

Museums theme – Adventures in Museology: category building over a century, and the context for experiments in reinvigorating the Science Museum at the turn of the twenty-first century

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Abstract

This article serves as an introduction to this issue's *Museums* theme, also represented by the contributions of Dirk van Delft, Peter Donhauser, Martha Fleming and Jennifer Landry. Together these papers look at how the modern science museum has re-created itself in recent years. This introduction argues that a key moment of change in the late 1980s and early 1990s marked a crisis to which science museums had to respond or be consigned to history. The introduction sets the scene, by discussing the longer-term development of the science museum as a category, and by describing the short-term context of that widely perceived crisis in the science museum around the turn of the twenty-first century.

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Introduction

In August 2015 *The Daily Telegraph* reported research showing that the Science Museum in London was the most 'googled' museum in the world; other research shows that the National Air and Space Museum in Washington is among the most visited. [\[1\]](#) Clearly such institutions have huge interest to the public, yet of all museums they are among the most complex in mission and scope. Many show historic objects, but they are not purely historical museums and the role of such objects is deeply problematic. Science objects are, in general (with many exceptions), not aesthetically beautiful, and are engaging instead on account of their material presence and their meaning. Many of the stories to which they allude are not well known and the significance of these narratives to general audiences often lies not in their inherent interest but in their relationship to contemporary issues. For many visitors, interest in the museum will be, at least in part, framed by the significance of science today and by its association with issues close to the hearts and minds of citizens, such as innovative technology, medical progress, contemporary conflicts, chemical pollution and genetic modification, and the role of powerful stakeholders such as government and big business. And yet, time and time again, the appeal of this frail skein of artefacts, history, education, propaganda and science engagement has been renewed.

The need for constant intellectual renewal underlies the series of annual *Artefacts* conferences which was launched in 1996 and

is continuing lustily in 2017 when it meets in Paris. A group of papers in this issue of the *Journal* (see also Fleming, Landry, van Delft, and Donhauser) are derived from presentations made at such a conference.^[2] They reported on innovative experiments made in the wake of a crisis of confidence across museums in the USA and Europe in the late twentieth century. Museums are expected to be scholarly and object rich but also relevant to the cultural challenges facing science and accessible to wide publics. A sense of conflicting responsibilities has led to sharp debate in recent decades but has also resulted in some potent and fascinating experiments which remain relevant today.

This paper introduces articles by museum directors and senior curators across Europe and the USA that look at how the modern science museum has re-created itself in recent years. This interest in the transformation of science museums is not an isolated theme. At the time of this issue preparing for publication (June 2017), a leading international journal in the history of science has published a collection of papers under the section title *Why Science Museums Matter: History of Science in Museums in the Twenty-First Century*.^[3] The papers presented here illuminate the debate generally by describing radical innovations introduced after a key moment of change in the late 1980s and early 1990s which, I argue, caused such a crisis that science museums had to respond or be consigned to history. In this introductory paper I set the scene by discussing the longer-term development of the science museum as a category and by describing the short-term context of that widely perceived crisis in the science museum around the turn of the twenty-first century.

The ambiguity of the category of 'science' museum is deeply rooted in our culture – such institutions have an ambition often wider than a traditional reading of the word would suggest. Typically, they also promote the machines devoted to the making of wealth, whether it be steam engines or automobiles or the curing of the sick. Engineers and historians are clear that technology is not merely applied science, and the relationships between science, technology and engineering have a complexity not taken into account in past histories of such institutions. In fact, the very existence of many science museums is predicated on the assumption that interest in one of these categories will blend with an interest in the other. Moreover, while there might be agreement about the need to display the peaks of the great achievements of fundamental science on the one side and the massive materiality of steam engines on the other, this can make the low-lands between seem unworthy of exploration either because they are uninteresting or simply too complicated. Yet the combination of science and technology in the science museum – that very variety and complexity – is itself important and interesting, as a way of establishing a better understanding of the exhibits, of the topics and of the categories of collection and display themselves. Seeing, and then interpreting, the relationship between science and industrial and medical practice as problematic and constantly renegotiated, rather than as natural and fixed, has proved liberating and stimulating.

Such a work of renewal has been experimental within a genre which has itself a long history of change. To understand the past and present challenges of this distinctive category of museums, it is worth reflecting on the inheritance which underpins the ambiguities they have and are experiencing. Certainly they owe part of their inheritance to the Cabinets of Curiosity of the eighteenth century, and indeed to the collections associated with honoured forebears, including distinguished men and women of science. This last is itself a complex category with its own association to investigation and knowledge (Arnold, 1996). Yet, there is also another key part of the ancestry of science museum collections which continues to be seen as crucially significant within the modern science museum. From the mid-nineteenth century, public interest in science, enthusiasm for the skills of science and engineering and support for scientific innovation have been seen by governments and promoted by interest groups as keys to future prosperity. The museums were therefore supported not to promote the aesthetics of the individual artefacts within them, but instead on account of the propaganda and educational effects of exhibits in which artefacts were just a particular kind of rhetorical device.

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The historical background

This tension between the conventional ambitions of museums to collect, preserve and interpret artefacts and a sense that the science museum had its own vocation to support the enthusiasm for, and understanding of, science, and economic vitality, can be seen in the work of the three late nineteenth-century pioneers, Arthur-Jules Morin at the Conservatoire des Arts et Métiers in Paris, Norman Lockyer in London and Oscar von Miller in Berlin (Butler, 1992).^[4] These men were not passengers on the train to the future, but active pioneers whose institutions pioneered the new science museum genre. The first of these men is arguably

the greatest but also the least known, for it was Morin who effected the integration of Industrial Exposition and Cabinet of Curiosities. The Conservatoire had been founded at the end of the eighteenth century as a school for workers and with it was associated the former royal collection. Early in the nineteenth century, under the management of Gerard-Joseph Christian, it became a cabinet of machines, a sort of natural history of machines appropriate to the founder of '*technonomie*' ([Sebastik, 1984](#)). With the final defeat of Napoleon in 1815 and the restoration of the Bourbons in the government, however, a most significant coup was engineered at the Conservatoire ([Fox, 1974](#)). From an institution devoted to the arts as they were traditionally understood, it was transformed into a centre of 'science applied to the arts'. Immensely popular lectures (attended by audiences measured in the hundreds of thousands), rather than the collections became the key parade ground for the presentation of the contemporary formation of knowledge and its implications. The expert in science had grabbed primacy in understanding and developing industrial processes and an understanding of industry was thus coupled to the understanding of science. This science knowledge was abstract rather than material and so the exhibition of objects connected to its natural history lost significance, as did an interest in the history of science ([Pickstone, 2000](#)). At this point a minor eighteenth century institution might have fossilised with little notice and no descendants.

However, in the mid-nineteenth century, under its new director the military engineer Arthur-Jules Morin 'the collection' was forged into a new sort of 'museum' ([Jacomy, 1995](#); [Fontanon, 1990](#)). Morin's enterprise involved a serious engagement with the inherited objects. He was responsible for a catalogue of the 21,000 artefacts held by the institution (1851) and in 1866 the apparatus of France's greatest chemist, Lavoisier, was acquired by the Museum. Morin was also himself a leader in the organisation of three universal fairs, in 1855, 1867 and 1878. His fundamental objective, however, was the development and sharing of an understanding of the relationship between science theory and practice. The chief engineer of the Conservatoire explained in 1861 the impact of the crowds at London's Great Exhibition ten years earlier flocking to see moving industrial machinery. This had convinced the French of the power of the visual experience of objects to provide a precise understanding of industry ([Tresca, 1861](#)). Morin therefore also created a laboratory for experimental mechanics at the Conservatoire (1856). Collections, a distinctive pedagogical form, and cultural evangelism had all been brought together. Regrettably, despite the importance of Morin, and the value of the preliminary work of the historian Claude Fontanon in researching it, we still lack a biography of this seminal museum leader. Certainly, by the 1870s, his museum with its collection combining historic firsts in both science and engineering – typical tools of the trade in the laboratory and the factory, and working machines – inspired envy and demanded emulation in Great Britain, France's old competitor in war and new partner in trade.

In Britain, Norman Lockyer, the Editor of the new *Nature* magazine and Secretary of the Royal Commission on Scientific Education, used his magazine to express admiration for the achievements in Paris.^[5] The *Fourth Report* of the Royal Commission highlighted the need for a British equivalent, which did not exist at the time ([Bud, 2013](#)).^[6] Accordingly, Lockyer promoted first a major exhibition of 'scientific apparatus' in 1876 and then from the 1880s a permanent museum, within the administrative framework of the old South Kensington Museum.^[7] This, like its companion applied arts museum (which eventually became the V&A) was based on objects. However, its point was not the aesthetic interest of the artefacts themselves but the story they told in the cause of promoting science as a key part of culture. In deciding which inherited objects to keep, the committee had a firm view expressed to Parliament in no uncertain terms: 'The principle of selection that we have followed has been to throw out such objects as have no historical interest, and are neither good examples of accepted practice or modern improvements, nor steps or links in invention.'^[8] Moreover, the Museum was willing to make its objects dynamic by running them and to illuminate their principles by sectioning them ([Mann, 1989](#)).

Competition within Europe took its typical course and the new Imperial Germany soon was able to justify its own new museum under the leadership of Oscar von Miller in Bavaria, drawing on the precedents of London and Paris. His 'Deutsches Museum' too, combined the roles of promoting reverence for the past and inspiration for the future ([Bud, 2013](#)). In their search to show the visitor that science was relevant to 'his business and his bosom' (to use the phraseology of the Science Museum engineering curator, [Dickinson, in 1924](#)), these museums put together, as if in natural harmony, diverse types of things: historic tools of great men [sic], iconic technological achievements, and working machines. In fact, general object-based museums dealing with the past and present of science and industry became common across European states. Not just France, Britain and Germany but most other European countries; Russia, Austria, the Czech Republic, Hungary, Norway, Sweden, the Netherlands and Italy also established and presented major collections. Many of these were founded in the forty or so years before the Second World War. Different in emphasis as these were, each dealt with both science and industry. In London, the Science Museum adopted a subtitle during the 1920s, 'National Museum of Science & Industry'. The ampersand indicates that the close relationship

between the two subjects was a matter of considerable emphasis.

The Deutsches Museum model deeply influenced the American movement as framed by Charles Richards, author of the classic 1925 report *Industrial Museums* (Richards, 1925). Waldemar Kaempffert, the first director of the Museum of Science and Industry in Chicago testified to its impact on his patron Julius Rosenwald (Kaempffert, 1929). By the 1920s the combination it expressed had so dramatically transcended the particular dynamics of individual institutions that a study visit to Munich would be the basis of the widely influential text *Technics and Civilisation* by American journalist and writer Lewis Mumford (Mumford, 1959).[9] At the heart of this book was the belief that in the new era of 'neotechnics', technical change would grow out of a more organic scientific development.

Within a generic category of 'industrial museum', large institutions – generally privately funded – were established in cities such as New York, Dearborn, Philadelphia, Washington, and Chicago (Holzmeyer, 2012; Jones, 2001; Sneddon, 2009). Institutions such as Chicago's Museum of Science and Industry were ambitious in their museological technique and in their evangelism for science-based industry (Sastre-Juan, 2014). Yet, because none of these seemed to have the standing appropriating to the United States compared with the largest European museums, there was a campaign to build a suitable US institution. In 1946, a few months after the publication of Vannevar Bush's *Science the Endless Frontier*, a curator in the Division of Engineering at what was then called 'The U.S. National Museum' began an article with the prophesy, which suffered no questioning, 'One day the United States will have a national museum of science, engineering and industry, as most large countries have' (Taylor, 1946). The new and spectacular building of the Museum of History and Technology duly opened in 1964, while the Canada Science and Technology Museum in Ottawa was founded in 1967. Each was based on the assumption that 'science, engineering and industry' is a natural set. Museums had effectively merged the categories of 'science' and 'industry'. This is also clear in the many specialised centres founded more recently, particularly in the United States where the Chemical Heritage Foundation in Philadelphia hosts a major display on chemistry (see Landry, in this issue) while on the other side of the country in California, the Computer Museum celebrates the information age. A fuller, more global listing is provided by the website of the Artefacts consortium.[10]

The attitudes expressed by these museums mirrored those of policy makers and foundation leaders, and after the Second World War national governments funded science intensively in the hope of industrial payoff. Since the 1970s even more intense campaigning for the benefits of certain sciences, and an emphasis on the importance of 'high tech' for economic renewal, has been complemented by the wish to combat public distrust of many institutions employing scientists and of science itself (House of Lords Select Committee on Science and Technology, 2000). Governments have poured money into biotechnology and information technology, and museums have reflected the trend. Accordingly, the Deutsches Museum opened a museum for contemporary research and technology in Bonn in 1995. At London's Science Museum, the Wellcome Wing, dedicated to contemporary bioscience and technical change, opened in 2000. Yet policy makers' own questioning of the automatic benefits of science funding since the 1970s, and particularly since the end of the Cold War, challenged museums' own institutional past and the uses they make of the past (see, for example, Parker, 2016).[11]

This challenge to the stories of the past presented by mainstream science museums gave strength to the alternative institutions and initiatives dedicated to promoting informal science education. In Paris, as early as the 1930s the more pedagogical but certainly informal Palais des Découvertes was created to supplement the more traditional Musée des Arts et Métiers (Eidelman, 1985; Schiele, 2008). Individual progenitors, including the Museum of Science, Boston, and San Francisco's Exploratorium became a social movement in the US from the early 1960s, when, in the words of Rob Semper (a key player in the development of the Exploratorium), science technology centres 'were born out of the confluence of the learner-centered educational movement of the mid-1960s and the investigation-focused science education reform movement of the late 1950s and early 1960s' (Semper, 2007; see also Koster, 1999). By the end of the twentieth century there were some three hundred science centres across the United States. Such institutions, which contained 'collections of ideas rather than things' came to pose both a cultural and an existential threat to the more traditional science museums, even in Europe. A few institutions such as London's Science Museum sought to incorporate science centres within their own walls but these were generally completely separate from the object-based galleries (Nielsen, 2014).

Crisis

The legitimacy of the object-based science museum was therefore being widely and fundamentally challenged in the late twentieth century. This multiplied a sense of uncertainty felt across the museum sector, expressed by the term 'the new museology' in which institutional objectives as well as methods were problematised. The two-decade period around the turn of the millennium was contemporaneous with other fundamental changes both in funding and in conceptions of the public. Government funding, on which many museums depended, was increasingly targeted to meeting policy objectives. The success of exhibitions was evaluated in terms of audience response. The publisher's blurb for a classic volume by Eileen Hooper-Greenhill, a leading Professor of Museum Studies reported, 'In order to ensure survival into the next century, museums and galleries must demonstrate their social relevance and use. This means developing their public service functions through becoming more knowledgeable about the needs of their visitors and more adept at providing enjoyable and worthwhile experiences.' In the book Hooper-Greenhill argued that museums were being transformed from 'storehouses' to 'learning environments' ([Hooper-Greenhill, 1994](#)). More attention was given to 'learning' and to the visitors' construction of meaning ([Hein, 1998](#)). Experimental private museums, such as Ironbridge, became the trend-setters rather than the large national institutions.^[12]

In the United States the challenge to the science and industry museum led, but also exemplified, international trends. An anguished 1997 article by curators at the National Museum of American History reported a crisis as stories had replaced artefacts as the focus of their museum ([Post and Molella, 1997](#)). The following year, a meeting to discuss the establishment of the new National Museum of Industrial History (which ultimately opened in 2016) heard a powerful call from Harold Skramstad, Director of the Henry Ford Museum. Skramstad complained of a disconnect between the interests of visitors and of curators and, in the words of the conference organisers, suggested 'the need for museums to break out of the traditional artefact- and scholarly content-centered paradigm and instead view themselves as "experience providers"' ([Skramstad, 2000](#); see also [Cutcliffe and Lubar, 2000](#)). He was answered by Matthew Roth, formerly Director of the Petersen Automotive Museum in Los Angeles. For him it was the artefact not the narrative that had to stay at the heart of the experience ([Roth, 2000](#)). Such tensions were international. How it felt in Britain was described by anthropologist Sharon Macdonald who embedded her research in an exhibition team at London's Science Museum. She points out how the conception of the new Food Gallery responded to a sense of crisis in the institution. At the heart of her ethnographic study is the chapter 'A new vision for the 21st century: Rewriting the Science Museum' ([Macdonald, 2002](#)).

As Macdonald showed, the role of the museum as a whole, conceptualisation of individual exhibits, and the treatment of historic objects within them have been deeply intertwined. How were museums to respond to the pressures to be responsive to the wishes of their users and make sense of their collections in ways that were acceptable to their wide range of stakeholders? A meeting held at London's Royal Society of Arts in 1990 to discuss research in museums was so venomous that one participant, the Science Museum's Director Neil Cossons, described it as 'a show trial' ([Cossons, 2000](#)).^[13] Much more seemed to be at stake than research, other issues ranging from the importance of an historical approach to charging for admission seemed to have been significant too. While the paper of Neil Cossons actually described a rich variety of curatorial historical research, it was reported as emphasising that 'visitors are now "customers"' and the future priority was the 'public understanding of science' ([Cossons, 1991](#); [Hill, 1991](#)). The 1996 establishment of the 'Artefacts consortium', which aimed to bring together the efforts of curators and historians of technology in museums and universities to develop a better understanding of the meaning and use of historic objects, can be seen as a communal curatorial response to this sense of crisis. In general, however, debates were local, private and bewildering to the outsider, conducted in terms that were themselves institution-specific. Museums were split internally with traditional curatorial teams feeling under pressure, while contemporary science, interactive gallery, and education teams expanded their influence.^[14] The complexity of the experience of great battles well evoked by Stendhal's description of the experience of the Battle of Waterloo in the *Chartreuse de Parme* has its parallel in the conception and construction of museum exhibits!

In response, as new ways forward were sought, many experiments were contemplated and some consummated. Museums, like other custodians of complex technological systems depend largely on tacit knowledge, and experiment therefore reflects a going beyond their own institutional legacies and the confidence bestowed by inherited tacit knowledge. It is certainly expensive and potentially risky. Some experiments became famous. Controversy raged over the proposed redisplay of the *Enola Gay*, which had dropped the first atomic bomb, at the National Air and Space Museum (1995). The Museum's interpretation of the military purpose of the 'bomb' dropping was so fiercely contested between the curators who suggested (drawing on academic historical

writing) that the post-war strategic balance was at stake and those veterans who were angry that the exhibition had glossed over the hundreds of thousands of soldiers' lives which would have been endangered in an alternative battle for Japan, that resignations followed and the exhibition was changed (Smith, 1998). In the nearby National Museum of American History, there had been fierce argument over the 'Science in American Life' exhibit which featured a nuclear shelter and was accused of being 'post-modernistic and relativistic' (Molella, 1999). But these experiments were seen by commentators as integral to the intellectual struggles of the time. In their review of museum exhibits as experiments, Macdonald and Basu emphasise their concern not with efforts 'to innovate ever more effective ways of disseminating knowledge that has been preformulated and authenticated by experts to those who are inexpert and presumably in need of it'; rather they are concerned with efforts 'to reconfigure the way in which exhibitions work' (Macdonald and Basu, 2007, p 16).

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Exhibits, objects and the modern science museum

This issue of the *Science Museum Group Journal* presents four narratives by the curators who were intimately involved in experimental projects, describing how they developed exhibitions which worked differently from ways inherited from their own institutional legacy. The papers each explain the institutional ambitions expressed by the exhibits they built, illuminating the usually invisible and often painful intellectual struggles behind the finished product. The challenge for each museum was to break out of their own traditional ways of doing things and to create exhibitions that were genuinely novel for them.^[15] Conducted in the wake of the crisis of the 1990s, and of the local issues by which it was inflected, in Macdonald and Basu's terms, these were experiments. Authors here describe the processes of conceiving and implementing innovative exhibitions at the Boerhaave in Leiden, the Chemical Heritage Museum in Philadelphia, the Medical Museion in Copenhagen and the Vienna Museum of Technology. In each of the four cases, the approach could be extended to the ways in which the entire museum worked. The authors explain how the exhibits for which they were responsible expressed a dream of how the entire organisation could be reconceived, and the exhibit itself was an experiment both in institutional reinterpretation and in the reinterpretation of their subject. Thus, the examples are presented here not as showcases of best practice, but as unique historical moments of institutional innovation and change.

The nature of the experiments varied, according to the institution. The Boerhaave is the national Dutch science museum, which was a target for reinvention by a new director. Formerly a collection which had been exhibited, it would now become a forum for the telling of stories, albeit by means of its great collections. Its director, Dirk van Delft, explains that he started with redefining the audience: from connoisseurs of scientific instruments to a more general community of 'culture-loving Dutch (and foreign) visitors'. The Museum would be radically reformed, including a programme of major temporary exhibitions.

The Chemical Heritage Museum in Philadelphia also sought to tell stories with objects. It was seeking to break out of its role as a private archive and research centre, to reach out to a broader public with an interpretation of a distrusted science without losing its core stakeholders of committed chemists. The institution had originally intentionally eschewed the name 'museum' to emphasise its service to the community of chemists that the rest of the building served. However, senior management and fundraising staff recruited an exhibition team with ambitions to serve a rather wider, if nonetheless scientifically literate, public as well. Jennifer Landry explains the tension between museum professionals used to engaging with a wide public and the core supporters originally concerned with an exhibition for people like themselves. As Landry explains: 'The curatorial team believed the exhibition should focus on the history and the social importance of science and technology instead of teaching scientific principles or explaining the technological "how" of the instruments.' The exhibition therefore had to express the values of a changing and complex organisation. Moreover, it had to contend with the ambitions of a design company more used to linear narratives than to the confusing interconnections highlighted by object collections. In describing the issues Landry provides a remarkably candid account of the complex exhibition development process of the time.

The third of the case studies described here sought explicitly to exploit confusion. The Medical Museion is an academic exhibition space and collection which, in the 1990s, was seeking to escape its past as a dusty medical collection and to demonstrate the potential of research and experimentation within a museum that expressed a *rapprochement* between the university and the museum. The team's approach was very different from the audience-building ambitions of the first two organisations. 'The core aim of the exhibition is to facilitate visitors' informed reflections upon the ways in which recent

biomedicine challenges significant cultural categories including the body and identity, therefore influencing our very understanding of ourselves as human beings, our sense of “personhood”, writes lead curator Martha Fleming.

In his paper, Peter Donhauser locates the development of a science centre within the history of the predominantly object-based Vienna Museum founded early in the twentieth century. He portrays the interactive engagement with young people in terms of its continuity with the aim to popularise science, which had animated the foundation of the museum at the beginning of the century. At the same time, the rise of interactivity represented a radical shift from an emphasis on technology itself towards a focus upon scientific principles, which then had a wider currency.

Thus the four museum case studies presented here each locate their detailed accounts within a broader analysis of museum strategy at the turn of the millennium. However, read together, the collection goes beyond this to confront common issues for the museum of the early twenty-first century. In particular, they address the continuing issue of how to integrate and combine the various interests, aims and stakeholders of the modern science museum.

Dirk van Delft deals with early-twentieth century Dutch Nobel prize-winner Kamerlingh Onnes, who first liquefied helium in 1908. Here van Delft combines his role as scholarly expert on the work of Onnes with his roles as curator and museum director ([van Delft, 2007](#)). He links the ambitious transformation planned for the Boerhaave, the shift in visitor base to the nature of, and rationale for, the temporary exhibition. The challenge he explores is how the Boerhaave could share the understanding of massive and important equipment which lacked both aesthetic appeal and obvious comprehensibility. His belief is that ‘The general public is only ready to accept into their heart these difficult objects if they form part of an accessible and attractive cultural or historical story’. The resolution chosen was to focus upon the rivalry with Onnes’ contemporary, the Scotsman James Dewar, who had a very different approach to engineering. Dewar had won the race to liquefy hydrogen, but Onnes went one colder with helium, at the very time that other competitors were racing for the South Pole. This narrative approach is seen as key both to the appreciation of objects and to the overall experience. ‘In practice, in the case of *Quest for Absolute Zero* this approach led to a process of selecting artefacts on a basis of their potential to contribute to the story. The objects in the exhibition should trigger the visitor’s empathy. Aesthetics or an iconic status of an object are less important in such an approach.’

In her paper dealing with the Chemical Heritage Foundation, Jennifer Landry shows how the curatorial team dealt with institutional tensions in the process of creating a new museum within an existing institution. The team also favoured narrative but the emphasis was much more on structuring narratives around artefacts: ‘the two guiding principles were to structure the narratives around the artefacts and to emphasise the social context over the scientific or technical information.’ The focus on social context and technical impact, and the ambiguous status of chemistry, which was identified both with science and technology, enabled the gallery to have a fluid relationship with both. Landry highlights, moreover, the need to satisfy several competing interest groups. It was important to emphasise distance from the chemical industry, normally assumed to be calling the shots in exhibits such as this, but also not to be so distanced from public expectations as to evoke the well-recalled wrath that had attended the Smithsonian exhibition *Science in American Life*. The crisis in museums, as perceived by the team, therefore was an active factor both in provoking the approach to issues of social and technical impact and in warning of the limits. Landry is articulate about the conception of the visitor as interested and knowledgeable about science and public affairs.

The paper by the artist and curator Martha Fleming takes a very different tack. The visitors at the Medical Museion were assumed to be immensely knowledgeable about their own bodies, and the 2008 exhibit was consequently conceived as a conversation, formally eschewing the one-to-one relationship between artefact and story. More than perhaps any other museum, the Medical Museion has been influenced by the work of the German philosopher Hans Gumbrecht who emphasises the material presence of things rather than the symbolic significance of concepts, and has taken seriously the presence of the object ([Söderqvist, Bencard, Mordhorst, 2009](#); [Gumbrecht, 2004](#)). Accordingly, rather than representing a narrative, the presence of the artefact was intended to prompt the visitor to rethink his or her relationship to bodies and machines. The language of Fleming’s paper, with its allusive style and reflexive emphasis, as well as the primacy given to the work of Michel Foucault, highlights the ambition of the award-winning exhibition it describes.

The fourth case study reports on the development of the Vienna Museum of Technology. There the modern experiment involved a formal division between a historically-oriented, object-based permanent gallery dealing with the evolution of scientific

knowledge, and a learning area dealing with phenomena and experiments. 'A wide variety of historical objects [are] presented in their cultural, economic and societal contexts, complemented by cutting-edge educational methods to make complex issues easier to understand.'

In their different ways, these papers show how museums have struggled to demonstrate how science can be relevant to their publics. These museums could take neither their audiences nor their patrons for granted. In the wake of the crisis of identity in the 1990s, they had to reinterpret long-established roles. No longer could other professionals be treated as threats or competitors, and nor could other means of interpreting science be ignored. Instead, institutions sought, imaginatively, to take their visitors on journeys which engaged with contemporary cultures and identities, and also economies. In these exhibits the interpretation of science and science's relationship with technology has been coupled intimately to the evolving identities of museums as a whole. This issue is a reminder that such concerns have been and are still argued about, not just in the pages of books and the avenues of power, but also in the exhibition halls and back corridors of the great museums.

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Tags

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Footnotes

1. For the Science Museum's online presence see 'British Museums most googled in the world'; for the standing of the National Air and Space Museum see 'Global Attractions Attendance Report', 2016.
2. The group of papers presented here came out of the 2011 Artefacts XVI conference at Rijksmuseum Boerhaave in Leiden, which addressed the theme of 'Conceptualizing, Collecting and Presenting Recent Science and Technology'. Other papers from that conference are published in the accompanying Artefacts publication *Challenging Collections: Approaches to the Heritage of Recent Science and Technology*, Boyle, A and Hagmann, J-G (eds), Smithsonian Institution Scholarly Press, 2017.
3. See 'Focus: why science museums matter: history of science museums between Academics and Audiences', 2017
4. This analysis is broadly comparable with the more general approach of Butler, 1992. Her approach is, however, more nationally based, and is less concerned with the international circulation of ideas about museums.
5. See, for instance, 'The French Museum of Physical and Mechanical Science', 1874
6. Royal Commission on Scientific Instruction and the Advancement of Science, 1874, Fourth report (C.884), 14
7. See Bud, R, 2009
8. 'Report of the Committee on the Science Collections of the South Kensington Museum', 28 October 1881, ED 24/47, National Archives, UK
9. Mumford drew his use of the word 'Technics' from his mentor Patrick Geddes, who drew on the German word *Technik*. Here it refers to the practice of making rather than its study, captured by the word 'technology', though later usage has combined the two, in English at least.
10. [Artefacts Consortium. Museum Directory](#), consulted July 2017. Artefacts is a consortium of scholars from museums and academe, established in 1996, in order to promote the use of objects in serious historical study.
11. This crisis of confidence is explored in Grandin, Wormbs and Widmalm, 2004.
12. Although the perceived promotion of 'heritage' by the private museums was deeply controversial. See, for instance, West, 1988; but also see Samuel, 1994. On the period, see Lowenthal, 1985.
13. Cossons, 2000
14. At the Royal Society of Arts conference, Cossons argued "Conservators, designers, educational and interpretive staff, administrators and managers have radically altered the population pattern. No longer do curators hold a majority of the sweat equity in our great museums" (Cossons 1991, 185).
15. The experience of the Science Museum is described by Boon, 2012.

References

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