Artefacts 30

Care & Repair

Abstracts

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Care for traditional boats

Traditional boats from Eastern Norway have received little attention over the past hundred years compared to the boats of Western and Northern Norway. This has resulted in significant knowledge gaps. Through the cross-sectoral collaboration project "Eastern Norwegian Traditional Boats: Active Interaction, Knowledge Development, Sustainability, and Living Cultural Heritage", the Oslofjord Museum/MiA – Museums in Akershus and ten project partners aim to address this imbalance. The project is supported by the Norwegian Directorate for Cultural Heritage (Kulturdirektoratet).

Most of the traditional boats in the Oslofjord museum's collection are stored in pitch dark storage facilities, year after year. They have minimal contact with the world outside – including the museum staff. Drawing on the concept of "care," the museum seeks to explore how a multifaceted approach to these boats – for instance cleaning, provenance research, 3D documentation, technological close studies, and revision of existing documentation – can activate them in new ways and give them a broader societal role.

How might diverse practices related to the boats work together to promote knowledge development, sustainability, and a living heritage? Can gentle, caring "nudges" of the boats awaken familiar and unfamiliar voices and stories? Is it possible to bring out a plurality of perspectives tied to the boats' current situations and their histories? These voices may be conflicting and irreconcilable, yet they all deserve to be included with care and made heard.

The concept of care is inspired by Maria Puig de la Bellacasa and her notions of "matters of care" and "an ethos of care."

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Talleres de reparación in Havana: Exploring the material traces of Cuba's recent history

My presentation will focus on the findings resulting from a project aiming at studying and documenting the repair shops (*talleres de reparación*) in Havana, Cuba. Repairing and recycling have been integral parts of Cuban life since the period especial of the 1990s. This era, marked by social and economic hardship following the collapse of the Soviet Union, pushed Cubans to innovate and adapt in ways that have profoundly shaped their material culture. The practice of repairing and repurposing household items, technological devices, and everyday objects became not only a necessity but also a form of quotidian cultural practice, which will evolve amidst ongoing economic and social changes.

There is a growing academic and cultural interest in material culture studies in Cuba, especially to understand how ordinary people adapt to systemic shortages and economic constraints. Repair shops serve as interesting sites where stories are exchanged, techniques are preserved or adapted, and social bonds are reinforced.

The project aims to provide a comprehensive historical overview of these repair shops, which were initially established under the Cuban government during the 1990s as part of a broader strategy to cope with shortages of technological devices imported from the Soviet Union. Understanding the origins and development of these *talleres* provides insight into state policies and community innovative responses over the decades.

It will also offer the theoretical frame for a sociological analysis of the current necessity to repair and recycle, especially in the context of Cuba's ongoing economic challenges and the global push toward sustainability. How do repair practices reflect broader social values but also tensions between concepts such as "resilience" and "necessity"? What motivates individuals and technicians to engage in these activities, often with limited resources and tools? Exploring these questions will shed light on the social fabric that sustains these practices, revealing their significance not just as economic necessities but also as expressions of cultural identity and collective

memory. The potential erosion of these practices raises questions about cultural continuity, the preservation of "indigenous" knowledge, and the implications for future generations. Understanding these dynamics is crucial for appreciating the broader cultural and social impacts of technological change in Cuba.

Funded by the School of Humanities at the University of Westminster in London, the project will be conducted during a one-month fieldwork period in Havana this summer. During this initial phase, the research will focus on an exploratory, photo-ethnographic survey of the devices—such as radios, televisions, and household appliances—and the spaces where repairs take place. Limited participant observation will complement this visual documentation, enabling a nuanced understanding of the interactions between technicians, clients, and the repaired objects.

The methodological approach combines visual anthropology with ethnography, emphasizing mainly only the objects and technical processes, but also some limited participant observation. Since the project involves taking photographs of objects and places, it will naturally imply that these images will serve as visual testimonies that capture both the material and symbolic dimensions of repair work. By studying the techniques used within the *talleres,* the project aims to document tacit knowledge that may be at risk of disappearing. Including the voices of technicians and their clients will not only enrich the current research, providing a more comprehensive understanding of the social significance of repair practices; it will also offer an opportunity to challenge dominant Eurocentric perspectives that often neglect the active roles of non-humans in shaping technological processes. By incorporating some concepts taken from Bruno Latour's sociology of objects, the research aims to work toward a more "symmetric" critical framework that recognizes both human and non-human actants in the repair ecosystem. This approach will allow for a more nuanced understanding of how repair practices function as socio-technical networks, emphasizing the agency of technicians, tools, repaired objects, and even clients.

In conclusion, this project by documenting the repair shops in Havana, by highlighting the importance of grassroots technological knowledge and practices, aims also to challenge linear notions of progress and disposability. By foregrounding local repair techniques and the social relationships they foster, the research aims to expand existing theories and promote a more inclusive, technology-oriented, understanding of material culture

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The cement leg: Object attachment, extreme repair and curious care

This paper focuses on a lower limb prosthesis held in the Science Museum, UK. Originally part of the Roehampton Limb Fitting Clinic's collection at Queen Mary's Hospital, this object's accompanying narrative offers only minimal information. Its owner, a World War One amputee, refused to give up the leg – which was only ever meant to be temporary – and instead made 'very extensive repairs to it over several decades, using both cement and glue' (SMG technical file). Later a roof thatcher and tiler, he grew so used to the 13.6kg leg that, when he eventually accepted a conventional prosthesis, it had to be heavily weighted to enable him to walk.

This paper uses psychoanalytic object relations theory, particularly that of Donald Winnicott and Christopher Bollas, to explore the potential meanings of this tantalising object and the wider questions it raises in a museum context. What can we make of a repair practice that renders an object almost unusable in a physical sense – what forms of 'use', 'value' and 'care' does this represent? How might readings of this object respond to ideas raised in Winnicott's theory of the psychological 'use of an object' (1969) and Bollas's idea of the 'transformational object' (1987) and the 'evocative object world' (2009)? These concepts rely on the interplay of internal or mentalised objects with real, material objects – most commonly people, though my presentation will explore the relevance for inanimate material objects in turn. Focusing primarily on DIY repair and object care in relation to psychological attachment and the physical adaptation of the body-object, the paper also builds upon Trustram and Froggett's work (2014) on object relations in the museum to offer a case for a renewed emphasis on the 'internal objects' of users, curators and audiences alike.

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Caring for the body / Caring for the object: the Giustiniani medicine chest as technology and relic

A permanent resident of the Medicine Galleries since 2019, on the second floor of the Science Museum in London, the Giustiniani medicine chest has long been one of the most fascinating objects in the Wellcome collection, where it was exhibited since 1946. With its hundreds of remedies, ingredients and instruments meant to create medicines aboard a ship, the chest is a complex sixteenth-century technology for the maintenance and repair of the human body in transit. In my presentation, I will ask: how was medical care enacted through this object?

The chest is a big wooden object, covered in darkened red leather; divided into four sliding compartments (see figure). Three of these drawers host boxes and bottles of plant, mineral and animal ingredients or compound remedies, and one contains miniature pharmaceutical instruments like a scale with weights, plasters, a mortar and pestle, which despite their small dimensions are nevertheless fully functioning. These were probably used to turn the ingredients within the chest into medicaments: by weighting them on the scales, grinding them in the stone mortar and mixing them in one of the four covered glass bowls. All these actions required not only a knowledge of medical recipes, but also a habit in the gestures needed to create medicaments from them (Sibum, 1995).

The chest is a remarkable assemblage of natural and artificial objects, some familiar (like chamomile) and some fantastical (like unicorn horn). Once opened, it reveals a painted landscape underneath its lid. Resembling a miniature apothecary or a cabinet of curiosities, like these other forms of early modern European natural collections the chest is implicated in practices of extraction of resources from the landscape, both local and exotic, which during this period became increasingly exploited as a source of healing for human bodies (Findlen, 1994). This is reflected in the Giustiniani chest by the presence of "New World Drugs", like Michoacan extract from present-day Mexico (Burnett, 1982). Thus enclosure, accumulation and division (Adamson, 2019) of materia medica played a role in what medicines could be made using the chest.

The chest not only provided tools, ingredients and storage for medicine, but was itself transported, restocked, cleaned and decorated by the Giustiniani family for at least two generations, both at sea and on land. In my presentation I also wish to ask: How was this object cared for by its user(s)?

The chest was made for a member of the Giustiniani family, as indicated by their family crest painted in various points on the chest. The Giustiniani were until 1566 the ruling family of Chios Island, in the Eastern Mediterrenean. Once the Island was conquered by the Ottoman empire the Giustiniani fled to Rome, where they established themselves as bankers and patrons of the arts. Although we do not know precisely which member of the family the chest was made for (Ackroyd 2019), there is compelling evidence that the chest was in Rome at the beginning of the seventeenth century, when it was inventoried as part of the property of the Marchese Vincenzo Giustiniani (d.1638). It was probably here that an unknown artist was commissioned to create the painting underneath the lid (Baldriga and Capitelli, 2001). This act of reworking shows that the object was used and valued by the family, and combined with the fact that the chest was acquired from their descendants suggest that it was probably kept as a precious heirloom.

The Giustiniani chest is not the only example of an early modern medicine chest that was kept in a home long after his function as a medical technology had ended. In 1967 the German princess of Salm-Refferscheidt allowed researchers in her home to photograph and describe an eighteenth-century medicine chest which had belonged to her grandmother, French poet Constance- Marie de Theis (Theodorides and Schadewaldt, 1970), and in 2012 Sir Robert Clerk in Scotland did the same with the seventeenth-century medicine chest that his ancestor, Sir John Clerk, had been gifted by Cosimo III, Grand Duke of Tuscany, during his Grand Tour of 1698 (Dingwall and Worling, 2012). Like the Giustiniani chest, these objects had travelled with her owners, had at some point been used as containers of medicines for the last time; and had afterwards preserved as prized furnishings of the home.

Eventually, not only was the identity of the owner of the Giustiniani medicine chest lost, but also any practical medical knowledge they might have had. Studying the ways in which the Giustiniani medicine chest interacted with its users not only will give us insight on the medical material culture of early modern Italy, but will also shed light on the little-studied moment in which maintenance (of the body, of objects, of systems of knowledge) is interrupted or becomes insufficient (Proctor and Schiebinger, 2008).

By looking at these four themes - gestures, accumulation, rework, and preservation, I will explore what this object can tell us about the connections between objects, the body and the environment, and the knowledge that these connections fostered in the

early modern world. I also aim to showcase the reverse: how these links might become broken, and how knowledge becomes lost in the breakage. In conclusion, by using both object analysis and archival sources from the Giustiniani Archive in the Archivio di Stato di Roma (ASR), I will explore how the Giustiniani medicine chest was used to take care of human bodies, and how in turn it was taken care of by its users.

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Caring for, and caring about, objects and collections

I propose to take the conference theme of 'care' at a meta level to consider different registers of care in the professional economies of museums. In *Artefacts: Understanding Use,* I proposed use as an interpretive category for thinking about objects at four stages: objects as used in their working 'lives' via the tacit skills of scientists and technologists; then as the substrate of methodologies for the study of that use; next as deployed (= used) in museum activities (principally displays), and finally as used by museum visitors for entertainment and learning.

I will propose that each of these differing 'life stages' of objects gives rise to the possibility of different kinds of care. Specifically in the third, museum, stage the historical diversification of museum professions has generated differing ways to care for, and to care about, both objects and collections, and these are sometimes in opposition.

I will consider the emotional tone of care, and especially how this has played out across historical occupational change, both in museum professions, and in the non-museum world. Here I'm inspired by sociologist Tim Dant's seminal paper on repair, where he writes 'about the complex repertoire of gestures, a variable emotional tone and the gathering of sensual knowledge.… distinctively human characteristics are not amenable to systematisation or replication in a machine process.'

The paper proposes this model of care as a way of bringing different visions for museum work into conversation.

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Mending as making: Reassessing the production of the Chelsea Maypole Group, 1755

Chelsea was one of the most ambitious of London's porcelain manufactories. At its height, during the proprietorship of Huguenot silversmith Nicholas Sprimont (1716-1771), the factory produced soft-paste objects in a plethora of experimental compositions and iconographies, pushing at the boundaries of the evolving luxury porcelain market.[1] Its spirit continues to pervade the historiography surrounding the development of eighteenth-century ceramic technologies in collectors' circles.[2] Ceramic newness – of form, quantity and material – has also become central to histories of British consumption in the period, including the work of Maxine Berg, Neil McKendrick and Lorna Weatherill.[3] This article finds repair technologies at the

[1] Arthur Lane, *English Porcelain Figures of the Eighteenth Century* (London: Faber and Faber, 1961), p. 56, 57; J. L. Dixon 'Examination of English eighteenth-century porcelains by transmitted light' in *English Pottery and Porcelain* ed. by Paul Atterbury (London: Peter Owen, 1980), p. 106, 108; Hillary Young, *English Porcelain: 1745-95* (London: Victoria and Albert Museum, 1999), p. 197.

[2] Frank Hurlbutt, *Chelsea China* (London: University Press of Liverpool, 1937), p. 15, 16; Geoffrey A Godden, *English China* (London: Barrie and Jenkins, 1985), p. 99; Peter Bradshaw *Eighteenth Century English Porcelain Figures 1745-1795* (London: Antique Collectors Club, 1981), pp. 78-128; J. L. Dixon, *English Porcelain of the Eighteenth Century* (London: Faber and Faber, 1952), p. 6; *The Chelsea Porcelain Factory: An English Ceramic Circle Study Day*, held at the V&A Museum, London, 1 December 2023.

[3] Maxine Berg *Luxury and Pleasure in Eighteenth Century Britain* (Oxford: Oxford University Press, 2005), pp. 126-130; Neil McKendrick, 'The Consumer Revolution of Eighteenth Century England' in *The Birth of a Consumer Society: The Commercialisation of Eighteenth Century England* ed. by Neil McKendrick, John Brewer and J. H. Plumb (Bloomington: Indiana University Press, 1982), pp. 9-33; Lorna Weatherill, *Consumer Behaviour and Material Culture in Britain 1660-1760* (London: Routledge, 1996), pp. 172-174.

heart of Chelsea's practice, presenting new historical and scientific analysis of the Chelsea Maypole, one of the factory's most ambitious figure groups.

The Maypole entered the Fitzwilliam Museum's collection in 1955, on permanent loan from Lord Fisher. Created during the factory's red anchor period, the group is of monumental size and ambition; it likely served as a branching dessert epergne, to be placed on the dining table with metal mounts for presenting food. Traditionally thought to be modelled by Joseph Willems (1715-1766) after a David Teniers the Younger (1610-1690) *kermesse* scene, the group consists of six dancers - decorated with delicate gilt and enamel to represent a variety of social classes – in hand-in-hand revelry.[4] They encircle an ornamented hillock, to which over seventy individually modelled flowers are attached, and atop which a fiddler and drunkard stand beside a barren tree.

Porcelain figures are often thought perfect forms. The Maypole, however, is a complex and fragile entanglement of repair interventions. The group has been off display since 2016, after a historic repair deteriorated and one dancer's leg fell to the bottom of the case. Emergency conservation treatment revealed that its central cavity was packed with unidentifiable fill material, its eponymous trunk supported by a glued and scorched wooden dowel. Three purpose made fragments of alien porcelain were incorporated into the body, significantly expanding the diameter of the group. The joints of the dancers were pinned together at the arms, legs and wrists, while all but eleven of the flowers were secured with adhesive, and of uncertain composition and provenance. Collectively, these interventions were a nest of ambiguities – of uncertain temporality, composition, and even boundary.

This article presents the historical aspects of a collaborative re-evaluation of the Maypole between 2023 and 2025, undertaken in support of the final stages of the group's conservation. Novel application of X-ray micro-computed tomography and macro X-ray fluorescence revealed the group's internal structure and visualised

[4] Maypole Group Object File, 2016. Located at: Fitzwilliam Museum, Cambridge; Lord Fisher, 'Nicolas Sprimont and his Red Anchor Figures' *Apollo* Vol XXXIX No. 232 (1944), pp. 122-131; Elizabeth Adams, *Chelsea Porcelain* (London: Barrie and Jenkins, 1987), p. 131.

variations in glaze and enamel composition, allowing distinction between different manufacturing techniques.[5] Together with close examination of the Maypole on the conservator's bench and archive-based research employing the Bemrose papers - the most substantial cache of material on the factory's practice - this enquiry has cast new light on the group's layered repair history.[6] The combined results have informed the design of a conclusive and sensitive conservation treatment for the Maypole, and provided strong evidence that the group was mended in the very midst of its making, prior to sale; that Chelsea's inventive, experimental character and frantic pursuit of the market created a piece which failed catastrophically during drying and was then patched by the factory using techniques familiar to their trade.

Eighteenth-century pottery and porcelain repair technologies – materially and technologically diverse sets of practices which include the refiring of rent sherds, sewing with brass wire, and girding with iron rims – have heretofore been studied as processes of consumption and waste.[7] John Walker's 'Production Consumption Model' and Michael Schiffer's *Formation Processes of the Archaeological Record*, discipline-defining works, place repair firmly at the end of the lifecycle of goods, while more recent efforts, for example the work of Sarah Pennell, have hailed repair as 'the other half of consumption'.[8] Finding a place for mending at the very heart of

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[5] We are grateful to Professor Graham Treece for his support conducting and analysing micro-CT imaging.

[6] Bemrose Papers, Central Archive, British Museum, London.

[7] Angelika Kuettner. 'Simply Riveting: Broken and Mended Ceramics' in *Ceramics in America 2016*, ed. by Robert Hunter (New York: Chipstone, 2016), pp. 123-139; Isabelle Garachon, 'From Mender to Restorer: Some Aspects of the History of Ceramic Repair', *Glass and Ceramics Conservation 2010*, Interim Meeting of the ICOM-CC Working Group (2010), pp. 22-31; Kasi Albert, 'Ceramic Rivet Repair: History, Technology and Conservation Approaches' *Studies in Conservation* 57:1 (2012), pp. S1-S8.

[8] John Albert Walker, *Design History and the History of Design* (London: Pluto Press, 1990), p. 70; Michael B. Schiffer, *Formation Processes of the Archaeological Record* (Utah: University of Utah Press, 1996), p. 64; Simon Werrett, Thrifty Science (Chicago: University of Chicago Press, 2022); Sara Pennell, ''For a crack or flaw despis'd': Thinking about Ceramic Durability and the 'Everyday' in Late Seventeenth and Early Eighteenth Century England' in *Everyday Objects: Medieval and Early Modern Material Culture and its Meanings*, ed. by Tara Hamling and Catherine Richardson (London: Ashgate Publishing, 2010), pp. 27-41, p. 28.

experimental productive practice, and tracing the inter-reliant agencies of destruction, production, care and thoughtlessness that pervade the Maypole's biography, this article seeks to question the appropriateness of these processual lenses. Instead, it argues that the rivets, glues, pins and paints of repairs are integral to, rather than separate from, collected objects; that innovation and maintenance can co-substantiate; and that to mend is to make.

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Who cares? The anatomy and pathology collections at the Université de Strasbourg

In the care of collections, the custodians who clean and maintain the materials might be the first agents of care to come to mind. The absence of care – neglect – leads to disarray, disorder, and decay. This may lead to the end of a collection, or a renewal of collection materials in a new structure, discipline or use. In the current acknowledgement in a spectrum of violence inherent in human remain collections and in the attention granted to dignity and respect, there are many instances and institutions that are publishing guidelines for human remains in collections. In fact, opening difficult and incommensurable issues of how to care for human remains in historical collections with dignity and respect unravels a number of interesting threads, at times entangled, contradictory or contestable in the history of collecting in science and medicine.

Human remains, human tissues and body parts preserved and conserved in collections are there because they were carefully selected, sectioned, fixed and mounted – as a macroscopic or microscopic preparation – to prevent natural decay or putrefaction. Lack of care of these preparations leads to their decay but does not lead to a return to a natural state. Within the recesses of collection storage facilities or cupboards and backrooms, they may decay or be ridden with bacterial or fungal growth or insect infestation. Fluids evaporate, become discoloured, ridden with mould or bacterial growth. Neglected preparations lose fluid, become discoloured, ridden with mould or bacterial growth, encased in dust and airborne residue. This decay is one that neither resembles what might be considered (usual) natural putrefaction (that be expected to follow funerary rites) nor the sterile immutable state of cared for anatomy preparations. This is not a natural or acceptable state of decay. In many respectful, sacred funerary rites, dead bodies are treated with neglect as they decay. (Perhaps mummification processes an exception.)

This paper probes reflection of what it means to care for human remains in historical collections. We reflect on what best care practices could entail. Basic

conservation and historical practices involve cleanliness and maintaining identification, labels, files and documentation. But others might argue that the care for a collection is in scientific research/knowing, in the interest of keeping them useable for ongoing or future research. Or in ending their time in a collection, through restitutions or disposal. There are innumerable contradictions in the practices and values of collection curators, of anatomists or biomedical researchers, of curators and historians, of the descendants of those whose parts are in the collection. The best intentions may not be in line with best practices. To go one step further, the disposal, by incineration or by burial, of neglected human remains (i.e., preserved in fixing fluid, paraffin wax or stained on a microscope slide) from collections may transfer chemical preservatives or substances that may be harmful to environmental ecologies.

This paper will orient these questions around the Strasbourg pathology and anatomy collections, which include millions of human remain preparations dating from the 18th to the 21st century, some of which are well preserved and some of which are wholly neglected. I argue that care is not a single defined practice, and that there are a multitude of approaches each unique to a profession that each have (or had) their place and space in the situated history of a preparation or collection: historians invests them by writing attentive situated histories, pathologists by using fine techniques, anatomists by valorising them in pedagogical exercises, biomedical researchers by gathering research data to further medicine and healthcare, activists by denouncing violence and demanding restitution, communities by presence and dialogue, and so on. Human remains are sensitive materials that cannot be cared for - or neglected - in the same way as other scientific collections. They – nor the relations – equally cannot be repaired.

This contribution aims to bridge Conservation and restoration of technoscientific heritage and Care and the medical humanities themes of the conference through an examination of care and repair of the materiality and immateriality of neglected human remains in collections.

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To care or to repair? A controverse for curators of museums of science and technology

The range of tasks of a museum curator includes the following main points: Collection, conservation, exhibition, research, and teaching. The overarching theme of Care is clearly assigned to the tasks of Collection & Conservation. Care means bringing relevant objects into the museum and preserving each of these objects, which have been catalogued in the collection as cultural heritage. Care means to preserve each piece of the collection for future generations in a certain condition, with its context and object history. Care as well means to enable visitors to get to know objects of scientific, or cultural importance in an exhibition.

As far as research is concerned, it is also well related to the subject of Care, as a profound knowledge of the object and its history must be developed and preserved.

However, the topic of teaching poses difficulties. In a museum of science and technology, phenomena should be made tangible and comprehensible with all senses. In many cases, the museum constructs interactive hands-on stations, mostly presented alongside the historical artefact, which is usually kept in a safe glass-case. But what if the original, historical exhibit itself serves as the interactive object? This situation creates real challenges for the curator if one attempts to harmonise Care and Repair with the main tasks of the curator's job. This shall be closer illustrated with three different examples from the computer collection of the Deutsches Museum, Germany. Our exemplary objects are closely related to the time of World War II, and are therefore comparable in terms of the period of construction, or better said, of the period where the used materials date from:

1. a functional replica of the Z3, the world's first fully automatic, programmable binary computer from 1941 from Konrad Zuse. It was rebuild by the inventor from historical components based on his sketches and memories in 1961, and donated to the Deutsches Museum, where it was daily demonstrated for

almost 50 years. Until the 1990s, the machine was continually repaired by the inventor himself.

2. the largest tide prediction machine ever built in the world, with more than 60 tidal gears, completed in 1938 by astronomer Heinrich Rauschelbach. It was donated to the Deutsches Museum in 1976, and running frequently for almost 5 years until maintenance time, man power and know-how was not available any longer.

3. an American M-209 cipher machine patented by Boris Hagelin. Machines of this type are relatively easy to acquire compared to other cipher machines from World War II. This little cipher machine was donated to the Deutsches Museum in 2017, and is still working almost flawlessly after 80 years.

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Colonial contexts in technical museums: The case of electrical engineering materials

In recent years, the question of colonial contexts have increasingly been raised in museum discourse—particularly within ethnological and art museums. One might argue, that this issue is largely irrelevant to technical museums, especially in collections of modern technologies such as electrical engineering, telecommunications, or computing.

I would like to counter this by proposing the thesis that the electrical industry—alongside the chemical industry as a high-technology sector of the 19th century—would not have developed as rapidly without access to raw materials sourced from colonial territories. These materials often possessed specific properties that were rare or entirely unavailable in the Global North and were frequently obtained at relatively low costs. Copper, for example, is a prominent conductor material whose historical significance is well established. Similarly, the use of gutta-percha and natural rubber as insulating materials is widely documented. Other materials employed for insulation purposes included silk, cotton, lacquers, and marble. While asbestos has received considerable attention, mica remains understudied in historical research. Many of these essential materials came from colonies located in the Global South.

It is therefore incumbent upon museum curators not only to preserve and exhibit technical artifacts but also to contextualize them within their broader historical and geopolitical frameworks. This responsibility presents the opportunity to collaborate with museum professionals in the Global South and to foster dialogues that could be considered as symbolic efforts toward the "repair of relations".

A systematic investigation of this thesis is necessary in order to make concrete determinations about the specific raw materials used in technical objects and their respective regions of origin. The aim is to identify materials of colonial provenance through various methods of material analysis.

This paper proposes an approach for studying selected objects from museum collections in order to better understand colonial materials employed in their production. A few case studies will be presented to illustrate the potential insights that such investigations can yield.

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Caring for a museofact: The operational replica of the Puffing Billy in the Deutsches Museum

The museum is generally regarded as a place for works of art, originals and authentic objects. The careful handling, permanent care and occasional restoration they receive reflects their privileged status. However, almost all museums also have many exhibits that are not original artefacts such as replicas, casts, reproductions, models, dioramas or demonstration equipment. We would like to refer to these objects as *museofacts*, as objects made by or for the museum. In museum displays, these objects fulfil various functions, ranging from protecting the original to communicating complex facts and constructing historical series. While some museofacts are disposed of as soon as their time as exhibits has expired, others gradually gain value and (almost) achieve original status. One indicator of this development is their regular maintenance or, in individual cases, their restoration.

The replica of the Puffing Billy in the Deutsches Museum in Munich, whose 1813 model was the first usable steam locomotive, is a good example of how a museofact can be enhance its status. As the museum's founders regarded it as a ‘milestone’ in technical development, but no original was available for the collection, they commissioned a replica of the only exemplar from the Science Museum in London. In 1906, the Bavarian State Railways' central workshop produced a detailed replica, which is still fully functional today and regularly used for demonstrations. Ongoing maintenance and occasional repairs to the Puffing Billy are therefore essential. Now almost 120 years old, this replica has long since acquired its own form of authenticity, making it almost impossible to distinguish from an original.

In this talk, we will first introduce the concept of the museofakt, before presenting the production of the replica and the special requirements of its maintenance and overhaul.

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The exhibition project 'In scena' (On Stage): Exploring the relationship between technology and theatre

On the stage of an opera house, different arts and skills come together, today as in the past: music, singing, dance, set design, costumes, but also technology and engineering. Since its inauguration in 1778, Milan's Teatro alla Scala and its stage have been transformed, like a living organism, in line with technical advances which, since the arrival of electricity in 1883, led to the great theatre reform of the early 20th century: the new orchestra pit commissioned by Arturo Toscanini, the lighting innovations of Mariano Fortuny and, above all, the new hydraulic stage with mobile platforms designed by engineer Luigi Lorenzo Secchi, inaugurated in December 1938 and built by the Milanese company Officine Stigler, specialising in manufacturing elevators and lifting equipment.

At the time of its installation, it was one of the most advanced theatre stages. Capable of handling complex and rapid changes of scenery and stage movements, it consisted of six mobile platforms, which were operated by specialist mechanics using hydraulic and mechanical systems involving levers, winches, pulleys and racks. The large mobile auditorium was the largest of its kind, with a surface area of 330 square metres, measuring 20.40 metres in width parallel to the proscenium and 16.15 metres in length. Water pressure was generated by an autoclave located in the stage pit. The bridges could be raised and lowered independently, with a maximum excursion of almost six metres. Movable platforms were favoured over the popular rotating stage solution of the time, and the hydraulic system was favoured over the electric system, which could not guarantee the necessary continuity of operation during theatrical performances in those years. Luigi Secchi was La Scala's conservator for half a century, from 1932 to 1982. During this time, he oversaw all the building's renovations, including the reconstruction of the theatre hall after the Second World War. Born in Avenza, Tuscany, in 1899, he graduated in engineering at Politecnico di Milano. During his long career with the Municipality of Milan, he was also involved

in social housing projects, swimming pools, covered markets and representative buildings.

Luigi Secchi's hydraulic stage survived the bombings of 1943 and was used until 2002. Thanks to continuous care and maintenance, it lasted over time but eventually could no longer meet the necessary safety standards. After being dismantled amid criticism and opposition from some citizens during the construction of the new stage, which was inaugurated in 2004, and spending more than twenty years in storage, part of this unique structure has been set up in a permanent exhibition ("In scena" – On stage) at the National Museum of Science and Technology in Milan: a 6-metre-long, 3-metre-wide, 4-metre-high module. But how can the complex functioning of the mobile bridge stage be explained when none of the mechanisms can be moved? How can the monumental whole of metal trusses, pulleys and cogwheels be represented when only part of it is on display? How can the technological and engineering aspects of the stage be linked to the history of the people who used it — the singers, dancers and musicians? How can the artefact and its parts be preserved while ensuring visitor safety by adequately securing its moving parts? How can the stage module be related to other artefacts from the historical collections on display? How can the artefact's long life and the modifications it has undergone over time be highlighted? These were the main curatorial and conservation issues at the heart of developing the museum and curatorial project. This process began with archival research and led to the creation of critical, narrative, multimedia and exhibition tools capable of conveying the complexity of the stage and the richness of its history.

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From garbage to gold: The afterlives of a disposal test model

The afterlives of artifacts in our care can be more interesting than their lives. This presentation will explore the life and afterlives of Delta Test Vehicle-3 – a crude airplane-like object which laid on the bottom of Lake Ontario for 60 years. It was recovered as part of the effort to locate the free flight models associated with the testing and development of the infamous Canadian Cold War- era supersonic jet, the Avro Arrow. Initially mistaken for an Arrow free flight model, it quickly became clear that it was not. The object spent two years in residence at the Canada Aviation and Space Museum undergoing extensive conservation treatment and as the subject of material culture analysis and historical research. It was acquired by Ingenium once these efforts led to a reasonable conclusion as to the identity and historical significance of DTV-3. Its materiality and temporality teach us about its construction, destruction, and preservation, as well as about testing methods, past and present. Perhaps most importantly, the DTV-3 is a fascinating example of how an object can be very banal, disposable, and insignificant in its own time, but become an object of national significance and historical debate in its afterlife.

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The lives and afterlives of the modern North American telephone

For the better part of the 20th century, maintenance and repair were integral to the business operations of North American telephone companies. Under their subscriber system of telephone service, telephones remained the companies' property and were leased to users as part of a service contract. Because phone companies had a proprietary interest in their sets, telephones were designed and built to be dependable, durable, and easily repaired. These telephones had long lives, circulating through many cycles of use-repair-and-reuse before they were deemed to be too damaged or technologically obsolete, and withdrawn from service.

When government regulators ruled (Canada: 1980, USA: 1996) that telephone companies could no longer restrict subscribers from purchasing and connecting 'foreign' phones to the companies' networks, the ecosystem of repair and reuse that had been so central to North American telco operations collapsed. Telephones became as 'disposable' as any other consumer commodity.

But the telephones that were designed and manufactured to be long-lived have proven to have long afterlives. They can, of course, be found in the collections of science and technology museums, where their continued care is entrusted to heritage conservators. Many more circulate in thrift shops and online marketplaces, often finding their way into personal collections of telephone enthusiasts. This paper looks at the roles played by telephone collectors and hobbyists in the repair, care, and maintenance of 20th century telephones. I suggest that online telephone clubs and societies––made up of amateurs and former telecommunications employees––have come to serve as 'communities of care,' committed to the maintenance and preservation of telephones and telephony's technoscientific heritage.

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Care and repair in and for early modern food conservation technologies: introducing the PRESERVARE project

Today, preserving food is understood as creating microenvironments that provide biological stability in foods where it is naturally lacking. The ERC Consolidator project PRESERVARE seeks to demonstrate that this understanding of preservation first developed in the early modern period. Before 1700, health, virtues, law and order could be preserved, while what we now would describe as a preserved foodstuff was generally described as conserved – which meant it was kept and used responsibly, i.e. not wasted and used to preserve health, but not that it could be kept (almost) indefinitely. Preservation thus applied to potentially changing states of being and behaviour of individuals and societies rather than to substances such as food. The development of new, large-scale technologies that extended the 'life-span' (i.e. the period in which they could be safely consumed) of processed perishable foodstuffs, changed the meaning of the term preservation, and for the first time also became a category applicable to food. This transition is reflected in the scientific, domestic, and trade literature of the time, but also in the scant remaining technological objects of early modern food conservation, such as processing tools and containers.

In this presentation, I will explore how care for and repair of ephemeral and semi-ephemeral materials and objects such as food stuffs, processing spaces, and tools and containers in early modern food conservation led to a new understanding of food as something that could not just preserve health, but which could be preserved in itself, not only domestically, but on a much larger scale too. Finally, I will discuss how these insights might inform our present care for and repair of remaining technological objects of early modern food conservation.

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Regimes of service and repair: Exploring itineraries of Royal Navy chronometers at scale, c.1820-1930

Drawing on recently transcribed data, this paper will offer some insights into regimes of service and repair of chronometers belonging to the British Royal Navy over more than a century. It draws on work begun as part of the AHRC-funded Tools of Knowledge project (2021-2023). This project had focused on the remodelling, augmentation and representation of an existing data set, held by Royal Museums Greenwich (RMG), about scientific instrument makers and their businesses.[9] However, it also considered whether data about the makers' products might be represented in a similar way, creating timelines, or itineraries, to track the movements and interactions of instruments over time, through their creation, use, repair, storage and/or disuse. The team working on this theme– Alex Butterworth (University of Sussex), Sarah Middle (then National Museums Scotland, now University of York) and the author – considered how to represent the itineraries of objects from NMS collections, individually and in small groups, and data on a large number of instruments, trackable over several decades or more.

That data was extracted from the Admiralty's Chronometer Ledgers, kept at the Royal Observatory, Greenwich, from 1821 to 1936. Partially transcribed by volunteers at Greenwich, the information in these volumes has now been more fully extracted through a crowdsourced transcription project, Voyages in Time, set up on the Zooniverse platform. Online volunteers recorded details from the Ledgers about the movements of thousands of individual instruments that were checked and rated at the Observatory and then issued to naval vessels, ports and personnel as well as for use on scientific expeditions and surveys. The chronometers were also regularly sent

[9] Initially gathered via Project SIMON (Scientific Instrument Makers, Observations and Notes), led by Gerard L'E. Turner in the 1980s, this data has been collated and added to by Gloria Clifton since the 1990s, creating an Access database and the *Directory of British Scientific Instrument Makers* (Clifton, 1995). The remodelled database (SEMSIM) was presented at Artefacts XXIX.

to their makers, or other chronometer making businesses, for servicing, adjustment and repair.

Information from the Ledgers has already been used by researchers interested in particular instruments, voyages or makers. Some of the insights gleaned were used by Alun C. Davies alongside the business records of key makers to tell the story of the rise and demise of the chronometer trade. Davies (1978) argued against earlier assumptions about "entrepreneurial decline", to show that the end of the trade was due to the "static technology and extreme durability" of chronometers, which meant that they rarely needed to be replaced. That durability was ensured through servicing and repair, activities that were thus an essential part of the chronometer-maker's business model. Now, with data from the Ledgers fully transcribed, it is possible to gain insight into patterns of repair and to better understand the long-term relationship of chronometer making firms with their own products and, in some cases, those made by other makers. The Ledgers therefore also indicate relationships between certain firms, and between makers and the Royal Observatory or Admiralty.

While a normal cycle of use might be test, issue, return, repair, the volunteer transcribers noted that in some cases chronometers went back and forth between makers and the Observatory numerous times without being issued for use. Sometimes they were subsequently put to use, but such a pattern might at other times point to the ending of the instrument's usefulness. Analysis of the data at scale should allow better understanding of such patterns, as well as what comprised a typical 'career' for – or the different types of careers available to – a Royal Naval chronometer. Some of the many instruments recorded in the Ledgers survive in museum collections, and it should also be possible to consider whether these preserved objects can be considered typical or (as we may often suspect) atypical.

In the history of the chronometer, the innovators have usually received most focus, particularly individuals like John Harrison, John Arnold and Thomas Earnshaw in the 18th century. Thereafter, stories of heroic use (voyages of scientific exploration, astronomical expeditions) or loss (Kendall's second marine timekeeper on HMS *Bounty*, chronometers associated with John Franklin's ill-fated North West Passage expedition) have often taken centre stage. This paper will, instead, focus on the cycles of maintenance that supported or signalled failure in the performance of these precision instruments.

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Developing customized conservation procedures for discolored Sokol space suits through collaborative discussion

The museum artefact enters the conservation workshop, when damage shall be prevented by creating a safe environment or repair of damage is needed. In 2019, the Deutsches Museum (DM) space curator brought the deterioration process in a Russian space suit to the attention of the conservators: the Sokol-KV2, worn by cosmonaut Klaus-Dietrich Flade (1992) showed a distinct discoloration.

In the following research process, the visual impairment in the textiles was traced back to a combination of off-gassing and color transfer from deteriorating rubber components as well as light sensitivity of the fiber material. Comparison with similar objects from other collections revealed the general nature of those ageing phenomena in suits, made by the Soviet / Russian manufacturer Zvezda. Since the 1950s, the manufacturing techniques at Zvezda evolved from one model to the next, yet design and material choices have been consistent over decades.

For the Sokol-KV2, the preventive conservation guidelines from the National Air and Space Museum (NASM) were successfully customized in the DM display. However, requests for treatment to reduce the discoloration reached both institutions. This was the starting point for a research collaboration, where traditional boundaries between textile and object conservation no longer come into play, thanks to the long-term experience with space suits (NASM) and technical textiles inseparably connected to other material (DM).

Conservators chose cleaning procedures on space suits with extra care, because of the possibility to remove traces of the artefact's history of use. Additionally, a lack of knowledge about long-term effects of cleaning the suits, composed of a mixture of materials, exists. At the same time, there are concerns about displaying the discolored space suits as functional and aesthetically iconic objects. The two

conservation specialists will approach the technical and ethical challenges with a condition survey and test series of Sokol suits, exploring also new technologies, like CO_2 cleaning. The potential of custom-made mannequins for preservation and the impact of their posture (standing, sitting) on visitor interpretation are also part of the study.

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Care and Repair in the Handling of Sensitive Medical Photographs at NTM

Medical photographs in museum collections can raise difficult ethical questions. At the Norwegian Museum of Science and Technology (NTM), I work as the main photo archivist and regularly face decisions about access and publication, especially with images that show vulnerable people. This paper discusses two cases: the photo archive of psychiatrist Carl Wilhelm Sem-Jacobsen, and a group of historical images of children by Severin Worm-Petersen.

The Sem-Jacobsen archive includes photographs of patients at Gaustad Hospital, many taken during brain research and treatment. Some images show patients during medical procedures or with experimental equipment. The documentation is incomplete, and it is often unclear if the patients consented to being photographed. These images are not part of official patient records, so the museum must decide how to balance the duty to make material available with the need to protect privacy. Norwegian law and ICOM's guidelines provide some direction, but many decisions come down to professional judgment. At NTM, we have chosen to restrict access to these images as if they were patient records, only allowing use by certified researchers.

The second case concerns Worm-Petersen's images of children, some of which were made for medical or eugenic research. Although most of these images are legal to publish, the staff have decided to withhold some from online access. The main reason is concern about how the images might be used or misinterpreted in today's digital environment, especially since the subjects could not have imagined this level of exposure.

Both cases show that care and repair in museum work go beyond physical preservation. They involve ongoing ethical reflection and sometimes difficult choices about access, privacy, and the afterlife of images. In practice, this often means developing local routines, discussing cases as a team, and sometimes relying on "gut feeling" when guidelines are not specific enough. The paper argues that museums should be open about these dilemmas and work actively to create frameworks for handling sensitive material, rather than avoiding or hiding it.

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Testing solid lubricants for the conservation of scientific and technical heritage

Scientific and technical (S&T) objects can undergo a change in their working regime when integrated into heritage collections, often transitioning from regular operational use to occasional motion or static display. The routine maintenance of this class of objects is impacted by the chosen exhibition state, as well as by the knowledge and expertise available within the institution. When movement is sought, lubricants, such as greases and oils, are commonly used to facilitate motion and reduce wear that may affect mechanisms and compromise both functionality and long-term conservation. However, lubricants are prone to degradation and failure over time, caused by environmental conditions and interfacial interactions with the objects' materials. Common consequent issues include lubricant dripping, mechanical failure, formation of metal soaps and metal particles.

The DRYLU project, conducted at the HE-Arc CR (Switzerland), aims to investigate the potential of solid lubricants (or 'dry lubricants') as a substitute for conventional liquid lubricants for S&T heritage care. These products have achieved success in the industry, as they provide higher performance in terms of chemical stability, cleanliness, reduced maintenance requirements, and environmental sustainability (Sunil et al. 2016). However, few studies have explored the use of dry lubricants in heritage conservation, yet no long-term assessment was performed, despite being crucial for their implementation in the field (Hallam et al. 2004; Cano et al. 2022; Tissot et al. 2024).

In the DRYLU project, accelerated ageing tests are conducted on metal mock-ups, and representative mechanisms are studied under static and dynamic conditions. The performance of dry lubricants is evaluated through a multimodal analytical protocol including tribological tests, imaging, and spectroscopy. Key evaluation criteria, such as material compatibility, chemical stability, corrosion resistance, and reversibility, are assessed in collaboration with partner institutions to determine the advantages and applicability of dry lubricants to S&T mechanisms.

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The maintenance and care of Stephen Hawking

It was a futuristic cyborg persona that first made Stephen Hawking famous in the 1980s and 1990s. Journalists were fascinated by the technologies that gave him a voice and mobility—and Hawking indulged. In the late 1990s, Homer Simpson described Hawking as Lisa's "robot buddy," in an episode the scientist helped to write.

Fast forward almost two decades, and Hawking's "robot" components remained the same, now severely out of date: his voice came from early 1980s CallText boards — the last remaining ones in the world. A proprietary Words+ interface continued to function as it had for decades, through binary 'clicks' on a text-based screen. This technological longevity was tightly linked to Hawking's biological one in surprising ways we analyze. 'Innovations' and additions succeeded only to keep existing components running as they always had, and emulation projects sought to preserve, including all quirks, identical functionality of hardware that was breaking down, and of software that was unusable in newer computers. All the while, Hawking—like all of us—aged, and his motor neurone disease progressed.

This year the Science Museum is launching a research programme in disability studies centered on Stephen Hawking. Another research strand will follow soon after, focusing on the hundreds of technological artefacts that comprised the Hawking 'machine', highlighting cultures of innovation, tinkering, and long-term maintenance around them.

This Artefacts contribution seeks, at the right moment, to provoke reflection on the hybrid elements spanning both research projects—encouraging a blurring of lines in our analysis of the organic- and machine-related artefacts in this collection. It gestures toward an extended notion of care and maintenance, shared by the living and nonliving parts of our selves, and reflected in the different professions and practices on which Hawking depended in his everyday, as evidenced in collection objects and in the interviews conducted around them.

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Extreme environment object conservation

The survival of human-made materials in extreme environments presents unique challenges to curators and conservators. From the dry, icy polar regions to low Earth orbit to the surface of the Moon, exploration technologies are created in anticipation of harsh conditions and leave historians and museum curators in need of conservation science to guide preservation plans. This works-in-progress session will present three case studies of material culture preservation presented comparatively under the eye of a seasoned conservator. Presenter Bryan Lintott will discuss the case of Antarctic exploration and the preservation of artifacts frozen in ice but not in time. Here, allowing material to remain in situ is becoming an increasingly high-risk option. He will explain the ongoing risk assessment protocol being developed to address this concern. Jennifer Levasseur will discuss ongoing scholarly and public history interest in preserving elements of the International Space Station. Due to be deorbited after 2030, little time remains to plan for how to return items used on the orbital outpost. Hope seems to hinge on new spacecraft becoming reliable transports. Lastly, Teasel Muir-Harmony will discuss the ongoing conversation about preserving our lunar heritage. As more companies and organizations send landers and rovers to the Moon, the risks to preserving the Apollo lunar sites likewise increase. Preservation may depend on a similar international agreement to the Antarctic Treaty to prevent encroaching upon those sites.

To wrap up the session, Objects Conservator Lisa Young will evaluate these case-studies for preservation concerns unique to each situation but also generally for objects exposed to extreme environmental conditions. How and why do some materials survive better than others? Are there similarities common to these unique cases, or differences between those from Earth or exposed to space? What steps can be taken to preserve these sites of extraordinary historical human activity?

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The care, repair and breakdown of the Smithsonian collection of spacesuit gloves

Spacesuits pose the most vexing problems of conservation of all museum objects. The combination of lightweight flexibility, a harsh use environment, and the idiosyncrasies of the human body bond the work life care, repair, and breakdown into a complex story of the history of the suits. Maintenance and breakdown are part of the considerations in the process of their use and in conserving them for preservation inside a museum collection. Reproducing maintenance protocols is not part of the conservation process and curators and conservators seek to freeze objects at the end of their work life, but documentation of how astronauts and technicians maintained remains an essential part of an object's history. Gloves are particularly difficult in this area. They are the smallest components of spacesuits but have the most physical demands placed upon them. Spacesuit gloves must come close to replicating the range of motion of unfettered hands here on Earth, while assuring the same protection that the main suits provide. This paper charts a path in looking for ways to apply what we have learned about the pressure garment assembly onto gloves in the future. Some clues may be found in studying the breakdown and erosion inside them as indicators for care and preservation. This might lead to a better understanding of how their design and construction and how they were used, might bring forward hints on how an historical collection can provide for future innovation.

The Apollo spacesuits of the 1960s and early 1970s allowed humans to freely explore another world beyond Earth are complex machines made from complex combinations of materials. To ensure the maximum mobility and comfort for the astronaut, the suits were custom fitted. The astronaut entered the suit from the rear, through the pressure sealing slide fastener opening. Convoluted joint sections of rubber were in the shoulders, elbows, knees, hips, and ankles. This enabled easy movement while the suit was pressurized or unpressurized. From the inside out, the suit was constructed of a nylon comfort layer, a neoprene-coated nylon pressure bladder and nylon restraint layer. The outer layers of the spacesuit consisted of

Nomex and two layers of Teflon-coated Beta cloth, followed by layers of neoprene-coated nylon, layers of Beta/ Kapton spacer laminate, and an outer layer of Teflon-coated Beta cloth. During the EVA periods, a liquid-cooling garment was worn closest to the skin, replacing the constant-wear garment worn while in the spacecraft.

Spacesuit gloves must fulfill both dependent and independent missions from the rest of the spacesuit. There is a common saying that the hands are where the mind meets the world. In space, there is no direct contact between the mind and the world outside the spacecraft. This transaction is mediated by the artificial structures called gloves. Gloves themselves do not play neutral roles in this activity. One can appreciate their interference most profoundly in contrasting displays at various space centers at or near National Aeronautics and Space Administration Centers. In Houston, at Space Center Houston, a large mural greets tourists of a gloved astronaut hand gesturing with the near universally known sign of thumbs up. In contrast, in a display at the Kennedy Space Center, in the Saturn V building, next to the gloves that Alan Shepard wore while on the surface of the Moon during his Apollo 14 mission are the original plaster casts of the hands of Neil Armstrong, Buzz Aldrin, and Michael Collins, the crew of Apollo 11. Anyone who has handled spacesuit gloves immediately understands the transition from the plaster molds to the heavy, multilayered glove with the final protection of a woven stainless-steel fabric can understand gloves' severe limits on astronauts' hands.

From the wrist to the tips of the fingers, the human hand has twenty-seven bones and thirty-four muscles. As the gloves meet the suit at mid-forearm, spacesuit gloves must also accommodate the movement of the forearm, including the ulna and radius bones and the fifteen muscles that operate as flexors and extenders in the hand. The ideal spacesuit glove must allow the free motion of twenty-nine bones and forty-nine muscles for an astronaut to make complex movements by operating simple and powerful tools in space. The earliest designs of spacesuit gloves were thickened versions of airplane pilot gloves. Once planning and training for the Apollo program began in earnest in the late 1960s, spacesuit designers had to coordinate with spacecraft designers, geologists, and astronauts to develop a robust glove that could reproduce a human hand's limited range of motion. Accommodation of complex motions demanded complexity of design and accelerated breakdown during use. In recent years, conservators and curators have been able to take advantage of imaging technology to peer inside the gloves.

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Contested plastic items

This work-in-progress presentation investigates what happens when ephemeral plastic items are challenged by new legislation and the demand from the public on more sustainable consumer goods.

Ephemeral plastic items are a neglected group of objects in most museum collections. They have little provenance being used for a short time. They have no place affiliation being produced globally. They have little design features being a mass product. How can we care for these contested items of profusion?

This study looks at plastic items undergoing transformations into more sustainable materials. How does the need for waterproof plastic coating and functional design challenge the transition to more sustainable products? How are the problems of fast-moving consumer goods being met legislatively and within product development?

The presentation is based on small collections of plastic objects in the collections of MiA-Museums in Akershus. Many of these items were not collected to communicate sustainability issues, but seen in a retrospective perspective, they have the potential to tell the story of political conflicts and the big problems and small victories in product development. These insights lead to more questions. How do we follow up on these collections of contested plastic items? Which items should we care for and collect in a world of profusion?

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Life eternal or managing decline? Understanding treatment options and their consequence

The treatment of an object is central to its interpretation. What happens in the workshop or laboratory has profound influence on how the public perceive the object.

There are many guidelines on how to sympathetically and ethically look after your objects, but these can often conflict with reality.

Large objects placed outside for example have a much higher attrition rate of parts that require frequent intervention, this is often at odds with best conservation practice as repair and make do take priority over preservation of primary evidence.

The struggle to keep the wolves from the door often results in degradation to original material, the introduction of foreign materials which eventually damage interpretation.

Large scientific and transport objects often have different expectations to other collecting areas; they are expected to be complete and possibly operable. Frequently the importance of a good example of type takes precedence over individual histories.

Aircraft conservation has had a particular problem with composite Frankenstein objects, vast libraries of donor parts are built up but this often results in dilution of the original objects and total loss of the histories of the donated parts.

Treating large scientific objects must be a collaboration, the skills of the conservator alone are not enough. The material practice must be sustained; industry specific methods must be applied alongside conservation treatments and how better to do this than restoration? Often carried out in collaboration with ex-industry volunteers.

In this presentation I would wish to explore the eternal difficulty in achieving balance in large, scientific object conservation.

The concept of repair defines an object through its entire life, the in service repairs are its signature and tell us about its in-use life. What happens after it comes to a museum dictates how much of this survives.

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Skeletal cares and repairs

On long-term display in Norway's National Medical Museum is the skeleton of a pair of twins conjoined chest-to-chest. The specimen came to us from Rikshospitalet, Norway's national hospital, and documentation of our Rikshospitalet accession is sorely lacking. Probably the twins once belonged to the Pathology Institute there, but they are not numbered or labelled in any way.

In February 2025, the museum was contacted by a woman interested in learning more about the twins' provenance, and in particular in getting them DNA tested in order to determine whether she was a close relative. According to her, her mother had given birth in 1943 to conjoined twins, who did not survive the birth, and without the mother's consent, their bodies had been transferred to Rikshospitalet for research. If the twins on display were indeed her brothers, the daughter wanted them to be properly buried.

Can these remains repair the wound in this family's story? Like all human remains, this skeleton walks a fine line between being an individual and being an artifact. I want to use the opportunity provided by this conference to present the facts as we know them, and to seek guidance from others who may have encountered similar situations, whether in medical collections or in science and technology collections more broadly. How do we balance the family's privacy against the museum's own interest in sharing this story with our users? What should we say, when, and to whom? In other words, how do we best care for this unique specimen and this unique stakeholder?

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Medical care and historical repair in the pages of a medical museum catalog

Mary Lewis Caley left many imprints in the historical record. A prominent Philadelphia Quaker, Caley's two marriages, four children, gifts of spiritual discernment, and status as a "lady" can be traced through the records of her local meeting house, city directories, historical maps, and the record of her burial in 1862 at Philadelphia's most elegant cemetery. One of the final marks she made in the historical record was the record of the unusual anatomical structure of her kidney, a discovery made at the private autopsy conducted by her physician in her home after her death. This is recorded in the Mutter Museum's nineteenth-century bound catalog, where her kidney is housed as an anonymized specimen.

Recent work by museum anthropologists has turned critical attention on the ways in which the structuring devices used in nineteenth-century museum cataloging systems have functioned to limit knowledge about Indigenous communities by excluding Indigenous categories of knowledge. Although there are far fewer extent catalogs of nineteenth-century anatomical and pathological collections to analyze, these catalogs served similar functions, flattening the social complexities of an individual's lived experience into a more universalized and de-personalized vocabulary of science and medicine. In the process, these catalogs separated the human subject from their identity and transformed them into a new epistemological category as a specimen representing medical data.

Critically re-reading such nineteenth-century catalogs and triangulating them with other physical artifacts of lived experience offers opportunities to weave the records they hold of anonymized medical care with reparative history that restores a human identity and story to anonymized specimens.

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Stubborn stones: Caring for and repairing a historical mineral collection at the Museo Galileo

The storages of the Museo Galileo in Florence have recently undergone extensive reorganization.

This initiative, focused on scientific instruments not currently on public display, brought to light a considerable number of objects requiring either special handling for conservation or more significant restorative interventions.

In several cases, parts of the same instrument, previously dispersed across different locations, were reunited, inventoried, and stabilized.

The reorganization thus enabled not only preventive conservation measures but also the development of a new, more coherent conservation system.

Amid numerous stories of broken and forgotten objects, this communication focuses on a particular case study: the rediscovery of approximately 200 minerals and stones, found almost accidentally during the reorganization.

The presence of these materials—within a museum primarily dedicated to scientific instruments—poses intriguing questions that we are currently exploring.

Beyond tracing the provenance of these objects, that we were able to determine through archival research, significant challenges remain regarding their physical condition.

Many specimens are fragmented, covered with dust and other superficial deposits, or show signs of oxidation; some are sensitive to light exposure and require special handling.

Precise identification, inventorying, and safe storage are crucial.

Additionally, the chemical properties of certain minerals—such as asbestos or cinnabar containing mercury—demand specific precautions for both conservation and human safety.

While the need for conservation efforts appears straightforward, decisions regarding repair interventions—for instance, the reassembly of broken fragments—raise more complex ethical and methodological questions.

The aims of this presentation are twofold:

1. to illustrate, through this case study, the challenges of care and repair encountered during large-scale interventions on technical and scientific collections;

2. to engage in an open discussion on possible approaches to such interventions, welcoming feedback and shared experiences.

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Rotten, broken. Used, displayed: Reimagining the potential of forgotten instruments

At the University of Santiago de Compostela's Physics Faculty, there are two groups of historical instruments with pieces dating from 1852 to the early 20th century, both have their origin in the former physics and chemistry cabinet. One group is carefully curated and elegantly displayed in the building's hall and other prominent locations, showcased on blue velvet within glass cases. The other, in stark contrast, lies broken and forgotten in a dark, windowless storage room, sharing space with cleaning supplies.

In this presentation, I will provide an overview of an ongoing PhD project that begins with the documentation of these instruments, applying well-established methodologies [1]. From there, I develop historical research in the form of object biographies [2], design didactic activities, and museum exhibits. I will show how research, communication and museology are inter-connected in a multilayered way, offering questions, answers and perspectives to one another [3].

Alongside this broader overview, I will highlight the often-overlooked potential of poorly conserved and unidentified instruments. These neglected objects can play significant roles: enhancing the *presence effect* of the scientific instruments and, therefore, improving the encounter between them and the visitors in the museum [4]; serving as tools for hands-on didactic activities that promote a better understanding of science nature [5][6], and contributing to a more honest and complex representation of institutional history.

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Scars on the lands and more-than-human artefacts: Care-ful museologies of the Trans-Alaska Pipeline

This paper will consider how entangled histories of oil, industry and indigeneity can be dealt with in museums of science and industry through 'care-ful museologies'. Through seven artefacts from the Science Museum Group's collection, this museological approach draws out numerous discussions. Including, the narratives constructed through displays of industry, the provenance of indigenous objects, the sensorial dimensions of sacred objects, objects as counter narratives and objects as material agents for future planetary care.

The story of oil in Alaska stretches back to 18th and 19th Century Canadian land claims on behalf of the British monarch, and European exploration of the arctic coast. As the sun set over the Yukon gold rush, systematic investigations into a new subterranean resource sparked foreign interest at the turn of the 20th Century. Oil in Alaska, known and used for centuries by the native Inupiaq, Yu'pik and Athabascan people, was seen by British and American industrialists as the final energy frontier.

Permission to construct and operate an oil pipeline across Alaskan Yukon territory was bought at auction from the federal government by British Petroleum in 1959. In partnership with US giants ARCO and Humble Oil, BP broke ground in the early 1960's and had oil flowing through the Trans-Alaska Pipeline System by 1977. Without doubt, the pipeline became an umbilical cord for an oil-dependent world.

Like many industrial megaprojects, this 800 mile intervention changed environments, moved people and challenged cultures in its wake. The pipeline ran directly through migration routes of caribou, forcing them to adapt to concentrated, now overgrazed, areas of land. Contrastingly, the sudden rise in jobs sparked a wave of workers and their families from across the US migrating to join thousands of native employees on Yukon construction sites. Indigenous peoples, including TAPS employees, found the languages, heritage and practices of their homeland unsettled by this reinvigoration of Yukon as a site of science and industry.

This narrative of oil is one that speaks to a wider play off between mass extraction and subsistence, and the impact of industry on people and planet. For the Science Museum, there is appetite to display the story of the pipeline's construction in all its complexity as it develops a brand new flagship gallery. But, with the complexities that the pipeline brings comes the need for great care. How can the gallery display industry and indigeneity in a way that centres care rather than reinforcing historical injustices. This paper serves as a case study on the application of 'care-ful museologies' to a display of artefacts visualising the Trans-Alaska Pipeline.

Developing from Morse's seminal work on Museums as a Space of Social Care (2020), the subfield of 'care-ful museologies' seeks to apply the same principles of care to how museums work with objects. Instead of thinking about care as conservation, this paper considers how principles of care (in both a sense of compassion and caution) can and should be central to choosing, researching, assembling and interpreting objects for display. The aim for this display is for each object to act as a 'care-ful' material agent for the complex environmental, social and cultural implications of the pipeline.

There are several objects within the Museum's collection that could contribute to this display. The first, and most obvious, are a 12-inch diameter cross-section of the pipeline (1995-192) and its cleaning pig (1995-193). Through 'care-ful museologies', the paper explores the affordances of these 'totems of industry' on the gallery floor, the risk of presenting Alaska as a resource frontier or scientific laboratory and the context of the colonial doctrine of terra nullius. Building on Morse's idea of social care mitigating settler colonial rituals of erasure, it is ideal for this display to also choose objects that show Alaska as a homeland - particularly to Inupiaq, Yu'pik or Athabascan populations.

All from the Sir Henry Wellcome collection, the Science Museum Group holds five objects that could serve as material agents of indigenous histories entangled with the Trans- Alaska Pipeline. All objects embody a counter narrative of how Indigenous Alaskans fueled their lives alongside the industrial extraction of the Trans-Alaska Pipeline. Collectively, these objects depict the tools and technologies used in the indigenous attainment of animal oil: subsistence hunts. These include a case for snow goggles illustrating an animal hunt (A645437), a model Bidarka boat (1930-769), a barbed plug for wounded seals (A650929), a seal shaped bowl for holding animal oil (A645088) and a seal amulet worn by a hunting chief or used to facilitate underwater diving (A645090).

Furthermore, this paper explores how these objects, all essential for the attainment, preparation and consumption of animal oil, serve as material evidence of the human potential to sustainably and carefully fuel life on earth. 'Care-ful museologies', as

echoed in Cameron's Curating for Planetary Habitability (2023) is as much focussed on healing historic injustices as it is about installing an ethos of future planetary care. Explored not as an emblem of past practices but as an ongoing act of subsistence amongst Indigenous communities in the Circumpolar North, this object assemblage of the 'hunt' can serve as a material example of utilising natural resources, but in a way centres respect and resourcefulness (Cameron, 2023).

The final and most pertinent object of discussion through the lens of 'care-ful museologies' is an Inuit spirit mask (A645097) likely used during rituals to ensure a successful hunt. This object will bring to the fore specific conversations around the sensory dimensions of more-than-human objects. Historically, the sensorial dimensions of indigenous objects were reduced to the sensory typologies of EuroAmerican collectors (who favoured sight) during the development of ethnographic museums (Classen & Howes, 2006). This paper considers why not choosing to display this mask might be an act of care itself, or alternatively, how interpretive interventions can attend to this desensualization.

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Changing time: Originality and use of clocks

Within our Science and Technology collections, many clocks are notable for having had long histories of maintenance, significant alteration and use, both before they came into our collections and within them. This paper will examine the different philosophies of care which surround clocks compared to our other collections with case studies of alteration and choice.

The purpose that clocks serve has remained familiar over centuries and some clocks have been kept functional for a long time or returned to functionality, sometimes with considerable changes to their original form and mechanism. Outside our collections, many early clocks have had work attempting to undo changes, reflecting a typically greater value in the current market for clocks as artefacts of their date of manufacture over the stories of use which the alterations reveal.

In 1662, the Bruce-Oosterwijck clock was part of the first attempt to establish longitude at sea with a purpose-made mechanical timepiece. This was a definite failure, and the clock's use as a piece of scientific apparatus was soon over. It owes its survival to the reuse of the mechanism as a mundane domestic clock within a fashionable late 17th century case, considerably altered as an example of 1662 clockwork, and less horologically valued, while with a strong historical story.

The Bartholomew Newsam clock, made for Margaret Stanley in about 1575, was considerably altered, probably in the 19th century, with the addition of a base taken from a chalice, gratuitous satyrs, and a larger dial. This could perhaps become a stronger artefact for telling stories of the Tudor court if we altered its appearance back – adding modern alteration to the old ones – but in the nearly 140 years this has been in our collections we have not yet chosen to do so.

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Innovative simplicity: Participatory care of Gara-Bo spinning machines and their legacy

Gara-Bo spinning machines, developed during Japan's Meiji era, embody a distinctive transition from manual to industrial textile production. Featuring a simple yet innovative mechanical structure with automatic control mechanisms, Gara-Bo was pivotal in shaping Japan's early patent technology. Despite its simplicity, preserving these machines in operational museum contexts presents significant challenges, including shortages of skilled technicians, difficulties sourcing authentic materials, and ongoing maintenance issues.

At the Nature and Science Museum, Tokyo University of Agriculture and Technology, we launched a participatory project titled "Growing Cotton, Spinning Community." This initiative actively involved museum visitors, students, and local communities in cultivating cotton, directly supplying raw material for live demonstrations of the Gara-Bo machines. Participants documented their cotton-growing processes via social media, fostering an inclusive virtual community extending beyond traditional museum interactions.

Our approach expands the concept of "care" beyond mere physical repairs, positioning community involvement and cultivation activities as integral parts of technological heritage preservation. This engagement not only sustained the machines' operational functionality but also enhanced participants' awareness and appreciation of traditional technological knowledge.

This participatory model offers global implications for museum practice, demonstrating how community-driven approaches and digital tools can effectively sustain and enhance technological heritage conservation.

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Iconic objects and image problems: Nursing heritage and the recruitment and retention crisis

This presentation shares the activities of a team of public history and medical museum professionals and nurses collaborating on a range of projects engaging with historical objects collected by the Dutch Museum of Nursing. Although no longer accessible in a physical museum setting, the collections are used in nurse education, for historical research (and increasingly in connection with research into contemporary issues in nursing), and for public engagement. The group is engaging with various challenges related to the invisible and undervalued work of nursing as well as uses of heritage collections to prepare for and inform the changing future of healthcare.

As part of a core focus on the transformation of nursing, the team is especially interested in historical stereotypes of nursing work that continue to undermine recruitment and retention of nurses. Recent research has shown that early career professionals are demoralized by outdated perceptions of their role, and that the gap between their idealized image of the job versus the reality drives many to leave the profession.[1] The team is exploring creative ways to engage with classic objects in the collection to generate reflection and reconsideration of the image, ambitions, and expertise of nurses and to generate critical perspectives on care.[2]

Examples to be discussed include objects that are simultaneously celebrated yet problematic, including a first edition of *Notes on Nursing* given by Florence

[1] Kox, J.H.A.M., J.H. Groenewoud, E.J.M. Bakker, S.M.A. Bierma-Zeinstra, J. Runhaar, H.S. Miedema, and P.D.D.M. Roelofs. "Reasons Why Dutch Novice Nurses Leave Nursing: A Qualitative Approach." *Nurse Education in Practice* 47 (2020): 102848; González, Hildegart. "The Image of Nursing in the Media: A Scoping Review." *International Nursing Review* 70, no. 3 (2023): 425–443.

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Nightingale to Dutch nurse Lientje de Bussy-Kruysse in the late 19th century and handed down through successive hospital matrons - until the position was eliminated and the book was donated to the museum, and the academic gown and cap of Anneke van den Bergh-Braam, the first nursing professor in the Netherlands (in 1986), whose career in academia is rarely emulated by nurses due to the strict separation between professional and university education. Such items have previously been used as positive examples, within a broader approach to heritage and identity formation in nursing training which emphasizes pride and belonging.[3]

Yet each offers the opportunity for more critical reflection on key topics facing the field today, such as the long shadow of Nightingale's image,4 homogeneity in the image of nursing versus the diversity in the profession, and the ongoing devaluation of care as unscientific/non-academic despite the developing of the field of nursing science.

Sharing examples of how nurses see their role and their history, based on the objects they are drawn to in the collections and their interpretations of them, as well as objects nurses have themselves proposed as potential additions to the museum, this presentation will highlight the limitations of past interpretive strategies and the changes in approach underway as the Museum of Nursing moves beyond its former identity (as the Florence Nightingale Museum) to engage more critically with the history and future of nursing.

[3] See, for example, Kelly, Jacinta, Roger Watson, James Watson, Malachi Needham, and Laura O. Driscoll. "Studying the Old Masters of Nursing: A Critical Student Experience for Developing Nursing Identity." *Nurse Education in Practice* 26 (2017): 121–125.

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Caring for stories, people and relations in exhibition spaces: User involvement in the making of the digital time travel activity

Norsk Teknisk Museum (NTM) launched "I/O" in 2022, a new permanent exhibition exploring telecommunications, data, and broadcasting through 360 objects interconnected via an innovative hybrid analog-digital interface. In this presentation we will discuss how the I/O exhibition can be used as a space for participatory processes, cultivating meaningful connections with stories, people, and objects. NTM has collaborated with approximately eighty people from the ages of 8 to 80 to develop *the digital time travel* activity. This activity sought to facilitate meaningful conversations between children and adults. It established collaborative meeting points that also revealed blind spots in how the museum understood the relevance and the impact of the objects and stories exhibited in the I/O exhibition. The insight gained from the workshop with the participants fine-tuned the conversation starters for the digital time travel activity. The project group also reflected on how diverse life experiences can shape the different directions that conversations about technology may take.

We conducted three workshops with students and family groups to investigate how images and text can spark discussions about the impact of data and communication technology from the viewpoints of different generations. During these sessions, participants used Polaroid cameras to closely examine objects on display. Simultaneously, we co-produced conversation starters in the exhibition space with the participants to encourage dialogue between the age groups. Following these workshops, we held two rounds of prototyping the activity within the I/O exhibition. This involved setting up opportunities for children and adults to interact with text prompts, objects, and museum staff. Our observations revealed a pattern of adults adopting a pedagogical approach during interactions with the museum staff and content, actively instructing children in completing the provided activities. Moreover, the anticipated efficacy of our conversation starters was not fully realized. This was particularly evident in family units comprising children of varied ages and literacy levels.

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The role of repair in the longevity of consumer goods produced in the GDR

The contemporary perception of consumer goods produced in the German Democratic Republic (GDR) can be described as ambiguous. There are several GDR-made products that gained a cultlike status for their durability; more than thirty-five years after their production came to an end, the handheld electric whisk RG28 is still used in households in former East Germany, and the motor scooter *Schwalbe* (Simson KR 51/1) can frequently be spotted in traffic. On the other hand, there's the notion that the chronic shortages of materials and goods in the GDR led to products requiring frequent repairs and users routinely mending their products.

A comprehensive study about the GDR as a so-called *repair society* has yet to be written. There is not much historical research available specifically dealing with repair in the GDR. Notable exceptions are some works by Reinhild Kreis and Kurt Möser [1]. These establish relevant theses about the role of repair as a socialist virtue and repairability as a criterion in construction. In my Masters thesis I take on a source-based approach to build on those theses. I aim to uncover 1) what role repair and longevity played for the state leadership, 2) to which extent repair was a criterion of construction to improve longevity, and 3) what the characteristics of GDR residents dealing with repair and maintenance were. The artefacts themselves, in this case consumer goods, play a central role in my research project as I focus on three objects as case studies to discuss said role of repair in the (presumed or actual) longevity of them.

[1] See for example Kurt Möser, Thesen zum Pflegen und Reparieren in den Automobilkulturen am Beispiel der DDR, *Technikgeschichte* 79/3 (2012) and Reinhild Kreis, Sozialistische Selbsthilfe. Reparieren als Tugend, Notwendigkeit und Freizeitbeschäftigung in der DDR, in: Heike Weber/Astrid Venn/Jörg Rüsewald (Ed.), *Reparieren, Warten, Improvisieren Technikgeschichten des Unfertigen, Berlin 2023.*

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Conveying care and repair of electrical devices

I propose a paper that explores the role of conveyors in caring for and repairing electrical devices and systems. Conveyors are people who occupy an often overlooked but vital third zone that overlaps with those of producers and consumers, intermediating between those groups while pursuing their own goals. Sales and service people are two types of conveyors. I use items from the Smithsonian's Electricity Collections that provide insights into the changing historical relationships among conveyors, producers, and consumers. I also draw from my personal experience of twenty years as a conveyor in the retail hardware trade to enrich my analysis of the care and repair history that the conference and subsequent publication seek to advance.

My paper addresses three basic questions. What artefacts do museums need to collect to document the history of care and repair? How should acquisition objectives change in our era of disposable technology? And how do conveyors differ from and interact with producers and consumers in the realm of electrical technologies? The artefacts and archives that document the activities of conveyors differ from those that document producer and consumer activities. The material culture of care and repair, as seen in the Smithsonian's collections, spans nearly 300 years of electrical technologies. During that time, from the pre-industrial era of the 18th and early 19th centuries, through the industrial era of the late 19th and 20th centuries, to today's post-industrial era, the practices of care and repair have changed substantially.

Conveyors of electrical care and repair include service people who may work for large organizations or small businesses. Salespeople offer many products and services to consumers, as well as to other conveyors, while providing a channel of information to producers. Educators who train sales and service personnel are an important intermural group of conveyors. Information flows are a core element of conveyance, whether that comes in the form of formal knowledge obtained from technology producers, or informal tacit knowledge gained from practical experience.

The material culture of conveyance is wide-ranging. Replacement parts may be highly specialized (circuit breakers), or prosaic (light bulbs and fuses), but are essential to repairing electrical devices and systems. Cross-reference books and distinctive slide rules allow conveyors to guide consumers in selecting replacement parts. Special tools, such as pliers to remove integrated circuits from a computer, enable service and often include safety features not required for general purpose tools. Technicians use equipment like multimeters to diagnose malfunctions. Advertisements designed to promote care and repair typically present technology as accessible. That differs from ads for disposable devices that actively or passively ignore maintenance issues.

Aside from hardware, means of conveyance include archival material. Owner's and service manuals provide care and repair information. The National Electric Code, adopted by many local and state regulatory agencies in the United States, conveys information about permissible care and repair techniques and components. Insurance providers played a major historical role in technology change through inspections and rate schedules that encouraged people to replace obsolete components and installations. In the past, this archival material would be hardcopy paper, perhaps augmented by photographs and schematics. Today, most of this material exists only in digital format, perhaps augmented by online videos. That shift raises questions of access and digital preservation.

In considering this topic, I explore what is being conveyed and to whom. Aside from parts and tools, conveyors provide channels for the flow of knowledge. Service manuals represent formal information flowing from technology producers to consumers. Warranty claims and the return of defective items represent formal information flowing in reverse, from consumers to producers. However, informal tacit information gained from experience can be even more important. Amateur radio operators who discover the limitations of a vacuum tube, electricians who discover a fire hazard by extinguishing flames, and anglers who learn how to safely operate a home-made electrical fishing-worm collector. While these three examples are in the Smithsonian collection, tacit knowledge can be difficult for historians to capture outside of oral histories. Conveyors enable and augment these formal and informal information flows, so focusing on their activities adds to our understanding of care and repair.

As historians, we must examine how the care and repair of technologies have changed over time. Such activities in the pre-industrial era relied on artisanal skills such as carpentry, or traditional knowledge learned from elders. The availability of mass-produced electrical commodities led to a concurrent commodification of care and repair. Technicians established dedicated shops to service radios, televisions, and other appliances as consumers read labels warning "no user serviceable parts

inside." Conveyors met a market demand for care and repair as technologies advanced beyond the ken of most consumers and specialized equipment grew more costly. In the post-industrial era, miniaturization and intellectual property concerns encouraged producers to design disposable devices–especially electronics–that actively discouraged if not thwarted repair attempts; Apple's iPhones being a prime example. Nonetheless, some conveyors established gray or black-market paths to provide care and repair.

The nature of information flows between conveyors, producers, and consumers diverge, reflecting the groups' differing goals and values. Non-electrical technologies such as locksets and kerosene heaters show many similarities even as their historical circumstances differ. Understanding the interactions between conveyors, producers, and consumers is increasingly relevant as people continue to adopt new technologies like Artificial Intelligence and the Internet of Things. All technologies malfunction and wear out, bring unintended consequences, and raise issues of control. Care and repair of technologies, seen through the activities of conveyors, touch all of these areas from a perspective that varies from the other groups. A perspective with a distinctive material culture that museums and archives–serving as technology conveyors themselves–must be aware of in their collecting and interpretive activities.

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Conservation and the afterlives of the obsolete

Obsolescence is becoming a big problem for technology collections, especially those with everyday consumer items – perhaps the collections most vulnerable to obsolescence. Obsolescence is at once a relational, material, and social phenomenon. Things become obsolete for any number of reasons: because their physical materials fail, because they cannot be connected to things that sustain their function, or because they go out of fashion, superseded by something newer. While describing diverse theoretical and practical approaches to obsolescence, the paper reflects on the role of museums as caretakers of the "afterlives" of objects and how this changes our relationship to obsolescence. From a conservator's perspective, it questions the role of museums in reinforcing a culture of obsolescence, engaging with the ethical-political dimensions of conservation practice.

Provocatively, new types of planned obsolescence by designers working with sustainable materials "designed to decay" have also entered the picture, challenging museums' ideals of material stability. In the "permanence culture" of contemporary museums, what does it mean, then, to say that something is *not* meant to last? Linking "planned obsolescence" to "designed decay" this paper considers how conservators and other museum professionals negotiate the anxieties caused by obsolescence in varied and increasingly creative ways. It engages with literature in adjacent fields not often cited in conservation literature, particularly in the fields of Sustainable design and Discard studies, with focused case studies of how care and repair are enacted in contemporary museum conservation practices to challenge the inevitability of obsolescence.