなぜ現れたのか―科学者たちはこうした問いに、それぞれの専門的な立場から挑んできたのです。

近年、こうした各学問の知見を総合して、より長い時間軸と大きな文脈から「われわれはどこから来て、どこへ行くのか」を考える、学際的な取り組みが注目を集めています。自然科学から人文社会科学までの幅広い分野の知見を総合したときに、わたしたち人間の存在についてどのような物語が紡がれるのかが、いま、盛んに議論されています。

さて、科学系博物館も、宇宙、地球、自然、生命、人間のあゆみを示す「もの」を集め、調べることで、この問いの探究に関わってきました。博物館はさらに、重要だと思われる「もの」を選び、それを工夫しながら展示することを通じて、「われわれはどこから来て、どこへ行くのか」をさまざまな角度から、俯瞰的、総合的に、試行錯誤しながら語り続けてきた存在でもあります。

本セッションでは、科学系博物館を舞台として、「われわれはどこから来て、どこへ行くのか」をどのように考え、どのように語るかを、改めて議論します。宇宙や生命、人類を研究する科学者に、この問いをめぐるサイエンスの現在地をお話しいただきながら、大きな物語を考えることの意義や、「語り」、特に「もの」による展示の可能性を、一緒に考えます。この根源的な問いに臨む人間の営み全体を捉えなおして、未来を考える糧とすることを目指します。

3）タイムテーブルおよびプログラム

13:00-13:10　開会挨拶　国立科学博物館 理事
　　趣旨説明　国立科学博物館 理工学研究部長
13:10-13:40　記念講演
　「科学をまたぐタイムマシン群」
　松岡正剛氏（編集工学研究所所長・角川武蔵野ミュージアム館長）
13:40-14:10　講演 1
　「地球を相対化して世界を知る」
　須藤靖氏（東京大学教授／宇宙物理学）
14:10-14:40　講演 2
　「生命誌が語る生きものとしての人間」
　中村桂子氏（JT 生命誌研究館名誉館長／生命史）
14:40-14:55　休憩
14:55-15:25　講演 3

「人類進化史から見た現代」

長谷川眞理子氏（日本芸術文化振興会理事長／進化生物学）

15:25-15:55　講演 4

「近代国家のはじまりにおける科学博物館の役割―来し方を振り返る（仮）」

隠岐さや香氏（東京大学教授／科学史）

15:55-16:10　休憩

16:10-16:40　講演 5

“How to Think the Anthropocene: Exploring Deep-time Through Interscalar Objects”

（人新世をどう考えるか：間尺度的な『もの』から『ディープ・タイム』を探索する）

Fabienne Will 氏（Munich Science Communication Lab and Deutsches Museum Munich）

16:40-17:10　講演 6

“The New Role of Museums in an Extraterrestrial Context”

（「地球外」の文脈における博物館の新たな役割）

Teasel Muir-Harmony 氏（Smithsonian National Air and Space Museum）

17:10-17:25　休憩

17:25-18:05　パネルディスカッション

司会・ファシリテーター：

有賀暢迪氏（一橋大学准教授・国立科学博物館協力研究員／科学史）

登壇者：

亀井修氏（国立科学博物館 産業技術史資料情報センター・参事役）

講演者から、須藤氏、長谷川氏、Will 氏、Muir-Harmony 氏

テーマ：

「われわれはどこから来て、どこへ行くのか」をめぐるサイエンスの成果は、どのような「もの」によって示せるのか。分野の垣根を超えて大きなストーリーを示すことの意義や、懸念点・注意点はどこにあるのか。新たな展示、新たな博物館の可能性は。

18:05-18:10　閉会挨拶

5. Regular Papers from *Kahaku*

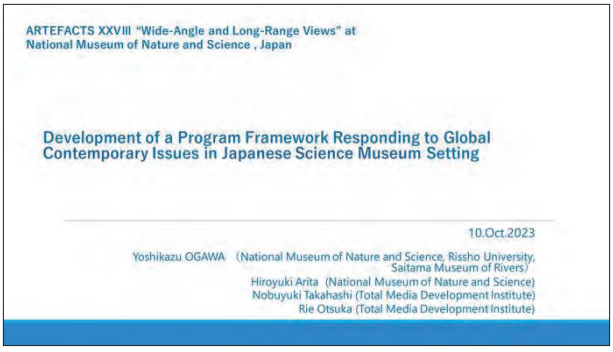
1）Development of a Program Framework Responding to Global Contemporary Issues in Japanese Science Museum Setting

Yoshikazu Ogawa (Rissho University) and Hiroyuki Arita (National Museum of Nature and Science), Nobuyuki Takahashi (Total Media Development Institute Co., Ltd.), Rie Otsuka (Total Media Development Institute Co., Ltd.)

Slide 1

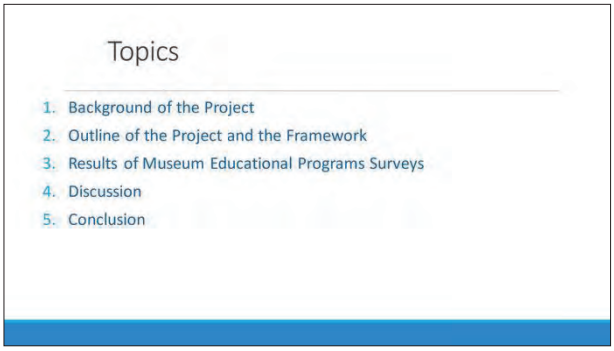
Prof. Yoshikazu Ogawa

Welcome to First session in the early Morning.
I'm Yoshikazu Ogawa. I have 3 jobs, University, Museum of Rivers and National Museum of Nature and Science, Japan (NMNS) that I used to be a staff. This time I am here as a Visiting Researcher of NMNS.

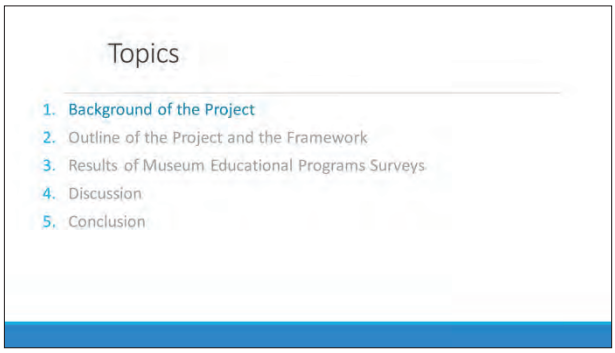


Thanks for organizing staff of department of Science and Engineering in NMNS and thanks for all participants for enduring the 14+ hour flight, jet lag, Tokyo rush hour, gingko nut smell…Through a variety of experiences in Japan, you attend this session, and for being here in one place. Here I would like to talk about Science Communication and Science Literacy in the context of museum education. It is research project which started in 2004 at NMNS. I am very pleased to introduce the projects and share the ideas at ARTEFACTS.

Slide 2 Topics



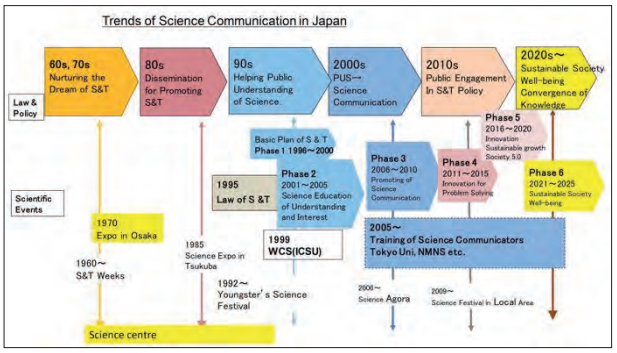
Slide 3



Here's the outline of this presentation.
I will talk about the Japanese trend of science communication and science literacy. Next, I will explain the outline and results of Museum Educational Programs Surveys in Japan.

Finally, I will discuss about the expected effect from this project.

Slide 4



This chronological table shows trends of science communication in Japan.

In 60s and 70s, the trend was to nurture the dream of science and technology. In 1970, I went to Expo in Osaka. The attendance was 64 million. There were 220 thousand children and parents who got lost. Actually, I got lost in this Expo as well. I have a clear memory of when I got lost and I saw a Human Wash Machine (which) a person came out from that. This is my personal impact but I felt the dream of science and technology as a child. Around the same time, many science centers opened to promote science education and school education.

In 90s, after the government report saying "young students are disinterest in science" was published, we focused on the education to make children interested in science. Also, we focused on the Public Understanding of Science. And, a new Law was made to Promote Science and Technology. According to the law, Basic Plan of Science and Technology has been developed in every 5 years since then.

There was a big movement from "Public Understanding of Science" to "Science Communication" in 2000s. In Basic Plan of Science and Technology Phase 3 (2006～2010), they focused on Science Communication. NMNS has launched Science Communicator Practical Training Program in 2006.

The new National Curriculum which will start in 2020 encourages to improve classes from the perspective of active learning, and focus on realizing a "curriculum open to society." It means that we should proceed more to connect with formal and informal learning.
Now, Basic Plan of Science and Technology, Innovation Phase 6(2021-2025) focused the Well-being and Convergence of Knowledge.

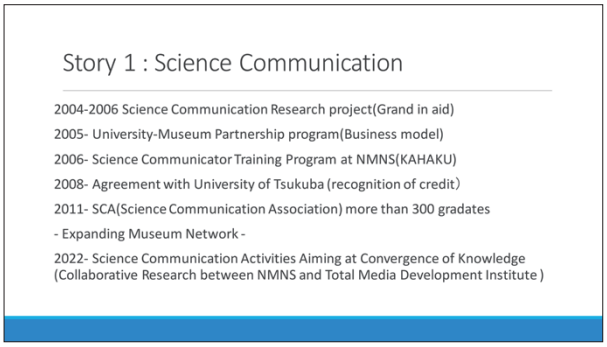
Slide 5

To realize a Well-being Society, I would like to propose two issues to make life more meaningful.

First is Science Communication. "How should science exist in our society?" Science and technology are developing progressively, but our awareness of science and technology haven't changed. Also, it is sometimes difficult for science communities to solve the social issues; i.e. BSE-infected beef and COVID-19. We need to build common understanding in the society through discussing scientific expertise and social issues. The World Conference of Science in 1999 discussed these issues. The recommendation to Science in Society and Science for Society is that we need to enhance communication between science and society.

Second issue is Science Literacy, that is also the local issue of Japan. In our society, the level of scientific knowledge for the school age is high, but low at the adult stage. The level of their attitudes toward science is also high in elementary school and low as they get older. We need to discuss "Science Literacy for all JAPANESE" including adults. In the view of life-long learning, museum is one of the facilities who can provide education for adults as well. So that means museums can help fostering public science literacy.

Slide 6



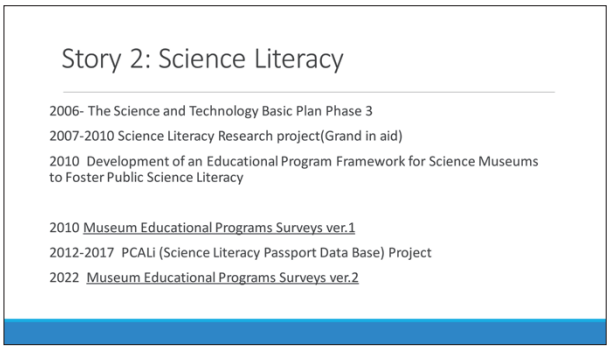
Here I am going to discuss one of the "two main issues", Science Communication Story in NMNS.

A science communication research project has launched in 2004 and prospective competency of science communicators in advanced society has been surveyed. Finally, we established the training program for science communicators in 2006. Dr. Kamei was involved in the planning and implementation of the programs and did a great job. This is University graduate students communicate with visitors and create and implement science café as the events of the program.

We established University-Museum Partnership program which grant to Science Communicators Training Programs. We have agreement with University of Tsukuba for the recognition of credits in graduate course. Over the 300 Graduate people are expending their

activities in society as Science Communicator Association.

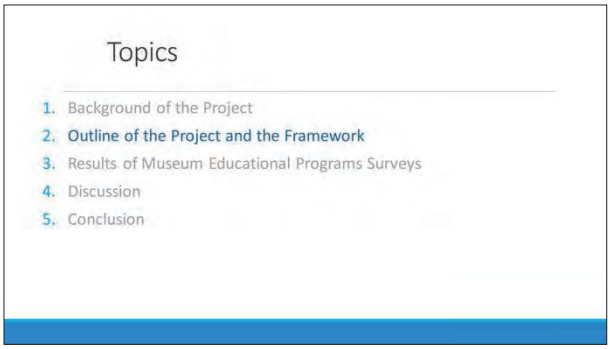
Slide 7



Next, I am going to discuss another one of "two main issues", Science Literacy history in NMNS.

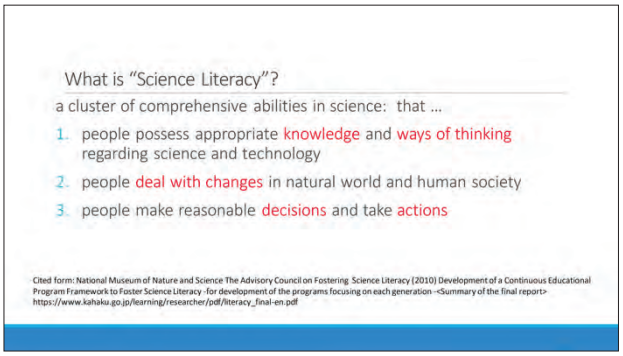
The Science and Technology Basic Plan Phase 3 was concluded in 2006. A science literacy research project started in 2007. In 2010, we established Educational Program Framework for Science Museums to Foster Public Science Literacy. Through this project, Museum Educational Programs have been surveyed in 2010 and 2022.

Slide 8 Topics



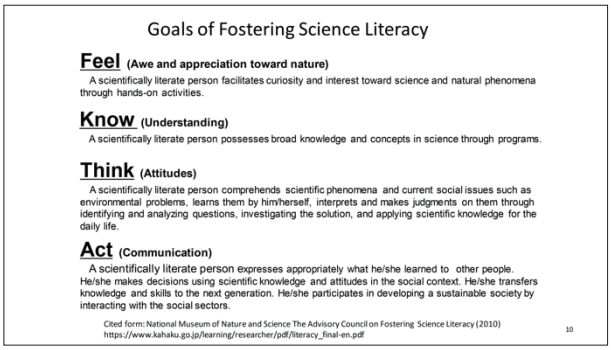
Slide 9

In this project, NMNH define Science Literacy as a cluster of comprehensive abilities in science.



1)People possess appropriate knowledge and ways of thinking regarding science and technology. 2)People deal with changes in natural world and human society. 3)People make reasonable decisions and take actions. We assume that a scientifically literate person deals with issues in the daily lives appropriately and realizes the society as a place where we make life more meaningful, that is a Well-being Society.

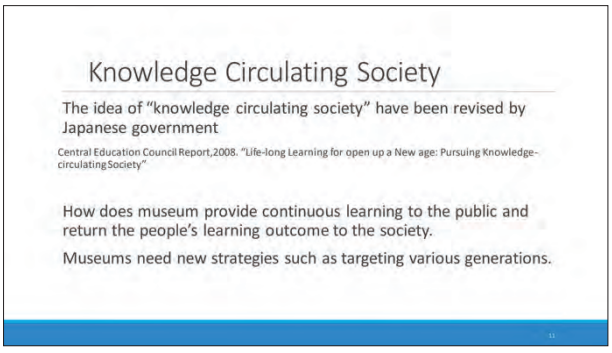
Slide 10



In our hypothesis, Science Literacy is composed of 4 goals to achieve to foster science literacy.

First, "FEEL". A scientifically literate person facilitates curiosity and interest toward science and natural phenomena through hands-on activities. Second, "KNOW". A scientifically literate person possesses broad knowledge and concepts of science and about nature of science. Third, "THINK". A scientifically literate person comprehends scientific phenomena and current social issues, interprets and makes judgments on them in scientific thinking, investigating the solution, and applying scientific knowledge for the daily life. And at last, "ACT". A scientifically literate person makes decisions using scientific knowledge and attitudes in the social context. They transfer knowledge and skills to the next generation. They participate in developing a society by interacting with the social sectors. It means science communication and process of knowledge circulating.

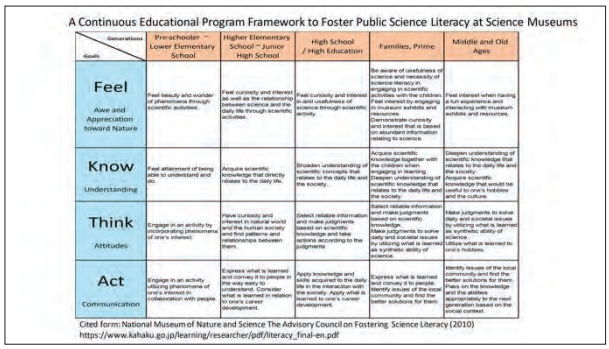
Slide 11



Knowledge Circulating is a key word in life-long learning.

The idea of "life-long learning" and "knowledge circulating society" have been revised by the Japanese government in recent year. It means that people should be able to make use of what they learned at museums back in their society. This project focus on how museums should provide continuous learning to the public and how museums should return the people's learning outcome to the society, that is the knowledge circulating society. Fostering science literacy should be conducted by collaboration with various sectors including schools, universities, museums and institutes, and needs new strategies such as targeting various generations.

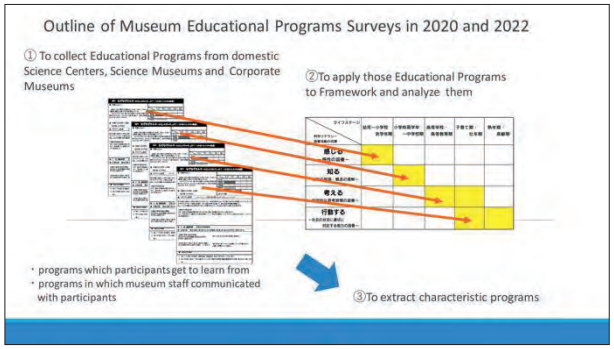
Slide 12



Based on the science literacy goals and the idea of knowledge circulating society, NMNS developed the framework of fostering science literacy. This matrix indicates exactly what people in each generation should be able to do according to the goals. We categorized the public into five life-stages groups – (1) preschoolers~ lower elementary school students, (2) higher elementary school~ junior high school students, (3) high school students and higher education students, (4) families and prime, and (5) middle and old ages.

For example, For the youngest life-stage which is from “pre-schooler” to “lower elementary school”, “feeling beauty and wonder of phenomena through scientific activities” is the concrete goal for “FEEL”. Especially for families and prime, and middle and old ages, we set the goals assuming that they have a certain role in the society as for ACT. Through museums return their learning outcomes to local society. They identify the local issues and find the better solution for their local society.

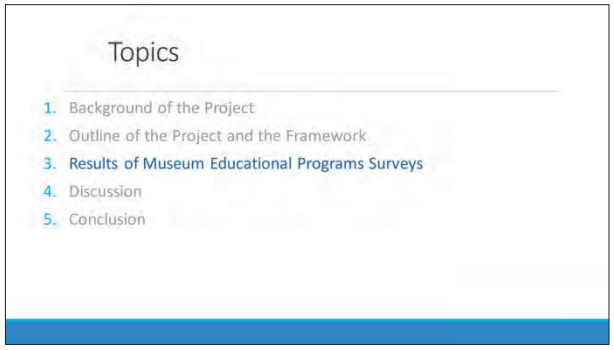
Slide 13



As I mentioned before, Museum Educational Program Surveys have been implemented in 2010 and 2022 by the same way.

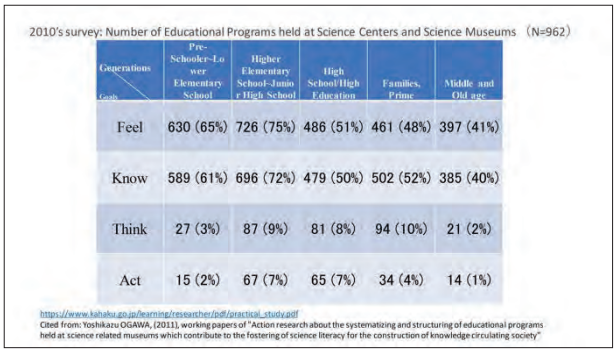
①To collect Educational Programs from domestic Science Centers, Science Museums and Corporate Museums ②To apply those Educational Programs to Framework and analyze them③To extract characteristic programs

Slide 14



I am going to talk about the effect expected from this project.

Slide 15


2010's survey: Number of Educational Programs held at Science Centers and Science Museums (N=962)

Generations / Goals	Pre-Schooler-Lower Elementary School	Higher Elementary School-Junior High School	High School/High Education	Families, Prime	Middle and Old age
Feel	630 (65%)	726 (75%)	486 (51%)	461 (48%)	397 (41%)
Know	589 (61%)	696 (72%)	479 (50%)	502 (52%)	385 (40%)
Think	27 (3%)	87 (9%)	81 (8%)	94 (10%)	21 (2%)
Act	15 (2%)	67 (7%)	65 (7%)	34 (4%)	14 (1%)

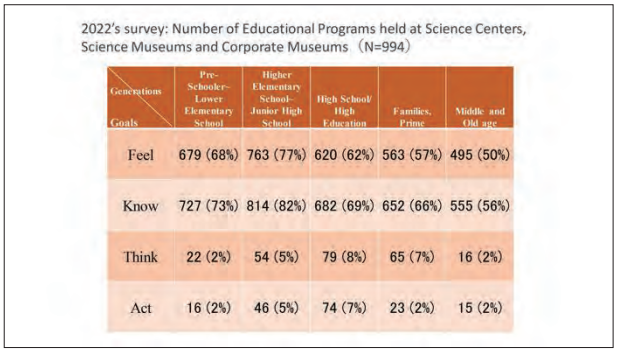
https://www.kahaku.go.jp/learning/researcher/pdf/practical_study.pdf
Cited from: Yoshikazu OGAWA, (2011), working papers of "Action research about the systematizing and structuring of educational programs held at science related museums which contribute to the fostering of science literacy for the construction of knowledge circulating society"

According to the Framework, we analyzed the current status of educational activities of science museums in Japan.

We collected materials from 106 science museums by post and analyzed the 962 educational programs. We categorized all programs according to our framework. One program doesn't necessarily have to be for just one goal.

From this result, we can say that 65% of the programs were for "FEEL" for the youngest generation. They provide enough educational programs to "preschooler to junior high school". On the other hand, they don't provide so much programs to "old ages" They provide enough educational programs that aim Feel and Know, but only little programs that aim Think and Act.

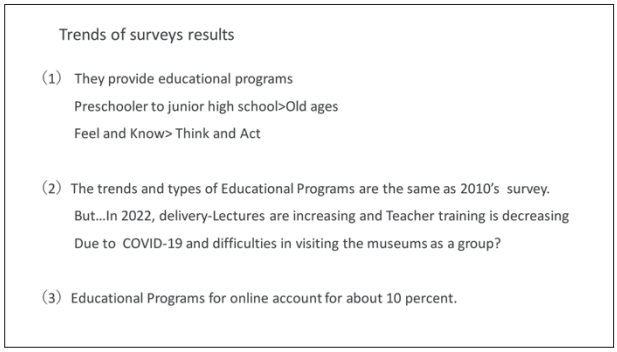
Slide 16


2022's survey: Number of Educational Programs held at Science Centers, Science Museums and Corporate Museums (N=994)

Generations / Goals	Pre-Schooler~Lower Elementary School	Higher Elementary School~Junior High School	High School/High Education	Families, Prime	Middle and Old age
Feel	679 (68%)	763 (77%)	620 (62%)	563 (57%)	495 (50%)
Know	727 (73%)	814 (82%)	682 (69%)	652 (66%)	555 (56%)
Think	22 (2%)	54 (5%)	79 (8%)	65 (7%)	16 (2%)
Act	16 (2%)	46 (5%)	74 (7%)	23 (2%)	15 (2%)

This table is the results of Museum Educational Program Surveys in 2022. We collected materials from 109 science museums by post and analyzed the 994 educational programs in the same way of 2010's. The trends of Educational Programs are same as 2010's Survey results.

Slide 17


Trends of surveys results

(1) They provide educational programs
Preschooler to junior high school>Old ages
Feel and Know> Think and Act

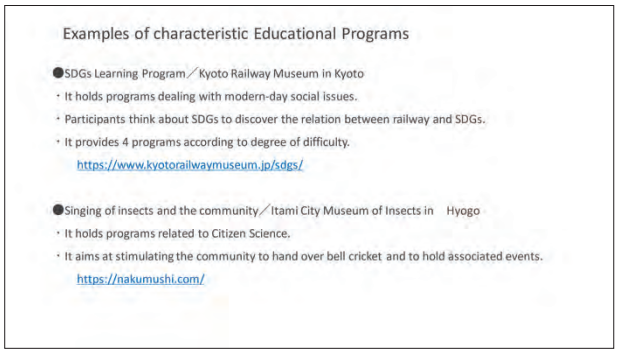
(2) The trends and types of Educational Programs are the same as 2010's survey.
But...In 2022, delivery-Lectures are increasing and Teacher training is decreasing
Due to COVID-19 and difficulties in visiting the museums as a group?

(3) Educational Programs for online account for about 10 percent.

Firstly, they provide enough educational programs to "preschooler to junior high school". On the other hand, they don't provide so much programs to "old ages" They provide enough educational programs that aim Feel and Know, but only little programs that aim Think and Act. Secondly, the trends and types of educational programs are the same as 2010s survey in the decade. But... Delivery-Lectures are increasing and teacher

training is decreasing is due to COVID-19 and difficulties in visiting the museums as a group. Thirdly, educational programs for online account for about 10 percent. It is necessary to further research for (2) and (3).

Slide 18

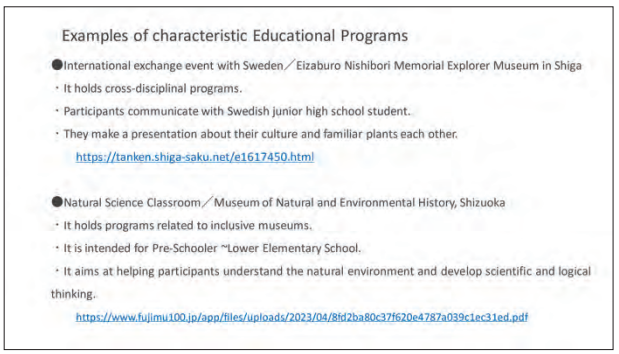


Through our research, we found that Japan's domestic science museums offer a truly diverse range of educational programs. We will depth research more than 30 case. I introduce 4 of these programs,

Firstly, SDGs Learning Program／Kyoto Railway Museum in Kyoto: It holds programs dealing with modern-day social issues. Participants think about SDGs to discover the relation between railway and SDGs.

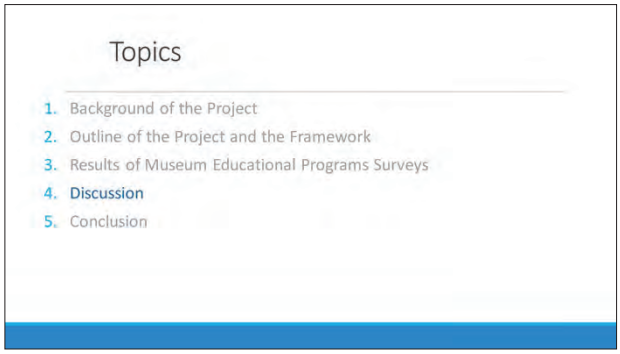
Secondly, Singing of insects and the community／Itami City Museum of Insects in Hyogo: It holds programs related to Citizen Science. It aims at stimulating the community to hand over bell cricket and to hold associated events. It has been held annually since 2006.

Slide 19



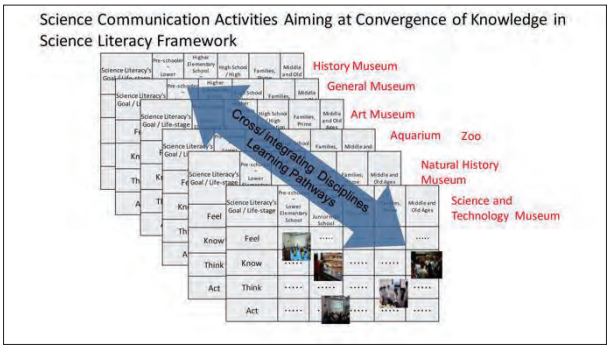
Thirdly, International exchange event with Sweden ／ Eizaburo Nishibori Memorial Explorer Museum in Shiga: It holds cross-disciplinal programs. Participants communicate with Swedish junior high school student. They make a presentation about their culture and familiar plants each other. Fourthly, Natural Science Classroom／Museum of Natural and Environmental History, Shizuoka: It holds programs related to inclusive museums. It is intended for pre-schooler ~lower elementary school. It aims at helping participants understand the natural environment and develop scientific and logical thinking.

Slide 20



Finally, I am going to talk about the role of museum.

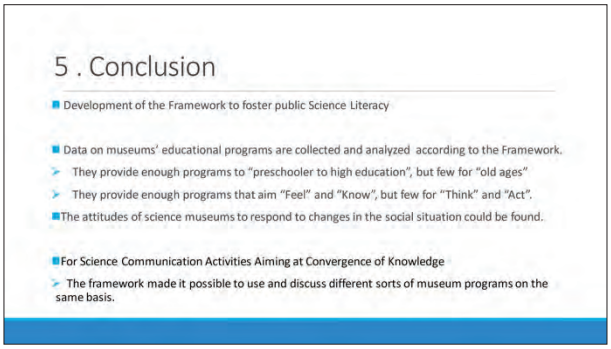
Slide 21



About The four goals, Feel, Know, Think, and Act to achieve these goals, and to foster Science Literacy, it is perhaps a better idea to put all theme's program in one common framework like this and analyze what we can do more. Museums can design educational strategy plan through using the Framework as a guideline, because many museums are facing a difficult business environment in Japan. Science and Technology Museum, Natural History Museum, Zoo, Aquarium, Art Museum, General Museum, History Museums…So far, we have found out that using this framework made it possible to discuss different sorts of museum programs on the same basis. The Framework can be applied to both humanities and sciences disciplines.

I've been thinking that there should be a collaboration program between humanities and sciences museum in this Framework. Actually, I have experience to implement a relay workshop between an art gallery, an aquarium and a general museum in Kyushu area and Hokkaido area in 2016. Through Cross-disciplinal and social context programs that I introduced before, the participants found their own learning pathways. This process satisfies their curiosity, creative learning and leads to their mental and social Well-being.

Slide 22



This presentation introduced the Framework to foster public Science Literacy. Data on museums' educational programs are collected and enables information sharing between museums. They provide enough programs to "preschooler to high education", but few for "old ages" They provide enough

programs that aim “Feel” and “Know”, but few for “Think” and “Act”. In the decade, the attitudes of science museums to respond to changes in the social situation could be found：educational programs that deal with contemporary issues such as the SDGs and inclusiveness. The framework made it possible to discuss different sorts of museum programs on the same basis. Museums can design educational strategy plan through using the Framework. I hope local science museums are continued to expect to promote school education and lifelong learning in each generation by referring to this framework.

Slide 23

Thank you for your attention.

■日本の科学系博物館における、世界の諸問題に対応したプログラム体系の開発

小川義和（国立科学博物館、立正大学、埼玉県立川の博物館）、有田寛之（国立科学博物館）、高橋伸幸（トータルメディア開発研究所）、大塚理恵（トータルメディア開発研究所）

Slide 1

早朝の最初のセッションにお越しいただきありがとうございます。

小川義和と申します。私は、大学、川の博物館、そしてかつて勤務していた国立科学博物館に関連する三つの仕事を持っています。今回は、国立科学博物館の客員研究員としてこの場に参加させていただきました。

まずは、国立科学博物館理工学研究部の主催スタッフのみなさん、そして 14 時間以上のフライトや東京のラッシュアワー、銀杏の匂いに耐えながら、日本でのさまざまな経験を経て、このセッションのために集まってくださったみなさんに感謝申し上げます。

本日は、博物館教育における「サイエンスコミュニケーション」と「科学リテラシー」についてお話したいと思います。国立科学博物館が 2004 年に開始した研究プロジェクトに関する内容です。この Artefacts の総会の場で、プロジェクトの紹介や知見の共有ができることをうれしく思います。

Slide 2 目次

Slide 3

こちらが本日の発表の概要です。

まず、日本のサイエンスコミュニケーション、科学リテラシーに関する動向をお話した後、日本における「博物館の学習プログラムに関する調査」の概要と結果について解説します。

そして最後に、このプロジェクトから期待される効果について議論したいと思います。

Slide 4

こちらは、日本の科学コミュニケーションの動向を示した時系列表です。

60 年代と 70 年代は、科学技術の夢を育むことが主な目的でした。1970 年、私は大阪万博に行きました。来場者は 6,400 万人。迷子になった子どもとその親の数は 22 万人で、実は私もその中の一人でした。迷子になったのは、人間洗濯機から人が出てくるのを眺めていた時だったことを、今でもはっきり覚えています。そして、それは私が子どもながらに科学の夢を強く感じた瞬間でもありました。同じ頃、科学教育と学校教育を推進する科学館が数多くオープンしました。

90 年代に入り、「若い世代が科学に興味を持っていない」とする政府の報告書が発表されたことを受け、私たちは子どもたちが科学に興味を持てるような教育や、「公衆の科学理解増進」に取り組むようになりました。さらに、新たに「科学技術基本法」が制定された後は、同法に従い、5 年に一度、「科学技術基本計画」が策定されています。

2000 年代は、「公衆の科学理解増進」と「サイエンスコミュニケーション」に関して大きな動きがありました。「第 3 期科学技術基本計画（2006～2010 年）」において、科学コミュニケーションが重視されるようになったのです。これを受け、国立科学博物館は、2006 年に「サイエンスコミュニケータ養成実践講座」を開設しました。

さらに、2020 年に新しい学習指導要領がスタートすると、アクティブ・ラーニングの視点か

らの授業改善や、「社会に開かれた教育課程」の推進に向けて、フォーマルとインフォーマル学習の連携強化が求められるようになりました。
なお、現行の「第 6 期科学技術・イノベーション基本計画（2021～2025 年）」では、「一人ひとりの多様な幸せ（ウェルビーイング）」と「総合知」が主なテーマになっています。

Slide 5

一人ひとりが豊かに生きられる「ウェルビーイングな社会」の実現に向けて、二つの課題を取り上げたいと思います。

一つ目は「科学コミュニケーション」です。社会における科学のあり方とは何でしょうか。科学技術が急速に進歩する一方で、科学技術に対する私たちの認識は変化していません。また、狂牛病牛肉や新型コロナウイルス感染症などの社会問題は、科学コミュニティにとって解決が難しい場合もあります。そのため、科学的知見と社会問題について議論することで、社会における共通理解を醸成する必要があります。1999 年の世界科学会議においてもこれらの問題が話し合われ、「社会における科学」と「社会のための科学」をテーマとして、科学と社会の間のコミュニケーションを推進することが提言されました。

二つ目は「科学リテラシー」で、これは日本独自の課題でもあります。日本社会では、学齢期における科学知識の水準は高いのですが、それが大人になると低くなります。科学に対する態度についても同様で、小学生の時点で高かったものが、年齢とともに低下します。つまり、大人を含めて「日本人全体の科学リテラシー」について議論する必要があるのです。生涯学習の観点から見ても、博物館は大人向けの教育を提供できる施設の一つであるため、公衆の科学リテラシーの涵養を支援することができるはずです。

Slide 6

ここからは、「二つの重要課題」の一つである「サイエンスコミュニケーション」について、国立科学博物館の取り組み事例をご紹介します。

当館では、2004 年にサイエンスコミュニケーションに関する研究プロジェクトを始動し、先進社会においてサイエンスコミュニケータに期待される資質を調査したうえで、2006 年に「サイエンスコミュニケータ養成実践講座」を開設しました。講座の企画・実施にあたっては、産業技術資料情報センターの亀井先生に多大なご協力をいただきました。この講座では、プログラムの一環として、大学院生が来館者と接しながら、サイエンスカフェの企画や運営を担当します。

なお、当館が立ち上げた「国立科学博物館大学パートナーシップ」事業では、「サイエンスコミュニケータ養成実践講座」に対する助成を行っています。また、筑波大学と協定を締結し、講座の受講を大学院の単位として認めるようにしました。このほか、300 名以上の修了生が国立科学博物館サイエンスコミュニケータアソシエーションの一員として、活動を展開しています。

Slide 7

次に、「二つの重要課題」のもう一方、「科学リテラシー」に関する国立科学博物館の取り組み事例をご紹介します。

2006 年に「第 3 期科学技術基本計画」が策定されたことを受け、2007 年に科学リテラシーに関する研究プロジェクトが始動しました。2010 年には「公衆の科学リテラシーの涵養に資する科学系博物館の学習プログラム体系」を開発し、2010 年と 2022 年に「博物館の学習プログラムに関する調査」を実施しています。

Slide 8 目次

Slide 9

このプロジェクトにおいて、国立科学博物館は「科学リテラシー」を、1）自然や科学技術に対する適切な知識や科学的な見方及び態度を持ち、2）自然界や人間社会の変化に適切に対応し、3）合理的な判断と行動ができる、総合的な資質・能力であると定義しています。社会生活上の諸問題に対し適切な対応ができ、豊かに生きる社会を構築するためには、科学リテラシーが必要であると私たちは考えています。

Slide 10

この仮説では、科学リテラシー涵養のための四つの目標が設定されました。

一つ目の「感じる」は、体験的な活動を通じ、科学や自然現象への興味・関心を高められるようにすること、二つ目の「知る」は、自然現象や技術の働きを理解し、科学的な知識を広げられるようにすること、三つ目の「考える」は、課題解決のための探究活動を行ったり、科学的な知識を実生活に活用したりすることを通じ、科学的な事柄や現代の社会的課題について総合的に捉え、科学的な観点から解釈・判断できるようにすること、そして最後の四つ目の「行動する」は、社会の状況に基づいて、科学的な知識・態度を活用して意思決定し、自らの持っている知識、能力を次の世代へと伝えるとともに、社会と対話し、社会作りに参画するなど社会への知の還元を行うことを目指しています。

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「知の循環」は、生涯学習における重要なキーワードです。

近年、日本政府では「生涯学習」と「知の循環型社会」に対する考え方を見直しており、博物館で学んだ知識を社会に還元し、活用することが求められています。そこで、このプロジェクトでは、一般の人々が継続的に学び、その成果を社会に還すこと、つまり知の循環型社会を実現するために、博物館が何をすべきかについて焦点を当てました。科学リテラシーの涵養にあたっては、学校、大学、博物館、その他機関を含むさまざまなセクターで連携するとともに、幅広い世代をターゲットにするなど、新たな戦略を策定することも必要です。

Slide 12

国立科学博物館では、科学リテラシー涵養の目標と知の社会還元の考え方に基づき、科学リテラシーを涵養するためのプログラム体系を開発しました。こちらの表には、世代ごとに求められる具体的な目標が書かれています。表の中では、人間のライフステージを（1）幼児～小学校低学年期、（2）小学校高学年～中学校期、（3）高等学校・高等教育期、（4）子育て期・壮年期、（5）熟年期・老年期の 5 つに分けました。

例えば、一番年齢が低い「幼児～小学校低学年期」の「感じる」では、「科学に親しむ体験を通じて、身の回りの事象の美しさ、不思議さなどを感じること」が具体的な目標になっています。一方、「子育て期・壮年期」、「熟年期・老年期」の「行動する」では、これらの世代の社会における独自の役割を考慮したうえで、博物館で学んだ内容を地域社会に還元してもらうため、「地域の課題を見出し、その解決に向けてよりよい方向性を見出すこと」が目標になっています。

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先ほどお話した通り、2010 年と 2022 年に、「博物館の学習プログラムに関する調査」が同じ手法で実施されました。

その主な作業内容は、①国内の科学館、科学系博物館、企業博物館の学習プログラムの収集、②収集した学習プログラムの体系化・分析、③プログラムの特徴の抽出となっています。

Slide 14

続きまして、このプロジェクトで期待される効果についてお話します。

Slide 15

プロジェクトでは、日本の科学系博物館における学習プログラムの現状を把握するため、2020 年に 106 か所の科学系博物館が実施している 962 の学習プログラムの資料を郵送で収集し、目標ごとにカテゴリー分けしたうえで、分析を行いました。なお、一つのプログラムが複数の目標を満たしている場合もあります。

分析の結果、65%のプログラムが最も若い世代の「感じる」の目標を満たしていました。ただ、「幼児～小学校低学年期」に対して十分な数の学習プログラムが提供されている一方で、「高齢期」向けのプログラムは少数にとどまっています。また、「感じる」、「知る」に関するプログラムが多いのに対し、「考える」、「行動する」に対応したプログラムはほとんどありません。

Slide 16

こちらは、2022 年に実施された「博物館の学習プログラムに関する調査」の結果を示した表です。2010 年と同様に、109 か所の科学系博物館が実施している 994 の学習プログラムの資料を郵送で収集し、分析したところ、2010 年の調査と似たような結果になりました。

Slide 17

一点目として、「幼児～小学校低学年期」に対して十分な数の学習プログラムが提供されている一方で、「高齢期」向けのプログラムは少数にとどまっています。また、「感じる」、「知る」に関するプログラムが多いのに対し、「考える」、「行動する」に対応したプログラムはほとんどありません。二点目として、10 年が経過しているにもかかわらず、学習プログラムの傾向や種類は同じようなものでした。ただし、コロナ禍で博物館の団体見学が難しくなったため、出張講座が増加し、教員研修は減少しています。三点目として、オンラインの学習プログラムは全体の約 10%でした。なお、二点目と三点目については、さらなる調査研究が必要です。

Slide 18

これらの調査では、日本国内の科学系博物館において、実にさまざまな学習プログラムが提供されていることがわかりました。また、30 以上のプログラムを対象に追加の調査も行う予定です。ここでは、そのうちの四つをご紹介したいと思います。

一つ目は、京都鉄道博物館の「SDGs 学習プログラム」です。これは現代の社会問題について取り扱ったプログラムで、鉄道と SDGs の関係性を見つけながら、SDGs について考えるものです。

二つ目は、兵庫県にある伊丹市昆虫館の「鳴く虫と郷町」です。これは市民科学について取り扱ったプログラムで、スズムシ里親プロジェクトなどの関連イベントを通して地域の活性化を図ることを目的として、2006 年から毎年実施されています。

Slide 19

三つ目は、滋賀県にある西堀榮三郎記念探検の殿堂が実施した、スウェーデンとの国際交流イベントです。これは学際的なプログラムで、スウェーデンの小学生たちと交流しながら、自分たちの文化や身近な植物について発表し合うという内容になっています。

四つ目は、静岡県にあるふじのくに地球環境史ミュージアムの「自然科学教室」です。これはインクルーシブ・ミュージアムについて取り扱ったプログラムで、就学前の子どもから小学低学年を対象に、自然環境を理解し、科学的な論理思考ができる人を育むことを目的としています。

Slide 20

最後に、博物館の役割についてお話したいと思います。

Slide 21

「感じる」、「知る」、「考える」、「行動する」の 4 つの目標を達成し、科学リテラシーを涵養するには、あらゆるテーマを共通のプログラム体系に盛り込んだうえで、その実現のために何ができるかを考えるのがよいのではないでしょうか。日本では多くの博物館が厳しい経営環境に置かれていますが、このプログラム体系をガイドラインとして使用すれば、戦略的な学習計画を策定できるはずです。科学系博物館、自然史系博物館、動物園、水族館、美術館、総合系

博物館、歴史系博物館など施設の種類にかかわらず、共通の枠組みの中で学習プログラムを開発できるのです。しかも、このプログラム体系は人文学と科学の両方の分野に対応しています。

私は、人文系博物館と科学系博物館の提携プログラムがあったほうがよいと常々考えてきました。実際の取り組みとして、2016 年に九州と北海道のアートギャラリー、水族館、総合系博物館をつなぐリレー式ワークショップを開催したこともあります。これまでにご紹介した学際的・社会的なプログラムを通して、参加者たちは自身の学習の道筋を見つけることができました。これは好奇心の向上や創造的学習の促進、さらには精神的と社会的の両面におけるウェルビーイングにもつながっています。

Slide 22

今回の発表では、公衆の科学リテラシー涵養のためのプログラム体系についてご紹介しました。これに関連し、博物館の学習プログラムに関するデータを収集して情報を整理したところ、「幼児～小学校低学年期」に対して十分な数の学習プログラムが提供されている一方で、「高齢期」向けのプログラムは少数にとどまっていること、また「感じる」、「知る」に関するプログラムが多いのに対し、「考える」、「行動する」に対応したプログラムはほとんどないことが判明しました。最近では、SDGs やインクルージョンをテーマにした学習プログラムも登場するなど、10 年の歳月の中で、科学系博物館が社会情勢の変化に対応していることがわかります。

このほか、私たちのプログラム体系を使用すれば、共通の枠組みの中で学習プログラムを開発しながら、戦略的な学習計画を策定できるはずです。地域の科学系博物館がこのプログラム体系を活かし、今後も各世代における学校教育・生涯教育を推進していかれることを期待しています。

Slide 23

ご清聴ありがとうございました。

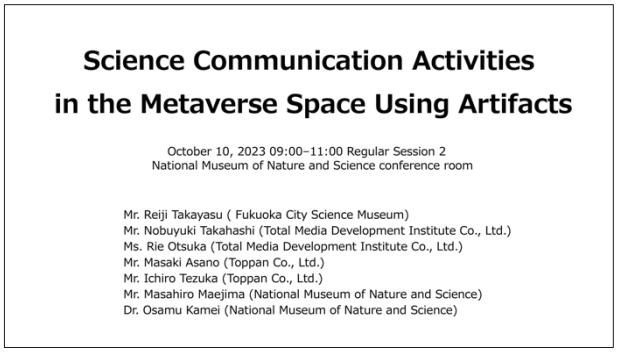
2）Science Communication Activities in the Metaverse Space Using Artifacts

Reiji Takayasu (Fukuoka City Science Museum) and Nobuyuki Takahashi (Total Media Development Institute Co., Ltd.), Rie Otsuka (Total Media Development Institute Co., Ltd.), Masaki Asano (Toppan Printing Co., Ltd.), Masahiro Maejima (National Museum of Nature and Science), Osamu Kamei (National Museum of Nature and Science)

Mr. Reiji Takayasu

Mr. Nobuyuki Takahashi

Slide 1: Science Communication Activities in the Metaverse Space Using Artifacts



My name is Reiji Takayasu. I am a member of the collaborative research.

This team consists of the following six people.

Mr. Reiji Takayasu (Fukuoka City Science Museum)
Mr. Nobuyuki Takahashi (Total Media Development Institute Co., Ltd.)
Ms. Rie Otsuka (Total Media Development Institute Co., Ltd.)
Mr. Masaki Asano (Toppan Printing Co., Ltd.)
Mr. Masahiro Maejima (National Museum of Nature and Science)
Dr. Osamu Kamei (National Museum of Nature and Science)

This research is a presentation on the preservation and utilization of artifacts.

As you may know, Japanese museums are having difficulty preserving actual materials due to small storage facilities, budget cuts, and a lack of specialized staff.

This presentation is a proposal for “methods for preserving actual materials and support for them" based on the consideration of “new ways to utilize materials."

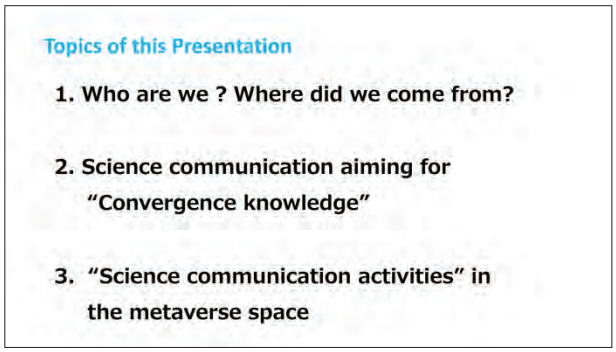
Slide 2: Topics of this Presentation

Topics of this Presentation are as follows.

1)Who are We ? Where did we come from?

2)Science communication aiming for “Convergence knowledge”

3)“Science communication activities” in the metaverse space



Slide 3: 1. Who are We? Where did we come from?

The first topic is “Who are We ? Where did we come from?”

・The members of this Joint research group consist of members from private companies and science museums.

・This “Joint research” has started in November 2022

The main theme is “Science communication aiming for Convergence Knowledge,” The goal is to build science communication activities based on ”convergence knowledge,” because we found that these science museums lack quality educational programs.

That research has three brunch of purposes, as follows.

(1) Survey of the current state of science museums in Japan

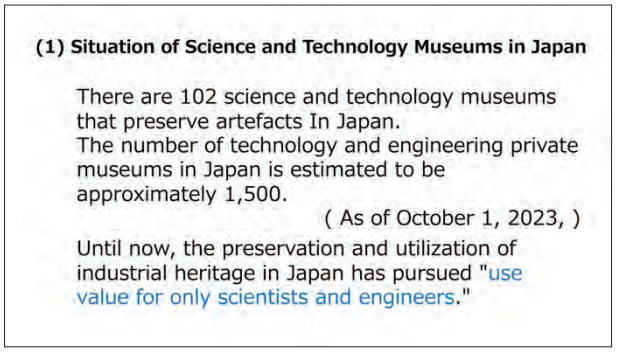
(2) Develop a science communication program that utilizes the artefacts

(3) Development of science communication using special exhibition “WHO ARE WE” at 21st Century Museum of Contemporary Art, Kanazawa

Slide 4: (1) Situation of Science and Technology Museums in Japan

The first topic is “Situation of Science Museums in Japan”

There are 102 science and engineering museums that preserve artefacts in Japan.



The number of private museums that hold actual materials is estimated to be mostly 1,500. (As of October, 2023.)

As you may know, Japanese museums are having difficulty preserving actual materials due to small storage facilities, budget cuts, and a lack of specialized staff.

This presentation is a proposal for “methods for preserving actual materials and

support for them" based on the consideration of “new ways to utilize materials."

Until now, the preservation and utilization of industrial heritage in Japan has pursued "use value for only scientists and engineers."

Therefore, we decided to change from an engineer-centered activity to a citizen and user-centered activity.

Slide 5: 2. Science communication aiming for “Convergence Knowledge”

What is “The Convergence knowledge?”

“ The Convergence knowledge” comes from The 6th Science, Technology and Innovation Basic Plan in Japan (2021)

That means Diverse “knowledge” gathers to create “knowledge vitality” that creates new value.

Convergence knowledge is what integrates knowledge not only from one specialized field but also from a wide range of fields such as natural science, literature, humanities, social sciences, local communities, business/government, culture/art, etc., rather than just one specialized field.

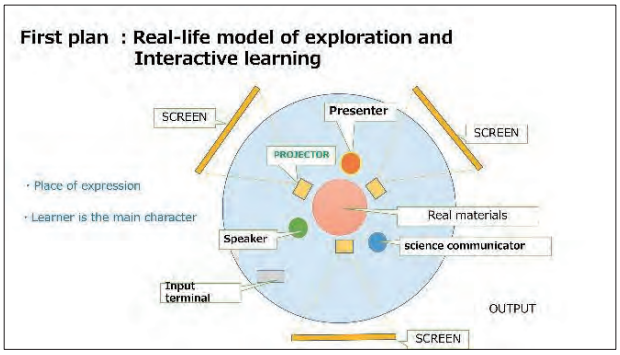
Slide 6: 3. “Science communication activities” in the metaverse space- using the Kyuu-hadeba hydroelectric power plant -

The third topic is “Science communication activities” in the metaverse space - using the Kyuu-hadeba hydroelectric power plant -

This learning model used industrial heritage that can’t be brought into science museums.

So, we decided to use a program that uses metaverse space.

Slide 7: First plan : Real-life model of exploration and interactive learning



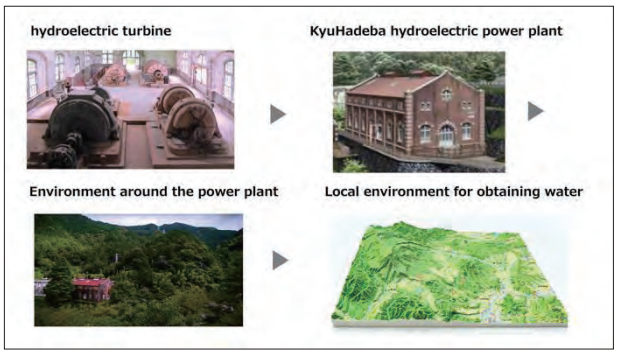
Our first idea was a science cafe-style learning model using real objects and science communicators.

The learning model was for learners to summarize the information they have acquired into their own ideas and then communicate them.

Slide 8: Industrial technology history material Niihama City Kyu-Hadeba Hydroelectric Power Plant

Such generators are impossible to move.

Slide 9: Niihama City Kyu-Hadeba Hydroelectric Power Plant

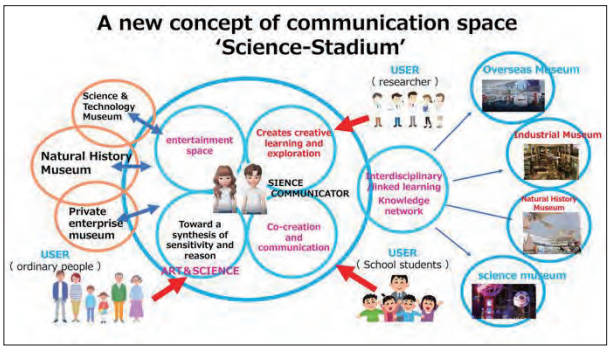


These are the learning resources we will use this time.

Slide 10: A new concept of communication space 'Science-Stadium'

This is our "New concept communication in the metaverse space, "Science Stadium"

This diagram shows how our plans will work in the future.



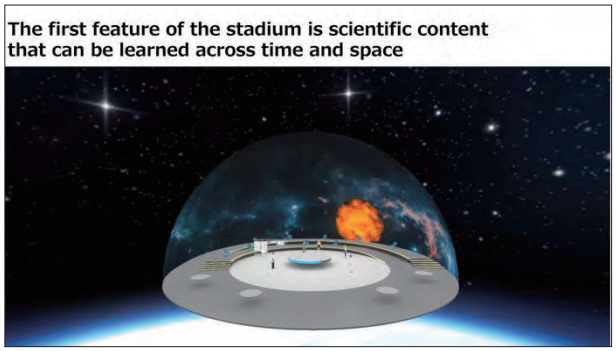
We provide educational courses by forming a network with science museums, libraries, universities, research institutes, private companies, natural heritage sites, etc.

By digitizing the science communication activities of science, we will provide a wider range of educational activities.

Slide 11: The first feature of the stadium is scientific content that can be learned across time

and space

Our team developed the stadium as a place to implement educational programs on the Metaverse, where visitors can experience interactive science and museums from anywhere, transcending time and space.



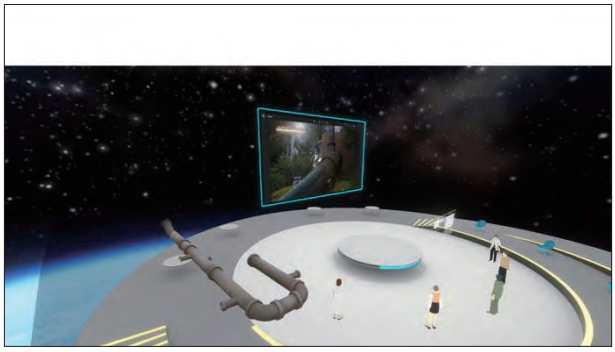
The first feature of the stadium is scientific content that can be learned across time and space.

You can go back in history, create the future, move through space instantly, experience natural phenomena that cannot be experienced in real life, and experience the past and future of the earth. The Metaverse space is reproduced at the same scale as the avatar itself, so you can feel the actual size and scale.

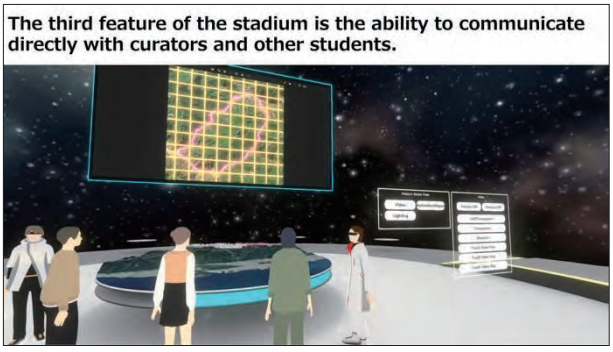
Slide 12: The second feature of the stadium is that you can view objects from any angle you like.

The second feature of the stadium is that you can view objects from any angle you like.

Slide 13: 3D animation to reproduce natural phenomena and industrial museum exhibits



Since we use 3D animation to reproduce natural phenomena and industrial museum exhibits, we can clearly express changes in objects and physically invisible forces. We have also implemented buttons that allow you to run animations and switch images, allowing you to observe objects at any time and from any angle you like.



Slide 14: The third feature of the stadium is the ability to communicate directly with

curators and other students.

Since the Metaverse is an online space, you can communicate with us at any time during the program. By participating in the program, you can deepen your understanding of the experience through two-way communication, such as sharing your own questions and discoveries with researchers and coming into contact with new ways of thinking and values.

Slide 15: 3-1 “Educational program” using a hydroelectric power plant in the Metaverse Space

In this presentation, we created an "educational program" using a former hydroelectric power plant to consider "the way power generation should be" in the SDGs era.

Slide 16: 3-2 Educational program structure

Our plan is follows:

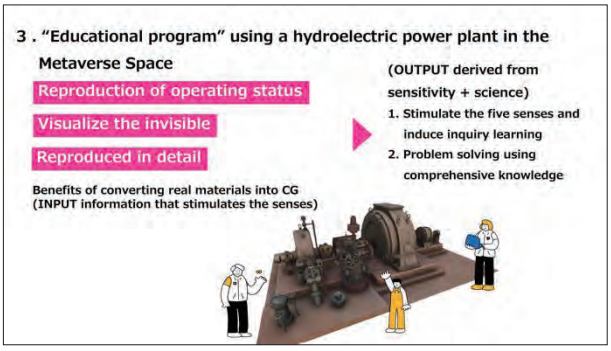
Step1: Understand total rainfall determined by watersheds

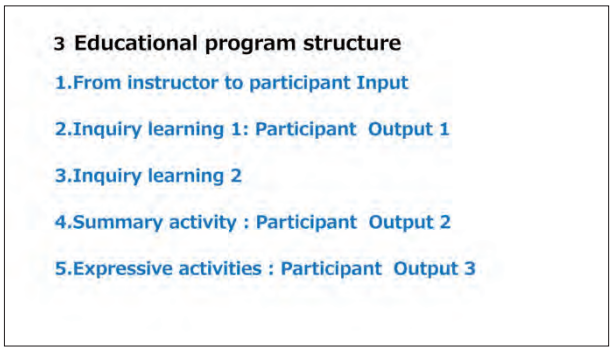
Step2: Calculate how much energy you can get

Step3: What are the challenges and improvements in how to generate from the perspective of SDGs?

Step4: Based on the knowledge gained through dialogue, design a futuristic system that generates energy

Step5: Thinking about energy that places less of a burden on the earth and expressing it.

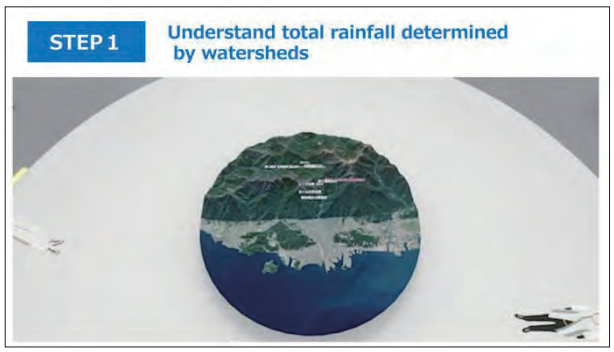




Slide 17: Understand total rainfall determined by watersheds

Step 1 from instructor to participant Input 1

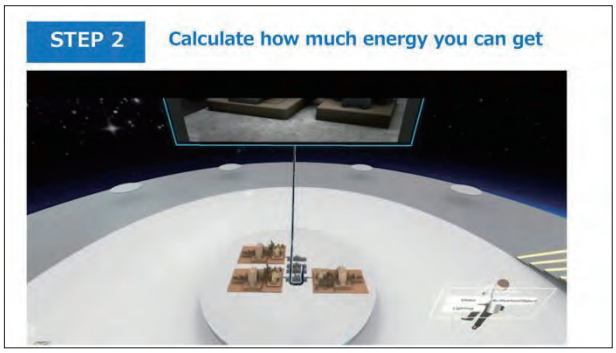
Understanding the source of energy that transforms rain into river water



Slide 18: Step2 Participant Output 1

Calculate how much energy you can get.

The total amount of water that can be collected depends on the characteristics of the topography, etc. Power generation efficiency is 70%



Slide 19: Step3 What are the challenges and improvements in how to generate from the perspective of SDGs?

Inquiry learning and Participant Output 2

What are the challenges of how to generate energy?

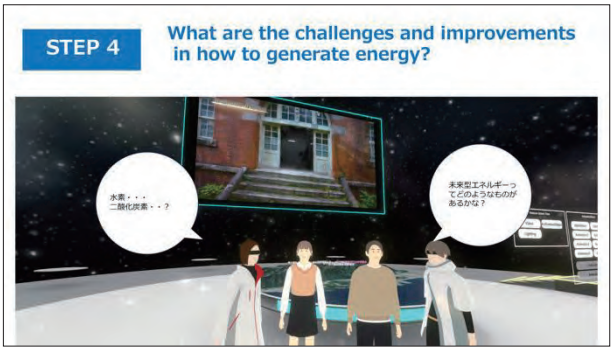
Nature destruction, stable sharing, safety, comparison with new technology.

Slide 20: Step 4 Summary activity

Participant Output 3

Design a future system that generates energy

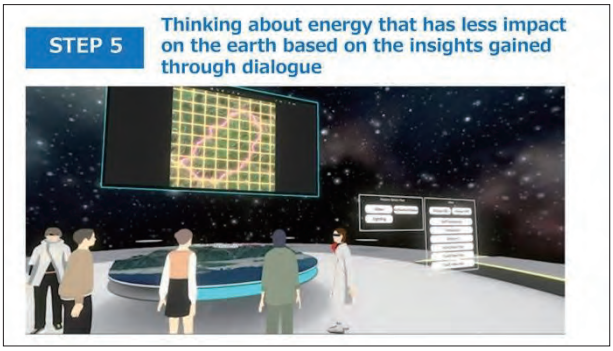
From the perspective of SDGs such as activities that utilize nature, the invention of industrial technology, and renewable energy, we will discuss how to create and use energy in the future.



Slide 21: Step 5 Expressive activities

Participant Output 4

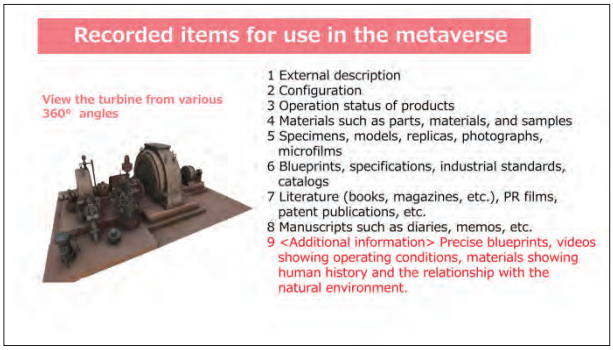
Is it possible to obtain energy with less load on the earth while solving the awareness of Participant's Output1-3 ?



Slide 22: <Recorded items for use in the metaverse>

Until now, the following items had to be recorded when preserving materials at museums.

When introduced into the Metaverse space, an additional item <9> will be added.



Additional items will be added when introduced into the metaverse space.

1 Exterior description of facility/structure name, location, size, and weight

2 Equipment, machines, measuring instruments/tools, and tool configuration

3 Operational status of products (including finished products, prototypes, mass-produced products, etc.)

4 Materials such as parts, materials, samples, etc.

5 Specimens, models, replicas, photographs, microfilms

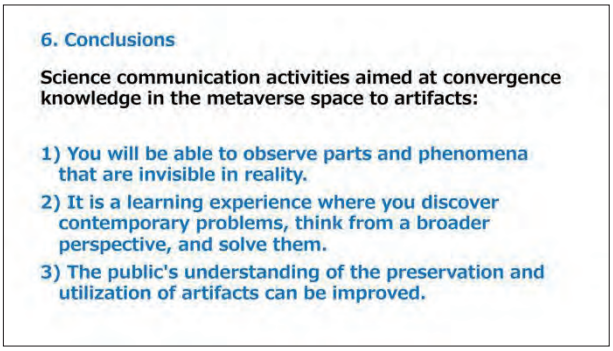
6 Blueprints, specifications, industrial standards, catalogs

7 Literature (books, magazines, etc.), PR videos, patent publications, etc.

8 Manuscripts such as diaries and memos

9 <Additional information> Precise blueprints, videos showing operating conditions, materials showing human history and the relationship with the natural environment.

Slide 23: 6. Conclusion



Applying "science communication activities aiming for comprehensive knowledge" in the metaverse space to physically difficult-to-access artifacts (industrial technology history materials),

1) Observe parts and phenomena that cannot be seen in reality

2) Think broadly and find ways to solve modern challenges

3) Also, by utilizing it in berth space, it is possible to increase the public's understanding of the significance of preservation and its utilization.

In the future, I will research the role of science museums in the collection, preservation, and digitization of industrial technology history materials and artifacts, and propose the importance of raising public awareness regarding the preservation of artifacts and utilizing the metaverse.

Slide 24: New concept communication space：Science- Stadium

This diagram is an image of the structure of the metaverse space.

That is New concept communication space：Science- Stadium

Slide 25: Here, you can tell a big story that starts with getting to know the Earth.

Our future plans are as follows.

・Consideration of new roles for science museums in collecting, preserving, and digitizing artifacts

・Proposing the usefulness of increasing public awareness of artifacts and utilizing the metaverse

Thank you for your attention. If you are interested in these new plans, please contact us for a quick tour tomorrow of the program.

■人工物を活用したメタバース空間における科学コミュニケーション活動

高安礼士（福岡市科学館）、高橋信行・大塚理恵（株式会社トータルメディア開発研究所）、浅野正樹（凸版印刷株式会社）、前島正裕・亀井修（国立科学博物館）

Slide 1: 人工物を活用したメタバース空間における科学コミュニケーション活動

高安礼士と申します。私は共同研究のメンバーです。

このチームは以下の 6 人で構成されています。

高安礼士（福岡市科学館）
高橋信行（株式会社トータルメディア開発研究所）
大塚理恵（株式会社トータルメディア開発研究所）
浅野正樹（凸版印刷株式会社）
前島正裕（国立科学博物館）
亀井修（国立科学博物館）

ご存知のとおり、日本の博物館は収蔵施設の狭さ、予算の削減、専門スタッフの不足などの理由から、実物資料の保存などに課題があります。本発表は、「新たな資料の教育活用方法」を踏まえた「実物資料の保存方法とその支援」についての提案です。

Slide 2: このプレゼンテーションのトピックス

今回の発表の内容は以下の通りです。

1)私たちは何者か? 私たちはどこから来たのか？
2)「知の融合」を目指したサイエンスコミュニケーションとは？
3)メタバース空間における「サイエンスコミュニケーション活動」の紹介

Slide 3: 1. 私たちは何者ですか? 私たちはどこから来たのですか？

最初のトピックスは『私たちは何者か？ 私たちはどこから来たのか？』です。

・本「共同研究」グループのメンバーは、民間企業や科学館のメンバーで構成されています。
・本「共同研究」は 2022 年 11 月より開始しました。

研究のメインテーマは「『総合的な知』を目指した科学コミュニケーション」です。アンケート調査によれば、日本の科学館では質の高い教育プログラムが不足しており、「総合的な知」（幅広い領域）に基づいた科学コミュニケーション活動を構築することが目標です。

この共同研究には次の 3 つの目的があります。

(1) 日本の科学博物館の現状調査
(2) 人工物を活用した科学コミュニケーションプログラムの開発
(3) 金沢 21 世紀美術館特別展「WHO ARE WE」を活用した科学コミュニケーションの展開

Slide 4: (1) 日本の科学技術博物館の現状

最初のテーマは「日本の科学館事情」です。日本には人工物を保存する理工系博物館が 102 館あります。そのほか、実物資料を所蔵する私立博物館の数は、約 1,500 館と推定されている。(2023 年 10 月現在)

ご存知のとおり、日本の博物館は収蔵施設の狭さ、予算の削減、専門スタッフの不足などの理由から、実物資料の保存に困難を抱えています。本発表は、「新たな資料活用法」の検討を踏まえた「実物資料の保存方法とその支援」についての提案です。

これまで日本の産業遺産の保存・活用は、「科学者・技術者だけのための利用価値」を追求してきました。そこで、私たちは、エンジニア中心の活動から市民・ユーザー中心の活動に転換することにしました。

Slide 5： 2.「総合知」を目指すサイエンスコミュニケーション

「総合知」とは何か?

「総合知」とは、第 6 期科学技術イノベーション基本計画（2021 年）で提案され、多様な「知」が集まり、新たな価値を生み出す「知の活力」を生み出すこととされています。総合知とは、一つの専門分野だけでなく、自然科学、文学、人文科学、社会科学、地域社会、企業・行政、文化・芸術など幅広い分野の知識を統合するものです。科学博物館においても、このような領域横断的な教育・研究活動が求められる時代になったという理解をしています。

Slide 6: 3. メタバース空間での「サイエンスコミュニケーション活動」～旧端場水力発電所を活用～

三つ目の話題はメタバース空間での「サイエンスコミュニケーション活動」 ～旧端場水力発電所を活用した～学習活動です。この学習モデルは科学館には持ち込めない産業遺産を利用するため、メタバース空間を利用したプログラムを利用することにしました。

Slide 7: 第一計画：探索と対話型学習の実生活モデル

最初のアイデアは、実物とサイエンスコミュニケーターを使ったサイエンスカフェ風の学習モデルでした。学習モデルは、コミュニケーターを介して学習者が得た情報を自分の考えにまとめ、それを互いに伝えるというものでした。

Slide 8：産業技術史資料 新居浜市旧端出場水力発電所

このような発電機を動かすことは不可能です。

Slide 9：新居浜市旧端出場水力発電所

これらが今回使用する学習リソースです。

Slide 10: 新しいコンセプトのコミュニケーションスペース「サイエンススタジアム」

これが私たちの『メタバース空間「サイエンススタジアム」での新概念コミュニケーション』です。

この図は、私たちの計画が将来どのように機能するかを示しています。
科学館、図書館、大学、研究機関、民間企業、自然遺産等とネットワークを形成し、教育講座を提供しています。

科学のサイエンスコミュニケーション活動をデジタル化することで、より幅広い教育活動を提供します。

Slide 11: スタジアムの第一の特徴は、時空を超えて学べる科学コンテンツ

私たちのチームは、時間と空間を超えてどこからでもインタラクティブな科学や博物館を体験できる、メタバース上の教育プログラムを実施する場所としてスタジアムを開発しました。

スタジアムの第一の特徴は、時空を超えて学べる科学コンテンツです。

歴史を遡ったり、未来を創造したり、空間を瞬時に移動したり、現実では体験できない自然現象を体験したり、地球の過去と未来を体感することができます。 メタバース空間はアバター本体と同じスケールで再現されているので、実際の大きさやスケール感を感じることができます。

Slide 12: スタジアムの 2 つ目の特徴は、好きな角度から鑑賞できることです。

スタジアムの 2 つ目の特徴は、好きな角度から鑑賞できることです。

Slide 13: 自然現象や産業博物館の展示品を再現する 3D アニメーション

自然現象や産業博物館の展示物を 3D アニメーションで再現するため、物体の変化や物理的に目に見えない力を鮮明に表現することができます。 アニメーションの実行や画像の切り替えができるボタンも実装しており、いつでも好きな角度から観察することができます。

Slide 14: スタジアムの 3 つ目の特徴は、学芸員や他の学生と直接コミュニケーションできることです。

メタバースはオンライン空間なので、プログラム中いつでもコミュニケーションをとることができます。 プログラムに参加することで、自身の疑問や発見を研究者と共有したり、新たな考え方や価値観に触れたりするなど、双方向のコミュニケーションを通じて理解を深めることができます。

Slide 15：3-1. メタバース空間の水力発電所を利用した「教育プログラム」

本発表では、SDGs 時代の「発電のあり方」を考える、旧水力発電所を活用した「教育プログラム」を作成しました。

Slide 16: 3-2. メタバース空間の九端場水力発電所を利用した教育プログラムの構成

プログラム構成の考えは次の通りです。

・多様な知を結集することで、地球規模の課題を多角的に解決します。
・一つの課題を多角的に紐解く場が必要。
・一方的な知識の提供ではなく、双方向の知識の融合を提供したい。
・展示を中心とした双方向の意見交換
・展示資料を自分で観察することで、自分なりの視点を得ることができます。

私たちの学習の構成は次のとおりです。

Step1: 流域ごとに決まる総降雨量を理解する
Step2: どれくらいのエネルギーが得られるかを計算する
Step3：SDGs の観点から見た創出方法の課題と改善点は何ですか？
Step4: 対話を通じて得た知見をもとに、未来のエネルギーを生み出すシステムを設計する
Step5：地球に負担の少ないエネルギーを考え、表現する。

Slide 17: 流域ごとに決まる総降雨量を理解する
Step1 インストラクターから参加者への Input1
　雨が川の水になり、発電のエネルギー源となる総量を計算する学習活動です。

Slide 18: Step2 参加者の探究学習と成果 1（自然条件と技術的な解決）
　どれだけのエネルギーを得ることができるかを計算します。
回収できる水の総量は地形の特性などにより異なります。発電効率は 70%として計算します。

Slide 19: Step3 SDGs の観点から見た生み出し方の課題と改善点は何ですか？
Step3 参加者の探究学習と成果 2（社会的な解決）
　エネルギーを生成する方法の課題を、自然破壊、安定的な共有、安全性、新技術などの視点も加味して考える。

Slide 20: Step4 まとめアクティビティ
参加者の成果 3（まとめ）
　エネルギーを生み出す未来のシステムを設計し、自然を活用した活動や産業技術の発明、再生可能エネルギーなど SDGs の視点から、これからのエネルギーのつくり方、使い方について考える。

Slide 21: ステップ 5 表現活動
参加者の成果 4（発表）
　参加者の成果 1-3 の意識を解決しながら、「地球への負荷が少ないエネルギーを得ることができるか？」について、各自発表し、成果を評価する。

Slide 22:〈メタバースで使用する収録アイテム〉
　これまで博物館で資料を保存する際に記録すべき項目は次のとおりでした。
　メタバース空間に導入されると、追加のアイテム＜9＞が追加されます。
1 施設・構造物の名称、位置、大きさ、重量の外観説明
2 設備、機械、測定器・工具、工具構成
3 製品の稼働状況（完成品、試作品、量産品等を含む）
4 部品、材料、サンプル等の資料
5 標本、模型、レプリカ、写真、マイクロフィルム
6 設計図、仕様書、工業規格、カタログ
7 文献（書籍、雑誌等）、PR 動画、特許公報等
8 日記やメモなどの原稿
9 追加情報は、精密な設計図、動作状態を示す動画、人類史や自然環境との関係を示す資料

Slide 23: 6. まとめ

物理的にアクセスが困難なアーティファクト（産業技術史資料）を対象に、メタバース空間における「総合的な知を目指す科学コミュニケーション活動」を適用し、

1) 現実では見ることができない部分や現象を観察する

2) 広い視野で考え、現代の課題を解決する方法を見つける

3) またバース空間での活用により、保存の意義と活用に対する国民の理解を高めることができる。

今後は、産業技術史資料や遺物の収集・保存・デジタル化における科学博物館の役割を研究し、人工物の保全に関する国民の意識向上とメタバース活用の重要性を提案する。

Slide 24：新コンセプトのコミュニケーションスペース

この図はメタバース空間（サイエンススタジアム）の構造をイメージしたものです。これは新しいコンセプトのコミュニケーションスペース「サイエンススタジアム」です。

Slide 25: 地球を知ることから始まる大きな物語

今後の展開については、

・遺物の収集、保存、デジタル化における科学博物館の新たな役割の検討

・人工物に対する一般の意識を高め、メタバースを活用することの有用性の提案

を考えています。ご清聴ありがとうございました。

これらの新しい事業に興味のある方は、明日このプログラムの簡単なツアーを予定していますので、お問い合わせください。

6. Abstracts and Photos

Keynote Session

Has There Ever Been a Long-range Perspective at the Deutsches Museum, and When Did It Got Lost?

Ulrich Kernbach (Deutsches Museum)

Collection-based science and technology museums today live in a paradoxical situation. On the one hand, their collections and exhibitions draw on historical considerations, pondering filters in time and in space to patiently serve their missions. On the other hand, they are driven by public and political mentalities equating modernity and progress with scientific and technological research. Serving these expectations of modern science being eponymous for science, fourth-generation science museums [1] are striving to stay relevant, to keep up and to engage in discourse. Being modern is the tune of the time, rapid-response Covid collecting or the future-oriented exhibition narratives are just two examples in this respect we can find in a number of institutions including our own.

For science and technology museums without a natural history component today, this focus might seem to leave little room for long-range perspectives that transgress these representations towards evolution of knowledge [2] rather than of science. This situation reinforced by the fact that most scientific and technological collections have a dominant bias of objects in the modern period for both preservational and historiographic reasons.

As the museum currently is undergoing a once-in-a-century transformation due to its complete renovation to be completed in 2028, this is an adequate moment to reflect on previous approaches towards representing long timescales in the evolution of science and technology at the museum. In this contribution, we will retrace the changes in museum practices at the Deutsches Museum from its foundation in 1903 to its present day museological approach.

The Museum founder, Oskar von Miller (1855-1934) having an all-embracing museum in mind, the founding exhibitions explicitly included long-range visions of the geological development on earth and pre-historic technology that still included colonial views of the world. The diorama as a medium of exhibition technology was used to counter the lack of artefacts for these historical periods. By looking at specific examples of exhibition renewals, we analyze how these perspectives were removed over time as the museum kept adapting to its social and political environment.

[1] Pedretti, Emilia / Iannini, Ana Maria Navas: Controversy in Science Museums: Re-imagining Exhibition Spaces and Practice. Milton Park 2020.

[2] Renn, Jürgen: The Evolution of Knowledge. Rethinking Science for the Anthropocene. Princeton 2020.

Remaking Museums: Examining the Scholarly and Intellectual Frameworks for the Material Heritage of Science and Technology as Seen in Museum Renovations

Margaret A. Weitekamp (Smithsonian National Air and Space Museum)

How have curators framed the intellectual and scholarly work undergirding exhibits of science and technology at major national museums by keeping objects at the center of analysis?

A striking number of science and technology museums have followed a similar pattern in recent years. In 2014, the Canada Science and Technology Museum building closed due to airborne mold and structural instabilities. The C$80.5 million renovations completed in 2017 upgraded the physical plant and re-envisioned exhibits. In 2015, after a year of work, the National Museum of Nature and Science opened its renovated north exhibit hall, Chikyūkan. Likewise, in 2015, the Deutsches Museum started a major project of renovation and modernization. In addition, since 2021, the Deutsches Museum Nuremberg offers a bold new vision of possible futures. With the closure of Blythe House in 2019, the Science Museum, London undertook major collections relocations while also supporting new exhibit development. Finally, the Smithsonian's National Air and Space Museum began its own revitalization and transformation project in 2018. Half of the Museum's building on the National Mall in Washington, DC reopened to the public in October 2022; east end exhibits will be completed in 2026.

These institutions share other commonalities. They are all major national museums founded to preserve the material heritage of science, technology, and the natural world: the National Museum of Canada (1842); the Smithsonian Institution (1846); the Science Museum, London (1857); the Deutsches Museum (1903 – although rooted in an electricity exhibition in 1891); as well as this year's Artefacts host institution, the National Museum of Nature and Science (1871). Each boasts impressive artifact collections. More so, all of these institutions have professional curatorial staff who have guided these major renovations not only as operational projects but as intellectual undertakings privileging material culture. What insights can be gleaned through comparative analysis?

Procedural histories of these renovations would only tell part of the story. Therefore, in addition to examining object choices and how that work was done within the constraints of budget, schedule, and cost, I plan to take a larger view at the intellectual projects that museum embody, to investigate how curators at these museums took on the challenge of redefining the stories told. What have been intellectual and scholarly frameworks used to

guide these renovations? How did that affect collecting? And how are public audiences responding to the wide-angle, long-range views being presented? This paper represents the first foray into a new book project investigating these parallel, transnational stories.

In addition to presenting this paper—the framing of the project, including its scope, methods, and expectations—in order to elicit critical feedback from the Artefacts conference participants, being able to attend the 2023 Artefacts conference would allow the author to develop and strengthen the personal and professional connections that will be vital to the development and completion of this book project. In addition to visiting the National Museum of Science and Nature, conducting interviews with curators would provide the foundation and first case study for this comparative, transnational examination of the role of museums in framing the changing scholarly engagement around the material heritage of science and technology.

Dr. Scott Anthony (Discussant)

PhD Candidates/Students Session

The Earth and the Electrometer: Measuring Atmospheric Electricity 1850–1930

Katy Duncan (University of Cambridge)

This talk presents the overlooked history of atmospheric electricity between 1850 and 1930 through the lens of its instruments, specifically the electrometer. This understudied instrument-led field of inquiry was a vital part of nineteenth century physics. The instruments for collecting and measuring atmospheric electricity had a plasticity that enabled phenomena to be interrogated creatively and productively. Further, physical instruments were employed as a metaphorical framework to capture the otherwise indescribable phenomena surrounding global atmospheric electrification.

The analogy and presumed identity between lightning and the sparks drawn from electrical machines, established in 1752 by Benjamin Franklin and Frenchman Thomas D'Alibard, has been heralded as a pivotal moment in the history of physics, ushering in a new era of electrical science that has connected and transformed our world. However, that same year, French experimenter Louis-Guillaume Le Monnier (1717-1799) found his electroscope rendered another phenomenon visible on a clear day: ordinary air appeared to be electrical too. His electroscope was a very simple instrument that merely indicated the presence of charge using an insulated string, but what it demonstrated contradicted the common assumption that air was an insulator. What was this invisible electricity, and where did it come from?

This talk looks at the period between 1850 and 1930 where new precision electrometers were developed to quantify the perplexing electrical relationship between the Earth and the atmosphere. I examine the instruments used in three case studies: the field-defining material innovations of British physicist-industrialist William Thomson (Lord Kelvin) from 1850; the subsequent, divergent projects by Austrian physicist Franz Exner and German schoolteachers Julius Elster and Hans Geitel; and the controversy that surrounded British physicist C. T. R. Wilson's global theory of atmospheric electrification in the early 20th century.

Electrometers were used, improved, transformed, and co-opted by different practitioners to investigate atmospheric electrification in various ways across this period. I argue their uses reflected and shaped shifting criteria that were employed to measure different atmospheric-electric phenomena. Crucially, though the electrometer's design remained largely the same after 1850, its malleability allowed different views of nature to emerge through the measurement of different variables: potential, charge, and current. By connecting these cases through their material culture, it becomes evident how atmospheric electricity and the electrometer played an integral role in the development of not only electrical studies, but physics more broadly. The atmosphere's electrometer led to a wealth of incidental developments in radioactivity, ionic physics, cosmic ray science, quantum mechanics, meteorology, and geo-science.

Further, thinking with electrical instruments was central to many practitioners' conceptualisations of the Earth-atmosphere system. Metaphorical Leyden jars, capacitors, circuitry, and batteries were invariably invoked to explain the global system otherwise out of reach. Changes in scientific understanding were thus mediated both by physical and metaphorical scientific instruments using different conceptual perspectives based on several invisible electric quantities.

In conclusion, this project motivates the case for undertaking more artefact-driven histories, arguing that they uniquely enrich existing accounts as well as generate new histories of science.

EcoMuseum in Kazakhstan: The Dark Aspects of the Soviet Scientific and Technological Achievements

Irina Fedorova (Friedrich-Alexander-Universität Erlangen-Nürnberg)

This paper focuses on the EcoMuseum in Karaganda, Kazakhstan, which stands as a unique institution focused on presenting (post-) Soviet environmental history – one of the destinations for dark tourism in Central Asia, alongside Polygon, ALZhIR, Baikonur and others. The development director of the museum, Dmitry Kalmykov, who participated in the liquidation of the Chernobyl accident, is now working on organising a clean-up of the aftermath of nuclear tests at the Semipalatinsk test site. The EcoMuseum, established in Karaganda in 1995 and registered as a public association in 1997, has a mission to collect and disseminate environmental information in Kazakhstan. As an ecomuseum, its aims to enhance the role of the community in addressing pressing environmental issues and they focus on increasing environmental awareness among the public and government authorities, engaging them in active nature conservation efforts, fostering collaboration between the government and the public to solve environmental problems and ensure sustainable development in Kazakhstan, conducting research on acute environmental issues through data collection and their own environmental studies. The EcoMuseum considers it to be their mission to educate the public about the climate crisis, toxic pollution from the oil and gas industry, and radiation danger, and effectively showcases the region's unique environmental challenges.

The museum's exhibition consists of various thematic sections: Mineral Resource Development, Industry, Radioactivity, Nuclear Testing and Environmental Consequences of the Soviet Military Industrial Complex, Space Exploration, and so on. It specifically focuses on raising awareness about the hazards of nuclear weapons testing in Semipalatinsk and the environmental impact of the space industry debris scattered across the steppe. As one visitor recalls, "It is fun, feels a bit like exploring grandma's attic, maybe if grandma was a nuclear scientist". Space junk is another point of interest for visitors, pieces of rockets, fuel tanks, nozzles, space capsules, which "show clear re-entry scorch marks". Despite limited financial support, the EcoMuseum thrives on the enthusiasm of its staff and a relaxed atmosphere that encourages interaction. Almost all of the exhibits in the museum can be touched – of course, not in the nuclear section, that contains actual artefacts that were exposed to nuclear blasts. Such accessibility makes the museum a unique destination, as acknowledged by a visitor's TripAdvisor review stating, "I don't know any other place where you could touch or hold Russian rocket parts in your hand." The paper's focus on artefacts, the unusual exhibits that can be found in the museum, allows to highlight the ways in which the museum revisits the

history of Soviet science and technology. Rather than focusing solely on the grand achievements of the USSR in nuclear and space fields as traditionally presented, the museum sheds light on the dark legacy associated with these advancements. The ways in which the museum's artefacts are collected, presented, organised and allowed to interact with, highlight the unique approach of the museum to involve this problematic legacy in addressing present issues.

Museography of Technical Objects: André Leroi-Gourhan's Museum Work on the Technical Milieu of the Eurasia

Lufeng Xu (École des hautes études en sciences sociales)

André Leroi-Gourhan (1911-1986), the founder of prehistoric ethnology in France, is the heir of both the French school of physical anthropology founded in the mid-19th century by Paul Broca, and the French school of ethnology whose representatives are Marcel Mauss, Paul Rivet and Georges Henri Rivière. During his long academic career academic career, Leroi-Gourhan worked mainly on the reconstruction of the daily life of life of humans in the Paleolithic period by tracing the process of hominisation. In order to illustrate his theories, Leroi-Gourhan had a very rich experience in the museum field. It was in 1932 that he met Paul Rivet, who held a chair in contemporary and fossil anthropology at the Muséum national de la nature, to which the Musée d'ethnographie du Trocadéro was attached, and that he launched a real museum activity.

Considering the young Leroi-Gourhan's interest in Eskimo objects and his language skills (mainly Russian, Japanese and Chinese), Paul Rivet entrusted him with the "Arctic" section. For four years, until 1936, Leroi-Gourhan was responsible for the classification, description and exhibition of Siberian and Eskimo objects (in collaboration with Paul Rivet, Georges-Henri Rivière Anatole and Lewitzky). In the autumn of 1936, the Japanese government offered him a scholarship to go to Japan in 1937 and he stayed for two years. During these two years, he collected a large number of Japanese documents and objects for the new Musée de l'Homme, reorganised in 1937 from the Musée ethnographique du Trocadéro. After his return to France in 1940 and until his departure for Lyon where he taught in 1944, Leroi-Gourhan worked a lot in Parisian museums. In addition to the Musée de l'Homme, he also worked for two Asian art museums that housed the objects he had collected in Japan: the Musée Guimet and the Musée Cernuschi (in collaboration with Joseph Hackin and Jean Buhot).

From the Musée d'ethnographie du Trocadéro to the Musée Guimet, from the Eskimos to the Japanese, Leroi-Gourhan's museum work is based on a comparative perspective. In the

meantime, a large part of the objects treated by Leroi-Gourhan in these museums are related to technique. The question of collecting, classifying, describing and exhibiting techniques is crucial in museographic knowledge and practice. For him, the museum, the object and the technique are inseparable. Through this museography of techniques, he developed comparative technology around the Eurasia, as shown in his article "Man and Nature" published in 1936 in the Encyclopédie française, edited by Lucien Febvre. How does this comparative technology manifest itself in museum theory and practice? What is Leroi-Gourhan's definition of a technical object? How does he classify and organise technical objects? How are technology and technical objects presented in different types of museums? On the basis of Leroi- Gourhan's theses, I will therefore analyse Leroi-Gourhan's idea of the museography of techniques established around the Eurasia.

Circulating Civilisation: Venetian Glass Beads as Agents of Global (Ex)Change

Sandrine Welte (Ca‘ Foscari University)

Deemed one of the truly transnational products of human civilisation, man-made glass can serve as a lens to investigate century-old crafts, long-distance interactions, economic exchange as well as trans-culturally shared knowledge traditions. Whereas accounts on the origin of glass production remain rather conjectural, evidence points to pearls as the first objects in this material. A plethora of different techniques developed in the Venetian Lagoon thereby afforded their status as globally coveted commodities. Venice’s strategic position on the shore of the Adriatic - appositely located between Orient and Occident and hence at the crossroad of three continents - proved favourable for the city to develop into a trade hub as through her ports, merchandise and goods from faraway places were disseminated into the European market. The sack of Constantinople in 1204 lastingly cemented the role of the Serenissima, as new territories got integrated into the republic, which at the same time allowed for an expansion of commercial routes. Developed over time according to shifting geopolitical contexts, these trade networks can be traced back thousands of years, accommodating extensive economic and cultural exchange while proving conducive to the establishment of wealthy centres of commerce. As routes of encounter and dialogue, they furthermore proliferated the dissemination of religions, while intensifying scholarly and intellectual discussion.

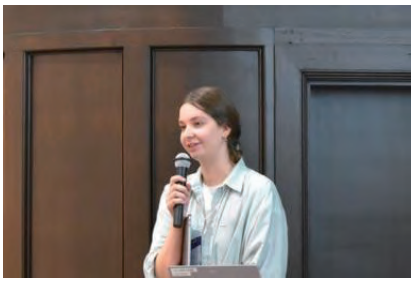
Crafted with keen attention to the unique heritage, the beads left the Lagoon destined for new shores where they were integrated into the local economies. By this, they were newly coded, according to the respective context. Light shall thus be shed on how an appropriation and a repurposing of the pearls underscores their transformative power, endowing the beads

with agency and new meaning while concurrently impacting practices of exchange as well as cultural traditions. As the pearls were primordially produced by women, they may furthermore serve as a lens to investigate the role they played within the economic system that was otherwise determined by the male sex.

Once singularities of precious nature, today, the hand-made pearls have become substituted by mass- produced items which - rarely manufactured in the lagoon - speak to a commodification and selling of Venice, while at the same time raising the question of what has remained of the once flourishing Silk Road. In view of ever scarcer resources - that equally entail the occurrence of sand - the glass beads equally serve as a mirror to reflect on notions of a ruthless global capitalism and ferocious financial system that seems to deny the possibility of a sustainable future.

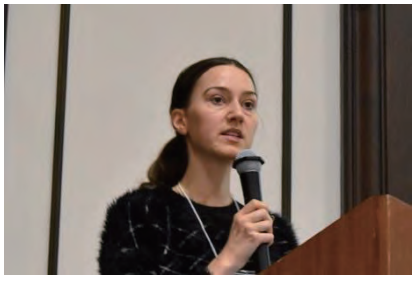
From production to distribution to consumption, a re-iteration of the economic and cultural significance of Venetian beads in their manifold 'existence' shall hence suggest a new take on the historical and contemporary circulation of objects as a mediator for intercultural communication and exchange.

Ms. Katy Duncan



Ms. Irina Fedorova

Mr. Lufeng Xu



Ms. Sandrine Welte

Regular Session 1: *Transdisciplinary Exhibitions*

Special Exhibition “Poison”: An Epochal Exhibition Held in the National Museum of Nature and Science

Tsuyoshi Hosoya (National Museum of Nature and Science, Tokyo)

In winter of 2022 to spring of 2023, National Museum of Nature and Science presented a special exhibition on poisons. The exhibition intended to introduce a wide range of poisons in nature and in our daily life, and provided an opportunity for the visitors to think what exactly poisons are, and how to live with them. Although there had been exhibition dealing with poison, the exhibition was remarkable and differed in the following aspects: 1) The exhibition covered a wide range of poisonous matter, including poisonous plants, animals, and fungi, minerals, and artifacts. 2) The exhibition also provided evolutionary and historical insights to poisons. 3) The exhibition was designed to produce images showing how we incorporated poisons into our daily life, and how our daily life is inseparable from toxic matter. We exhibited more than 250 items in 1,100 m2 venue, and about 300,000 people visited in 93 days (Nov. 1, 2022 to 19 Feb, 2023). The exhibition was also held in Osaka (at Osaka Museum of Natural History) and had about 150,000 visitors (March 18, 2023 to May 28, 2023).

The exhibition consisted of five chapters. Chapter 1 was the introductory part to show the definition of poisons (defined as “harmful matter to organisms, including human and animals”), and categorized to three groups based on their targets (blood, cells, and nerve systems).

Chapter 2 was the core part of the exhibition showing a variety of poisonous organisms (plants, animals, and fungi), minerals, and artifacts including insecticides and marine microplastic. At the head of this chapter, we attempted to astonish the visitors by the four highly magnified models of poisonous organisms (hornet, larva of moth covered with spines, stems of Urtica plants covered with glassy spines, and Okinawan pit viper attacking toward the visitors) all supervised by the professional researchers to the detail.

Chapter 3 provided examples where poisoned triggered the evolution and diversity by showing some episodic examples (remarkable ecosystem developed in a highly poisonous environment in the deep sea, Müllerian and Batesian mimicry, breeding strategies using poisons, and acquired toxicity resistance).

Chapter 4 presented a cultural viewpoint about the relationship between poison and human. Through this chapter, we intended to show how human found, analyzed, avoided or utilized, and incorporated poisons to our daily life by a series of artifacts (poisonous arrow, poisonous gas, chemical approaches, insecticides and repellents, and foods).

The final chapter was a comprehensive part to look back the exhibition by giving

some symbolic items (toxic alien species, penicillin, and antitoxins), to deliver a message that we live surrounded by poisons but some poisons are useful. We have the wisdom and skills to use and overcome them. We need to live well with poisons.

Going Wide: Exhibiting Elephants and Ivory

Kristen Frederick-Frost & Carlene Stephens (Smithsonian National Museum of American History)

In November 2019, a year-long exhibition titled Elephants and Us: Considering Extinction opened at the National Museum of American History—an unusual venue for a topic that one would expect to see elsewhere at the Smithsonian, perhaps at the National Museum of Natural History or the Zoo & Conservation and Biology Institute.

This exhibition focused on African and Asian Elephants, but it did so by exploring the role the United States played in the decline of wild elephant populations as well as the country's modern scientific and legislative efforts to conserve Earth's largest land mammal. The demand for ivory artefacts provided a narrative thread that stretched across centuries, across academic and museum disciplines, and ultimately enabled a long-range view of how elephants were—and are—critical to the very concept of extinction.

This talk focuses on the exhibition development of Elephants and Us and considers the promises and pitfalls we encountered. A truly cross-disciplinary endeavor, the project relied on the collections from three Smithsonian units and combined efforts from curators of the history of technology, science, politics, and culture. A biologist advisor on the team was a former top administrator at the U.S. Fish and Wildlife Service. We explore the consequences of crossing deeply entrenched academic boundaries between history, natural history, and conservation sciences. This blending of perspectives facilitated a rich intellectual research experience which resulted in a novel narrative that juxtaposed objects in surprising ways. But as our narrative expanded, so too did the stakeholders. The result was an unexpected challenge: to strike a balance between the contemporary scientific and collecting values of our institution while grounding the exhibition in a critical historical approach.

In addition, we learned a powerful lesson about artefacts. One expects to find an elephant jawbone or a mastodon tooth in a natural history museum, not at an American history museum. We discovered that crossing disciplines means confronting those expectations and recognizing that for visitors and museum professionals alike the new context can bring either destabilizing disappointment or a deeper understanding.

We discuss the aspects of our exhibit development and implementation that met with success as well as the areas in need of improvement. It is our hope that the lessons we learned

from this exhibition and the questions raised might resonate with other museum professionals who are embarking on cross- disciplinary projects, in large national institutions or small local collections.

Exhibiting Seaman's Yarn: A Pirate, a Cipher, and the Fiery Cross of Goa

Carola Dahlke (Deutsches Museum)

The field of cryptology alone offers a multitude of exciting exhibits and stories for a museum of science and technology. But when secret ciphers meet seaborne piracy and gold treasure, it sounds like a perfect mix for a successful story-telling. However, today's thorough long- range view behind the scenes of the golden age of piracy led to sobering contexts related to colonialism, inquisition and finally a lack of artefacts.

This is how the story is passed on: In the waters of the Indian Ocean, a ruthless pirate attacked a rich Portuguese cargo ship in 1720. He robbed the ship and the entire cargo, consisting of diamonds, jewellery, gold and silver bars as well as pearls, fine fabrics, spices, furniture and precious stones, estimated by historians to be worth up to 5 billion euros today. Religious articles from Goa Cathedral, located in India, had been on board, including the Golden Cross of Goa, which is said to have weighed more than a hundred kilograms, so that three men were needed to reload it. After this successful robbery, the pirate went into hiding for several years and was only discovered and executed in 1730. Shortly before his death, according to legend, he threw a cryptogram into the crowd - supposedly with the description of where to find his share of the pirate treasure. For centuries, the whereabouts of the cryptogram and the treasure was unknown. Until in 1934, the honourable French historian Charles de la Roncière (1870-1941) published a dime novel. According to the author, a lady from the Seychelles had found a secret cryptogram in the family's estate, and had asked de la Roncière, who worked at the Bibliothèque Nationale in Paris, for help. De la Roncière related the cryptogram to the great pirate's raid of 1720, and published more details and a first deciphering of the cryptogram in his novel. Although unlikely, de la Roncières publication triggered a veritable treasure hunt that continues in earnest to this day. Numerous books and filmic interpretations reproduced this story at second and third hand, and a large community keeps hunting the pirate's treasure, deciphering and interpreting the supposed cryptogram, and describing the main artefact, the Fiery Cross of Goa, as a famous piece of art.

So, to sufficiently substantiate this story for an exhibition on cryptology and enciphered manuscripts at Deutsches Museum with original documents, archive research was undertaken to distinguish between legend and truth. Undoubtedly, the French pirate Oliver Levasseur (ca 1680-1730) and the Portuguese ship with the name Nossa Senhora do Cabo e

São Pedro existed - everything else seems to be sailor's yarn: Since its publication in 1934, the authenticity of the cryptogram was regarded with great doubt. Written in a simple masonic cipher, i.e. easy decipherable, the content sounds more like a cooking recipe than a clue to the treasure. But if the cryptogram was a fake, there was still the big question of where the pirate treasure was hidden. To learn more about the nature and dimension of the treasure, original documents from the 18th century were analysed. Finally, a presumable real story emerged from eye-witness accounts that unfortunately no longer had much to do with the original idea: The rich cargo of the Portuguese Ship consisted most probably of slaves, apart from a handful of diamonds that were shared between the pirate's crew.

However, most surprising of all was that the much-described golden cross of Goa had never existed. Yet, there is a legend from the year 1619 about a flaming cross of Goa (i.e. the Holy Cross of Boa Vista) that burned outside a church and healed sick people. This miracle was said to appear in the hardest times of the Goa Inquisition, when about 16,000 native Hindus were massacred in the name of Christianity.

Putting everything together what we know today, we must assume that the well-known and respected historian Charles de la Roncière mixed few facts with more legends, and invented a cryptogram to write a very successful and breath-taking dime novel. Which means that the greatest sailor's yarn has been written by a land person - and is still considered real today. So what is to be exhibited now?

Exploring Methods for Re-evaluating ArtScience Collections: Experiences with Botanical Art Exhibition at the University Museum

Ayumi Terada (The University Museum, the University of Tokyo)

In recent years, a new concept of ArtScience has been proposed. Combining art and science, it aligns with the prominent rise of interdisciplinarity and intermedia in related research fields. Botanical art is a classic example of ArtScience. Beginning to be produced in Europe in the 16th century, botanical art has made great progress, especially since the 18th century. It holds scientific value in the accuracy of the information depicted through the observation of plants, which is essential for the development of botanical research. Meanwhile, its artistic value lies in the high illustrative quality, which are the works of artists.

Botanical models have the same composite value as the botanical illustrations. Botanical specimens can be considered in the same manner as artefacts made from natural objects. However, many botanical illustrations and models have been neglected once they have served the purpose for which they were created, and botanical specimens are often placed only in the context of science, as research materials unrelated to art and artefacts. While recent

exhibitions of botanical art in art museums hint towards its re-evaluation, the simplistic placement of botanical illustrations in the general realm of existing art does not do justice to their value as ArtScience.

The purpose of this paper is to examine the methodology of re-evaluating botanical collections in museums as artefacts that have the character of ArtScience from the field of natural history and museum studies. Specifically, this paper will focus on botanical illustrations and specimens.

The University Museum, the University of Tokyo (UMUT), houses botanical specimens and illustrations collected for research and education at the University of Tokyo from the late 19th century, when the university was founded, to the present day. These include the earliest historical collections of botanical art in Japan. The UMUT organised exhibitions of botanical art collections from the University of Tokyo seeking to bridge art and science. In particular, specialists in art history and botany have collaborated in the planning of exhibitions that combine botanical art and specimens, two indispensable tools for botanical research, to highlight the characteristics of each artefact.

In recent years, the social role of museums has been reviewed, emphasising that museums should not be limited to the transmission of existing knowledge and values but should also be creative places that generate new values and discussions. As research-oriented museums, university museums are expected to play a role in experimenting with and sharing results with society. In this paper, I discuss the challenges of preserving and utilising the botanical collections of ArtScience through some practical case studies of exhibitions at UMUT. This analysis is done against the backdrop of the social role of museums in general and university museums.

Dr. Tsuyoshi Hosoya

Dr. Kristen Frederick-Frost

Dr. Carola Dahlke

Dr. Ayumi Terada

Public Session (International Symposium)

"Where Do We Come From, and Where Are We Going?": Retelling the Story of Humans and Nature and Exploring the New Roles of Science Museums

*Conducted with simultaneous interpretation in Japanese and English, as well as live streaming on the internet

Plenary Talk:

Leap Through Science: The Reversible Time Machines

Seigow Matsuoka (Director of Editorial Engineering Laboratory and Kadokawa Culture Museum)

Lectures:

Pondering on the Unknown World Beyond the Pale Blue Dot

Yasushi Suto (The University of Tokyo)

Human as a living thing in Biohistory

Keiko Nakamura (JT Biohistory Research Hall)

Modern Human Environment from Evolutionary Perspectives

Mariko Hasegawa (Japan Arts Council)

Revisiting the Past: The Role of the Science Museum in the Formation Process of Modern Nation-State

Sayaka Oki (The University of Tokyo)

How to Think the Anthropocene: Exploring Deep-time Through Interscalar Objects

Fabienne Will (Munich Science Communication Lab and Deutsches Museum)

The New Role of Museums in an Extraterrestrial Context

Teasel Muir-Harmony (Smithsonian National Air and Space Museum)

Mr. Seigow Matsuoka

Dr. Yasushi Suto

Dr. Keiko Nakamura

Dr. Mariko Hasegawa

Dr. Sayaka Oki

Dr. Fabienne Will

Dr. Teasel Muir-Harmony

Regular Session 2: *New Role of Artefacts in Science Communication*

Development of a Program Framework Responding to Global Contemporary Issues in Japanese Science Museum Setting

Yoshikazu Ogawa (Rissho University) and Collaborators

Background:

Science literacy is vital if people are to properly respond to the problems concerning science and technology they face in everyday social life. Although schools are still required to play a basic role in the process, the lifelong fostering of science literacy should be conducted by diverse bodies that include: lifelong learning organizations such as science museums; a variety

of media, businesses and non-profit organizations and local communities and households. To realize a well-being society in which people can enjoy happiness throughout their lifetime, science museums are required to perform the social roles of contributing to foster science literacy and to raise the degree of maturity of the science culture. For the effective development of the above, new methods and ideas such as educational programs for each generation of people are required.

Methodology:

In order to meet this objective, we developed the "Continuous Educational Program Framework to Foster Science Literacy." This is composed of a continuous learning system that sought to foster science literacy at every stage in the life of each generation, focusing on the issues in the natural world and human society. It not only develops and improves the knowledge and attitudes towards science and technology at every stage of each generation, but also enables each individual to recognize their own development. In addition, through communications between science museums and society, society is encouraged to support such developments. The framework consists of five generations and four goals. It will assist diverse science museums to develop educational programs that foster science literacy thinking in people spanning five generations, from preschoolers to senior citizens. It would foster four goals: cultivation of sensitivity, attainment of knowledge and understanding of concepts, fostering of the habit to think scientifically, and development of the ability to properly respond to circumstances in society.

Information on 1000 educational programs conducted in 100 Japanese science museums were aggregated and classification were performed based on this framework in 2010 and 2022.

Results:

In both surveys, most of the educational programs conducted in Japanese science museums were aimed at "cultivation of sensitivity" and "attainment of knowledge and understanding of concepts" for younger generations.

On the other hand, a survey in 2022 revealed that some museums have implemented educational programs that deal with contemporary issues such as the SDGs and inclusiveness. It was also revealed that about 10% of educational programs were conducted online.

Conclusions:

Despite the management of museums facing difficult circumstances in Japan, science museums are expected to devise a framework to foster science literacy in order to contribute to the building of a well-being society whose people can live in prosperity within a mature science culture. In our surveys, the attitudes of science museums to respond to changes in the social situation could be found. Local science museums are continued to expect to promote school education and lifelong learning at every stage in each generation by referring to this framework.

Communicating Science in the Peripheries: Role of Artifacts at University Museums in Northern Mindanao

Jonel Maria Caba (Mindanao State University) and Bulkhia U. Panalondong (Central Mindanao University)

In an ever more connected world, artifacts play a crucial role in bridging the gap between scientific knowledge and the public, especially in the peripheral regions where external and internal factors affect the establishment and management of museums. In the southern region of the Philippines for instance, artifacts serve as cultural and historical artifacts that contextualize scientific knowledge within the local context. The artifacts provide a tangible link to scientific concepts and allow for hands-on exploration, enhancing visitors' understanding and appreciation of scientific principles. By showcasing these artifacts, university museums contribute to the preservation and promotion of local scientific heritage, fostering a sense of pride and identity among the local communities.

This paper explores the role of artifacts in communicating science in the peripheries, specifically focusing on university museums in Northern Mindanao, Philippines. By employing a qualitative approach, utilizing interviews, observations, and document analysis the aims to understand how artifacts contribute to the dissemination of scientific knowledge and promote public engagement with science in these museum settings.

Ultimately, the study highlights the significant role that artifacts contribute to the understanding of science, technology, and nature through the university museums in the peripheries. It demonstrates how these museums have the ability to close the communication gap between science and the general public, streamline scientific literacy, and preserve the scientific heritage of the area.

Learning from Scientific Artefacts: Teaching Practices at Tsinghua Science Museum

Zheran Wang (Tsinghua University/Tsinghua Science Museum)

Tsinghua Science Museum (Hereinafter referred to as TSM) was established in 2018 with the aim of creating China's first university science museum based on historical scientific objects. Nearly all Chinese science museums adhere to the science center model, which typically lacks object collections. In such an environment, the development of TSM represents a highly innovative and challenging undertaking. Although the museum's permanent building will not

be completed until 2026, during the current preparatory phase, professors and staff have made significant strides in integrating museum construction with teaching. Specifically, the practice focuses on two areas: material culture studies based on collections of historical scientific instruments and reconstruction research of ancient scientific or technological artifacts.

At TSM, the scientific collection currently boasts 7,000 objects, which we have salvaged from university laboratories or acquired from antique markets in Europe and the United States. We have designed a series of new courses that use these collections to complement the traditional teaching system. Through the courses, students gain an in-depth understanding of the history of science with an emphasis on the artifacts that shaped it. In addition, students have the opportunity to gain hands-on experience with the collection and learn how to write reports or biographies of objects. Motivated by artifacts, students seek out diverse sources, combine different types of knowledge, and create distinctive historical narratives.

Another way to expand our collection is through reconstruction research, since many historical scientific objects have been lost or are too valuable to obtain. Tsinghua University's strong engineering background has allowed us to collaborate with various departments on campus to design and manufacture reconstruction models. In the last five years we have reconstructed Pascal's mechanical computer, Brunelleschi's lifting machines, Leonardo Da Vinci's various flying machines, Tycho Brahe's astronomical instruments, etc., and these models have been exhibited in corresponding exhibitions. Students from different departments are invited to participate in these projects. During these projects, students will not only learn to design and build models using the latest engineering techniques, but will also gain a new appreciation for the ingenuity and challenges of pre-modern technology.

During our work on TSM and teaching practices, we have become more and more aware of the significance of a museum like this for university education. It has the power to serve as a crucial bridge between different areas of knowledge and bring together individuals from diverse backgrounds.

Science Communication Activities in the Metaverse Space Using Artifacts

Reiji Takayasu (Fukuoka City Science Museum) and Collaborators

Abstract:

This paper explores the potential of science communication activities in the Metaverse space using artifacts. Specifically, we examine the use of a former hydroelectric power plant as a man-made material and Toppan Printing's Metapark® as a metaverse space to cultivate public awareness of preserving science and technology materials. Our claims include the

discovery of new industrial heritage value through virtual educational programs, improved access to artifacts, and the cultivation of problem-solving awareness through science and technology, thus ensuring the value of preserving industrial artifacts. We discuss the concept of applying the Metaverse to artifacts that are otherwise difficult to access, highlighting its usefulness in science communication and fostering public engagement with science and technology.

Introduction

In this section, we propose the application of science communication activities in the Metaverse space to artifacts that are challenging to access physically. We emphasize the importance of utilizing the Metaverse to cultivate public awareness of science and technology, while discussing the role of science museums in collecting, preserving, and digitizing artifacts.

Target Artifacts

This section focuses on the Former Hadeba Hydroelectric Power Plant and its surrounding environment, situated in Niihama City, Ehime Prefecture. We provide a brief history of the power plant, its significance in promoting the modernization of the Besshi Copper Mine, and its transition into a tourist facility. Notably, we highlight the presence of historical generators and a Pelton turbine within the power plant.

Construction of Metaverse Space

Here, we outline the development of a practical program within the Metaverse space. The program involves avatar science communicators facilitating science communication activities through an "avatar museum". The steps for constructing the metaverse space include building a digital museum prototype, exploring innovative production expression methods, creating avatar science communicators, and organizing a lecture on the potential of natural energy for creating new energy.

Science Communication Activities

In this section, we describe the science communication activities conducted in the Metaverse space. Participants engage in activities centered around understanding energy conversion from rain to river water, brainstorming ideas for eco-friendly energy generation, and discussing various topics such as nature, industrial technology, renewable energy, SDGs perspective, collective learning, and the future of energy. We present the tools used, including interactive writing boards, information-sharing boards, voice and text communication features, and active avatar speakers.

Results and Discussion

The results and discussion section highlights the outcomes of the science communication activities. The program's theme, "Where did humanity come from and where does it go?", encouraged interdisciplinary discussions, conceptual changes due to new discoveries, bird's-eye views, and the formation of communication spaces. The findings include the recognition of electrical energy's indispensability, understanding of energy conversion mechanisms, and

the significance of preserving and utilizing materials in a virtual space for industrial technology history.

References

岩渕, 熊野, 亀井, 小野, 木村, 「没入型 3D メタバース情報空間による観光支援システム (Exploring Immersive 3D Information Metaverse for Planning Sightseeing Tours)」, 人工知能学会第二種研究会資料, 2012 巻 AM-02 号, pp.48-55, 2012.
DOI https://doi.org/10.11517/jsaisigtwo.2012.AM-02_09

Keywords: science communication, Metaverse, artifacts, industrial heritage, virtual space, energy conversion, interdisciplinary discussions

Mr. Jonel Maria Caba

Ms. Bulkhia U. Panalondong

Prof. Zheran Wang

Left: Dr. Andrew K. Johnston (Session Chair)

Special Session

Leonardo da Vinci and Propaganda: The 1939 Milan Exhibition and the Invention of a Brand

Claudio Giorgione (Museo Nazionale Scienza e Tecnologia Leonardo da Vinci)

In 1939 the city of Milan organized a very important exhibition about Leonardo da Vinci, with the aim

of presenting his complete work as artist and engineer. The long list of works displayed, with a great diplomatic effort for getting important loans from Italy and abroad, included drawings, paintings, sculptures, documents, plaster casts, works by his pupils and many artists of his time and, last but not least, a huge dissemination of his activity as engineer and "scientist", thanks to the construction of a large collection of models after his drawings and studies of machines and architectures.

The exhibition, held in the new "Palazzo dell'Arte", was largely supported by the Fascist Government and Benito Mussolini himself, being part of a propaganda cultural programme designed to support the politic of "autarchy". This meant the independence and cultural supremacy of Italy in any field of life, economy, and culture, without any need, help or contribution from foreign countries. In fact, the Leonardo exhibition was accompanied, in the same venue, by the "Exhibition of Italian Inventions", very similar to a National Fair, presenting technologies and industries in the most various fields, from telecommunication to optics, from transportation to chemistry, from building engineering to military industry. Leonardo da Vinci was in fact used to legitimate the excellence of Italian technology.

Despite this climate of propaganda, the 1939 Leonardo Exhibition signed a very important episode in the dissemination of his life and work, in terms of museology, museography and in the practice of creating models of machines for educational purposes, to help the understanding of Leonardo da Vinci drawings and studies by a general audience. The collection of models was used not only for the touring of the exhibition in New York and Tokyo between 1940 and 1942 but also, in the post-war period -after its destruction- inspired the creation of new collections for the Museums of Vinci and Milan, ready for the celebrations for the 500th anniversary of Leonardo da Vinci's birth. In a different political context, still Leonardo was used as a "brand" to display the genius of the Italian inventor who anticipated the future, demonstrating how strong the myth of the super-human renaissance man has grown in the reception of the general public, remaining so strong even nowadays.

Reconsidering Past Exhibitions: Leonardo da Vinci's Scientific and Technological Exhibits in Japan

Yoshimi Takuwa (Tokyo Institute of Technology)

A thought-provoking example for reviewing exhibits which praised or mythologized Leonardo da Vinci in the past, from a modern perspective, is the exhibition held in Tokyo in 1942. This exhibition showcased the scientific and technological exhibits brought in Japan from the 1939 exhibition in Milan that had been supported by the Fascist Government. However, in Japan the exhibits were used for propaganda in a different way than they had been in Italy. In the past, the two main exhibitions which triggered the fever of 'Leonardo as an engineer' in Japan, were both held in Ueno. Since this ARTEFACTS meeting is going to be held in the same Ueno location, I would like to introduce the history of the transformation of the image of Leonardo

in Japan.

I have counted all publications published in Japan from 1905 to 1975 that include Leonardo's name or his works in their titles. Shortly after Japan stopped its policy of national isolation and opened the country to the world, Leonardo da Vinci began to be introduced as a painter. Even before the general public had concrete knowledge of Leonardo's works, authors such as Soseki Natsume (1867-1916) introduced him in his short stories as a mysterious character. It was only after the Italian-Japanese Cultural Agreement in 1939 that more and more publications focused on Leonardo's achievements as a scientist and as an engineer. The graph of the Japanese publications on Leonardo shows peaks in 1942 and 1974, i.e. the years in which the main exhibitions were held. It is therefore suggested that the 'Leonardo fever' in Japan was mainly caused by the exhibitions.

The 1942 exhibition featured a dynamic display of the reconstructed models based on Leonardo's manuscripts brought from Italy. Some of the young people who visited the exhibition became historians involved in Leonardo studies after the war. For example, Yutaka Hirata (1910-1993), Teiji Nishimura (1913-2004), Shuji Takashina (1932-) wrote about their impressions of Leonardo as an engineer after seeing the dynamic display. Surprisingly, Japanese news footage has survived of these models of weapons and machines in motion. It shows how much impact the dynamic display had on the young visitors of that time.

The 1942 exhibition, under the strange official name 'Asian Renaissance: The Leonardo da Vinci Exhibition', promoted Leonardo's universality as a genius of 'total war'. It also attempted to show the reality and limits of Western civilization and the influence of Eastern culture on the Renaissance. It was such a highly wartime propaganda event that when new exhibitions of Leonardo were organized after the war, the Japanese organizers never mentioned the 1942 exhibition. It can be said that the 1942 exhibition was deliberately forgotten in Japan, since the catalogs of foreign museums, including Italian ones, introduce the event of 1942, including an episode in which the precious reconstructed models were lost in Japan instead of being returned to Italy.

The 1942 exhibition in Tokyo was deliberately glorified during the war and intentionally forgotten afterwards. Japanese control of the exhibition exceeded the expectations of the Italian Government, which lent the exhibits. However, a study of the young people who visited the exhibition at the time shows that they were not influenced by the distortions of the organizers and continued to be interested in Leonardo as a whole after the war, producing several well-known scholars. The heritage of the 1942 exhibition to future generations is an interesting example when reconsidering past exhibitions.

Dr. Claudio Giorgione

Dr. Yoshimi Takuwa

Regular Session 3: *Global/Transnational Histories of Artefacts*

Exploring Global Dye Histories in "Bold: Color from Test Tube to Textile"

Elisabeth Berry Drago (Science History Institute)

In September of 2023, the museum of the Science History Institute will open "Bold: Color From Test Tube To Textile," a new exhibition exploring the landmark 19th century "turn" to synthetic dyes and their many continuing impacts on fashion and culture, labor and industry, environments and sustainability. This paper will explore curatorial strategies around the following core issues: meaningfully presenting artifacts within a global (rather than solely Euro-American centric) dye history narrative, exploring dyeing's challenging labor histories (including contemporary labor histories), balancing the materiality of mass-industrial and craft-artisanal dye methodologies through careful object selectio, and partnering with global/local makers to broaden the reach and impact of the exhibition.

The incidental discovery and rapid commercialization of aniline dyes reshaped the emerging chemical industry as well as historical modes of textile production across the globe; while synthetic dyes arguably helped to "democratize" cross-class participation in fashionable dressing, they also contributed to watershed pollution and (in the case of aniline and benzene formulas) formed cancer "clusters" among dye workers. Today, both mass-manufacturers and artisan dyers are seeking sustainability by exploring new methods for color application and

processing (foam dyeing, laser finishing) and new dye sources (food industry waste, in the case of avocado-pit dyeing) as well as by reclaiming traditional methods for at home and at scale. The core of the exhibit draws on the Institute's rich dye-related collections, including historical dye samples and test yarns, some developed locally by Dow and DuPont; manufacturer's fabric swatch books, particularly from the United States and Germany; documentary photography of dyeworks and dye laboratories; lab instruments such as colorimeters and light-boxes, and tools including slide rules and vat calculators. To supplement largely American and Euro-centric holdings, the Institute has conducted targeted research and collecting of international textiles and dye samples, including West African (Yoruba) adire indigo cloth; Japanese kakishibu (green persimmon) dyecloth; Korean indigo and ramie fabrics and modern home dyeing kits; as well as expanded representations of traditional and contemporary dyers at work. The rich materiality of the exhibition, and a focus on textiles and garments, will help center visitors in familiar sensory experiences while rendering visible the often-invisible effort, skill, ingenuity, and technological complexity of the dyeing process.

The importance of synthetic color as a tool for self-expression or as a cultural marker, but also its consequences as a lucrative global commodity, is examined within the exhibition itself and in this presentation. Dyeing's entanglement with labor forms a core angle of approach; from Civil War era "free labor" fairs, which encouraged buyers to eschew plantation-grown indigo and cotton, to present-day crises around textile worker safety in the Global South, how do we balance a desire for bold color with a sustainable and equitable future? Partnerships with innovative, sustainability-centered dye firms (including Huue and Green Matters) have bridged our museum's historical interpretation and collections with cutting-edge technological solutions, while partnerships with global and local heritage craft dyers (Kindigo, Modest Transitions) have enriched our understanding of community-centered dyeing as powerfully enduring cultural traditions.

The Role of Ainu Fish Skin Artefacts in Communicating Indigenous Traditional Science and Technology Promoting the Circulation of Knowledge among Arctic Communities

Elisa Palomino (Smithsonian National Museum of Natural History, Arctic Studies Center)

Over the centuries, natural resources, and in particular salmon, have shaped the economic and cultural activity of Indigenous Ainu Peoples. Salmon are magical creatures that uniquely connect the ocean and the land through their life cycle. In turn, the Ainu had an even relationship with the salmon: for them, fish, man and environment were equals. They developed highly specialised techniques to transform their salmon 'exchanges' into strong, lightweight fish skin robes and shoes in order to provide the warmth needed for clothing. This

article analyses early modern fish skin artefacts preserved in Hokkaido National Museums, examining the material exchanges and cultural connections fusing a shared expression among Arctic coastal Indigenous groups.

Ainu women built up a vast knowledge on how raw materials respond to weather elements. They would choose the most suitable fish skins for constructing garments that could resist damage from the weather: rain, humidity, wind and from the wearer: sweat, friction and erosion. Passed down from generation to generation, this climatic knowledge informed every step of skin processing and garment sewing, and a good seamstress had to be at once artist, designer, biochemist and climatologist. Human activity - hydroelectric dams, industry, pollution and global climate change - has created challenges that even the resilient salmon struggle to survive. To reverse these effects, we must adopt ancestral knowledge in partnership with the environment. Colonialism allowed Westerns to construct an idea of science that ignored local Indigenous wisdom by considering it primitive. Today we are aware of the need to reduce the negative ecological impact and exploitation of nature by the human species. The preservation of scarce natural resources could be achieved by making use of the skills and knowledge of the community, a prototype of which can be found in the Ainu experience. This paper interweaves research into the Ainu fish skin innovation and technology and that of the ichthyic species used in the construction of historic fish skin artefacts.

International Anthropology and Natural History Museums contain information about how humans utilised both biological raw materials and material culture from flora, fauna and other elements of biocultural heritage on community lands. They embody Native Peoples' history, science and Traditional Knowledge. The role of museums and their artefacts is connecting the transnational circulation of knowledge and to make it accessible and relevant to the public. Museums, as institutions of public culture, have become a forum for exploring contemporary Indigenous issues. Fish skin artefacts were collected by explorers and scientists and have been stored in museums far from Indigenous Peoples. Their past difficult history has led museums to engage more closely with Natives on the display and interpretation of artefacts. This research aims to discuss the emerging and inclusive understanding of museum collaborative consultations with Indigenous Peoples. The project aims to decolonise and safeguard the indigenous fish skin intangible cultural heritage by documenting, preserving, transmitting and revitalising it through empowerment processes of the Indigenous communities to harness their traditional knowledge and leadership.

Keywords: Arctic and Subarctic; Ainu Indigenous Peoples; Fish Skin Artefacts; Traditional Science and Technology; Climate Knowledge; Circulation of Knowledge; Intangible Cultural Heritage; Interpretation of Artefacts; Museum Anthropology; Museum Decolonisation.

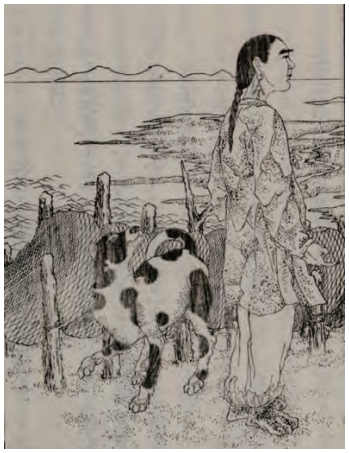


Figure 1. Ainu fisherman wearing a fish skin robe and fish skin shoes depicted in 'Kita Ezo zusetsu' ("Illustrated Explanation of Northern Ezo.") published by Mamiya Rinzō, a Japanese explorer from the late Edo period from his travels to Sakhalin Island. Ainu Rare Book collection. Library of Congress. Washington DC, US.

Figure 2. Ainu fish skin robe from Sakhalin Island. 19th century. Botanic Garden & Museum (HUNHM), Field Science Center for Northern Biosphere, Hokkaido University, Sapporo, Japan.

Figure 3. Fish display. National Museum of Nature and Science, Tokyo, Japan.

Dr. Elisabeth Berry Drago

Dr. Elisa Palomino

Regular Session 4: *Challenges of the Old and the New*

Back to the Future: Potentials of Historical Objects in Museums for the Communication of Contemporary Technologies and Future Trends

Alexander Sigelen & Andreas Gundelwein (TECHNOSEUM: Landesmuseum für Technik und Arbeit in Mannheim)

The TECHNOSEUM, Baden-Wuerttemberg State Museum of Technology and Labour in Mannheim, is one of the largest technology museums in Germany. The collections provide a broad range and representation of the history of technology with a focus on southwestern Germany. The historical perspective ranges from the beginning of industrialization in the 18th century to the present. A special feature is the multi-perspective view on the complex interactions between technology and society. Currently, the museum started a fundamental process of reorientation in which, in addition to the retrospective, future issues and technologies as well as global processes driven or influenced by technical possibilities (e.g. globalization, migration, climate change) are increasingly coming into focus.

In this context, the question how historical exhibits can be made more accessible with regard to the communication of current and future scientific, technological and social developments and challenges is central. In addition to the development of new approaches, the critical examination of previous object-oriented forms of science communication is also important.

We will give detailed insights into our considerations by means of objects from the fields of precision mechanics, electronics and computer technology. The object examples are mainly located in Mannheim and the neighboring Black Forest in order to reflect global developments on a local scale. In the Black Forest, for example, from beginnings in the already export-orientated small scale mechanical workshops of the 17th/18th century, a clock industry of global significance developed in the 19th/20th century. Based on this, companies for mechanical and electronic entertainment devices emerged (e.g. SABA, Dual). High unit labor costs as well as the emergence of microelectronics (e.g. quartz watches) led to a decline and migration of these industries, e.g. to Japan, in the 1970s.

We would like to pay special attention to the following aspects of content and didactics:

(1) How can the „black box“ surrounding todays micro-electronic be "lifted" by presenting historical technology, whose components are usually much more visible than they are today, and how can its technological and scientific basis thus be made comprehensible even to the broad public?

(2) How can long-term technological trends, e.g. miniaturization or digitization, be

illustrated by contrasting historical technical artefacts with current devices?

(3) In what ways can historical objects contribute to understand socio-economic processes, such as the migration and relocation of production sites within the scope of globalization and international division of labor – and how can we turn this process into a fascinating story and „lessons learned“?

(4) How must technological objects be interrogated in order to provide information about living and working conditions and long-term cultural change, e.g. the emergence of the industrial and later the consumer society.

(5) Which forms of didactic approach are particularly suitable to answer these questions, from the "immobile" presentation of groups of exhibits (e.g. historical ensemble, staging, time series, contrasting) to demonstrations and experiments with personal imparting by Explainers, and which new didactic approaches are needed for new target groups?

On the basis of our reflections, we would like to discuss which potentials historical technological objects can offer in the context of museums for the communication of technical-scientific, technical-historical, social-historical as well as social- and cultural-scientific questions of the past, present and future.

“The Splendor of Returning Light”: Recreating a Magic Lantern Show

Katie Boyce-Jacino (Adler Planetarium)

Magic lantern shows were a mainstay of popular culture from their invention in the late 17th century until the rise of cinema in the early 20th century, and in the 19th century they were especially popular. The subject of magic lantern shows could be anything - some promised recreations of battles, others scenic vistas of faraway lands, and others fantastical artworks. A popular subgenre of magic lantern shows was the illustration of scientific principles, and it is this subject that this paper proposes to examine.

The Adler Planetarium has in its collection a complete set of beautifully hand-painted magic lantern slides that exhibit different astronomical principles - the transit of Venus across the sun, the tides, the diurnal rotation of the earth, the seasons, etc. Each circular glass slide is made up of several painted layers of glass, some of which are stationary and some of which can be rotated with the turn of a small hand crank. The projectionist showing the slides can thus demonstrate the dynamic movement of planets and stars.

The history of these particular slides is largely unknown; we have no record of their maker or how they came to the Adler, or the life they lived before. We have also never put the complete set on exhibit; occasionally one or two slides have made their way into different

exhibits, but we've never exhibited them as a whole. We have also never made a public attempt to actually project the slides. The delicacy of the glass and the gears and the colors makes it difficult to safely use them, but the result is that these slides have been largely neglected in the Adler's history of astronomy exhibits.

When I started at the Adler in February of this year, one of the first projects I took on was to think about how to safely bring the magic lantern slides to life. In particular, I wanted to figure out a way to actually project them. In this paper, I first give an overview of the efforts I and the collections team undertook to safely and effectively project the slides - first by using a lens and a flashlight, and later by rewiring an antique lantern projector. Secondly, I ask a more critical question: what is the goal of projecting antique slides like this? What purpose does it serve in the space of the museum? Is the goal to recreate a feeling of the past for modern audiences? Is that either possible or desirable?

More broadly, my examination of the Adler's slide collection seeks to explore the ways that small, particular technologies, like slides and projectors and lights, offer a way to familiarize the past, to make it feel lived-in and real. Bridging the connection between modern audiences and the audiences of the past helps make the historical worldviews - about space, about nature, about the universe - feel legible and understandable.

Artefacts of the Intangible: Quantum Computing in Museum Environments

Petrina Foti (Rochester Institute of Technology)

Everything that we have observable knowledge of or can experience directly, from the cosmic to the microscopic, operates with the same set of principles. At the atomic level, the rules change dramatically. The development of quantum mechanics transformed our understanding of the universe and revolutionized scientific progress, from physics to chemistry to information science. One of the most disconcerting new avenues of exploration has been the quest to build a reliable, scalable quantum computer—a computer that utilizes specialized hardware to employ quantum behavior. Though many important milestones have been reached in the past decade, at this moment in time, quantum computing's potential to surpass classical computing in everyday use remains an objective still waiting to be achieved rather than an unarguable certainty. Yet, even at this relatively early stage, the development of quantum computers opens a number of possibilities in terms of science and technology. Therefore, it is reasonable to then ask what these advances in computing technology might mean for the museum.

Even though quantum computing technology has not reached its full potential, it already poses significant, unsettling difficulties in terms of both collection and exhibition practices. There has been long been discussion on how the history of computer technology,

particularly artefacts, might best be presented in a museum setting. Yet, when faced with quantum computing, not all of these solutions will be able to be translated to accommodate the particulars of quantum systems. The greatest challenge that museums face when narrating quantum computing is how much we do not and might never know and how little we can represent.

This paper, based on a chapter that will appear in the upcoming Museums and the History of Computing (Routledge, 2024), will examine both what quantum computing is, how museums have begun to record its development and what the quest to understand this potentially revolutionary technology reveals about all computer technology.

Dr. Alexander Sigelen

Dr. Katie Boyce-Jacino

Dr. Petrina Foti

Round robin, Wrap-up, and Farewell






Group photo at the end of the meeting

APPENDIX: PREVIOUS ARTEFACTS MEETINGS

- I: *Medicine and Health*, August 1996, Science Museum, London
- II: *Electronics*, September 1997, Smithsonian (National Museum of American History), Washington
- III: *Transportation*, September 1998, Deutsches Museum, Munich
- IV: *Pictures*, September 1999, Musée des arts et métiers, Paris
- V: *Environment*, September 2000, Deutsches Museum, Munich
- VI: *Military History*, October 2001, Smithsonian (National Museum of American History), Washington
- VII: *Space*, September 2002, Science Museum, London
- VIII: *Music, Acoustics and Technology*, September 2003, Technisches Museum, Wien
- IX: *Scientific Instruments as Artefacts: Shiny Objects and Black Boxes*, October 2004, Universiteitsmuseum, Utrecht
- X: *Globalization and the History of Science and Technology*, November 2005, Smithsonian (National Museum of American History), Washington
- XI: *Constructing and Deconstructing Icons of Achievement in Science and Technology*, September 2006, Nobel Museum, Stockholm
- XII: *Exploration*, September 2007, Norsk Teknisk Museum, Oslo
- XIII: *Science/Technology and Art*, September 2008, Smithsonian (National Museum of American History), Washington
- XIV: *Relationships between Science and Technology as Expressed in Exhibits*, September 2009, Science Museum, London
- XV: *Knowledge on the Move: Conflict, Displacement and Re-Engineering Society – 1933 to 1989*, September 2010, Canada Aviation and Space Museum, Ottawa
- XVI: *Conceptualizing, Collecting and Presenting Recent Science and Technology*, September 2011, Museum Boerhaave, Leiden
- XVII: *National Styles and Identity: Scientific, Technical and Medical Artefacts in a Global Context*, October 2012, National Museums Scotland, Edinburgh
- XVIII: *Modern Chemistry and Material Science: Artefacts Tell the Story*, October 2013, Chemical Heritage Foundation, Philadelphia
- XIX: *Environing Exhibits: Science, Technology, and Museums in the Anthropocene*, October 2014, Deutsches Museum, Munich
- XX: *Scientific Heritage at World Exhibitions and Beyond, The Long Twentieth Century*, September 2015, Museo Nationale di Storia della Scienza e della Tecnica Leonardo da Vinci, Milan
- XXI: *Understanding Use: Science and Technology Objects and Users*, October 2016, Science Museum, London

- XXII: *What Works for What Object? Gestures, Savoir-Faire and Body Culture in Museums of Science and Technology*, October 2017, Musée des arts et métiers, Paris
- XXIII: *Relevance of Collections*, October 2018, Adler Planetarium, Chicago
- XXIV: *Diversity*, October 2019, National Museums Scotland, Edinburgh
- XXV: *Access*, October 2020, Ingenium Canada, Ottawa
- XXVI: *Responding to COVID-19*, 2021, (virtual Meeting)
- XXVII: *Objects of Science and Technology in Motion*, October 2022, The Deutsches Museum, Munich

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