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The art of curation: collection, exhibition and scholarship

Introduction

Artefacts on display in museums can be described as congealed culture,[1] mute testimony to the cultures in which they were produced, used and finally conveyed to posterity. But in fact they are far more. They symbolise the power and authority of the exhibiting institution, and often are used to attract support, both public and elite. They are the medium through which national museums such as the Smithsonian Institution define and assert particular views of culture.

These assertions, naturally, breed tensions over ends and means within national museums among administrators and curators. The focus here is on curators – their role in collections and exhibition, and these activities' interplay with scholarship, in the context of a particular institution, the Smithsonian's National Air and Space Museum. My goal here is to suggest the texture of the curatorial experience through a personal account of two intimately-connected undertakings: building a collection of artefacts documenting astronomy in the space age and creating the permanent exhibition 'Explore the Universe' (opened in 2001).

One can argue that developing any exhibition story dealing with a concept, an event or an era is influenced by how the curator views the subject matter, the resources available and the topics deemed acceptable by the institution and prevailing culture. All these factors influence the exhibit, and hence the act of collection. But such factors also may come into play well before an exhibition is created. Aerospace museum curators identify and select all sorts of bits and pieces of the material legacy of space travel, and turn them into artefacts. The choices they make may be shaped by social, political and economic forces as much as by intellectual priorities.[2] As Oxford historian Jim Bennett has observed of all forms of curation, therefore, 'museum collections [...] show you not what there was but what was collected'.[3] Stating the obvious, yes, but in fact this observation has profound implications worth pursuing; specifically, what factors inform, in this case, the collecting of space artefacts? How do scholarly judgments intersect with political and economic influences? Whatever the answer, for each curator, for each and every institution concerned, collections may illuminate, and in turn affect, scholarship.

The curator and his or her working milieu thus compose an important nexus: this conjunction literally creates the stuff of history.

'Explore the Universe'

In the 1990s I became part of a hybrid curatorial/scientist team tasked with replacing an existing astronomy gallery, 'Stars' – an initiative set in motion in 1988 by the arrival of a new Director, astrophysicist Martin Harwit. I had long wanted to improve sections of 'Stars' in association with my curatorial colleague Robert Smith. But the new Director called for a completely new gallery, one that had a strong scientific voice, to state 'what we know and how we know it' about the universe. He wanted visitors to understand the scientific process, to discover for themselves how scientists work and think about things, but relying on interactive displays rather than artefacts to achieve these ends – all in a 4600-square-foot gallery. Initial responsibility was entrusted to a newly-formed infrared astronomy group established by Harwit, rather than the curatorial Space History Division. During this initial planning, the museum became embroiled in a controversy over an exhibition on the end of the Second World War featuring the *Enola Gay* B-29 bomber. This controversy led to Director Harwit's departure, the dissolution of the infrared astronomy group and the return of gallery planning to the curatorial department and to me as curator.[4] With this change, artefacts assumed a prominent role in the gallery's conceptualisation, and the gallery, in turn, offered a crucial opportunity to build the collection, as described below.

But with Harwit's departure, I felt that a new Director might not assign a high priority to an astronomy exhibition. To build support, I accepted a suggestion by a former exhibitions chief, Nadia Makovenyi, that we form a core exhibition team consisting of curator, designer, scripter, fundraiser and educator. This organisational technique did create 'grass roots' interest in the exhibition that transcended the curatorial department. Inadvertently, the *Enola Gay* controversy facilitated this support: an exhibition on astronomy was considered to be 'safe' – far away from politically-sensitive issues (a proposed exhibition on the air war in Vietnam also was cancelled during this period). Our major challenge, which we accepted, was to compete for financial backing as the Development Office focused on fundraising for a new facility at Dulles (now the Stephen F Udvar-Hazy Center).

The new gallery theme emphasised galactic and extragalactic astronomy and cosmology (though we were not encouraged to use that word, as it was feared there could be confusion with the practice of beauticians). These themes posed a range of conceptual hurdles, including aspects of cosmology and evolution that the museum's visitors might regard as controversial.

We knew that two areas of modern astronomy had to take centre stage in this new gallery, entitled 'Explore the Universe': the search for the remnant structure of the big bang, and the search for the large-scale structure of the universe. And because the initial planning phase for this new gallery was unusually long, by the mid-1990s we also knew that we could not ignore a key and exciting new area of astronomical research, the question of dark matter. As curator, I needed to consider how artefacts could tell these stories.

By the mid-1990s, the outline of the gallery was well established: the organising theme was that the application of new technologies to astronomy tended to reveal new universes – in other words, each time science changed the way it looked at the universe, using only the eye, then the telescope, and then adding new detection devices to telescopes, science encountered a fundamentally different universe. Exhibition areas devoted to visual sky astronomy, to telescopic astronomy, to photographic and then spectroscopic astronomy (Colour plate 11) take the visitor from the eleventh century through to the twentieth, from the geocentric to the heliocentric, to a stellar universe, to a universe composed of galaxies and finally to an expanding universe set approximately in the mid-1950s. Institutions from around the world loaned historical artefacts, including William Herschel's original 20-foot telescope wooden tube and an 18.5-inch speculum mirror, Mount Wilson's original 100-inch Newtonian cage used by Edwin Hubble, and Lick Observatory's Brashear radial-velocity spectrograph. We also acquired significant contemporary ground-based artefacts for the collection, including Palomar's prime-focus spectrograph – from 1950 until the early 1980s the fastest spectrograph in the world sitting on top of the largest telescope in the world. This spectrograph/telescope technology symbolised William Herschel's classic dictum that the purpose of large telescopes was to increase the 'power of penetrating into space'.[5] Herschel's point of view is reflected in the gallery's choice and arrangement of artefacts: from Tycho's equatorial armillary sphere (Colour plate 12), a Huygens lens, the Herschel 20-foot reflector, to Mount Wilson's 100-inch reflector and the prime-focus spectrograph from the 200-inch. The latter artefact highlights that astronomy's ability to 'look' into space also can be the result of increasing the efficiency of the detector – a point that introduces the final section of the exhibition, the 'Digital Universe'.

This section was originally called 'Space Astronomy', to reflect an institutional mind-set at the museum which had looked to NASA as the primary stakeholder. But we were able to broaden the scope of this section and rename it as we secured additional funding from the National Science Foundation, as well as corporations such as Kodak, Corning and TRW, some of which had invested heavily in ground-based instrumentation. This change allowed for an exhibition organised mainly along parallel scientific and technological lines, mapping revolutions in thinking about the universe with changes in technology. This parallel, though not particularly profound to the specialist historian, was met with happy smiles and even surprise by contemporary scientists and our technology-oriented patrons.[6]

The 'Digital Universe' section departs, however, from the linear parallels and firm conclusions of the first four sections. As it deals with the present, I chose not to offer conclusions on scientific views of how our understanding of the universe has changed as a consequence of digital technology, though some possibilities are presented. This section takes a thematic approach, examining broad categories of cosmological questioning: the origin of the universe, the evolution of the universe, the large-scale structure of the universe. Most of the objects exhibited here are new accessions, from a variety of sources: the Hubble Space Telescope back-up mirror; flown and retrieved Hubble instruments; COBE engineering instruments, an early computer-controlled photometer and an image-tube spectrograph as examples. Some were chosen because they demonstrate key paths of development. The original '4-Shooter' CCD camera from Palomar, for example, proved the concept embodied in the wide-field planetary camera on Hubble.

The primary criterion guiding these acquisitions was to identify and collect instruments responsible for changing science's view of the universe. The image-tube spectrograph (acquired from the Carnegie Institution) is the one built and used by Vera Rubin and Kent Ford to determine the rotational dynamics of spiral galaxies and sense dark matter unequivocally. The development of our understanding, over a period of decades, of the existence and structure of the cosmic background radiation, the 'fingerprint' of the big bang, is explored through a series of artefacts: George Gamow's original YLEM bottle, Robert Wilson's pigeon trap, Robert Dicke's radiometer, COBE hardware and various higher-resolution successors. The evolution of structure in the universe is represented by the twice Shuttle-flown Hopkins Ultraviolet Telescope, by WFPC-1 hardware from Hubble and finally by the Smithsonian Astrophysical Observatory's 'Z Machine' from Mount Hopkins, the central instrument used by John Huchra and Margaret Geller to create a survey that revealed large-scale structure in the contemporary universe.

The most challenging portion of 'Digital Universe' deals with missing matter. If the exhibition had opened in 1995, it is unlikely that issues such as dark matter or dark energy would have been included. Parts of this section, such as the faint-object spectrograph (FOS) retrieved from Hubble, or a 20-inch photomultiplier from the original Kamiokande II detector that took part in measuring the neutrino flux from supernova 1987A, were originally planned for a treatment on 'exotic' or 'extreme' objects such as supernovae and black holes. However, in the ensuing years it became clear that these instruments could be linked in the search for dark matter. Starting with Vera Rubin's spectrograph (detection of the mass anomaly), the Kamiokande detector and the FOS represent aspects, along with elements of X-ray telescopes, of the search for missing baryonic matter. Not covered at all is the growing field of astroparticle physics that is devoted to the search for non-baryonic matter. This is an area for future attention.

Our growing recognition of the importance of the search for the dark side of the universe influenced other parts of the 'Digital Universe' section. We began the section displaying the known electromagnetic spectrum using as many graphic illustrations and interactives as we could fit in. Our purpose was, first, to show how small the optical spectrum is compared to the full spectrum, and, second, to introduce a major display of electronic analogue and digital detectors designed to study the full spectrum, as well as the high-energy particle flux called 'cosmic rays'.

The detector collection in the 'Explore the Universe' gallery ranges from a loan of Dicke's original radiometer, which confirmed the big-bang cosmic background radiation, to an IRAS focal-plane element, the first semiautomated photoelectric photometer at Kitt Peak, prototype and back-up X-ray area detectors from ROSAT and Chandra, an element of the scintillation chamber from the Compton Gamma Ray Observatory and the original flown ionisation chamber Victor Hess used to establish the vertical profile of cosmic rays. The point of this display is to show the vast variation in detector designs required to sense the known universe. The subtext is that, even with all this effort, science only has limited understanding of the universe because, as astronomers finally accepted, their detectors have only been able to detect a very small portion of what is out there. This treatment introduces the visitor to the gallery's last section and the theme of the dark universe.

Presenting history in a museum context

During the time I was developing 'Explore the Universe', the Space History Division was rethinking its collections rationale. In the early 1990s, the division changed the basis of the collections rationale to emphasise clear, broad goals rather than catalogues of specific artefacts. Working in the former mode, I had developed a two-dimensional taxonomy to highlight the important correlation between detectors and spectrum in the development of astronomy. This led to the acquisition of a suite of X-ray, ultraviolet, visual and infrared detectors representing some 40 years of developmental effort by the Navy and Air Force, as well as by NASA/Goddard, universities and industry. But I also realised that this 'Noah's Ark' approach had real practical and intellectual limits. I did want to demonstrate that a diversity of real and perceived uses propelled development, and that goals, objects and techniques changed with time. I recognised that my collecting responsibilities had to encompass a broad range of possible future interests, ranging from preserving technical details of the hardware to preserving 'institutional goals and styles, national goals and priorities, [and the] scientific goals of those who lobbied, designed, built and then used the hardware'.[7]

But a profound change was taking place within the division, reflecting disciplinary trends. Other members of the staff expressed a growing sympathy for a stronger historical approach: that 'the objects in our collection are more meaningful and significant as historical artefacts than they are as examples of clever or effective engineering or as sources of specific kinds of information'.[8] We explored arguments in material-culture studies that centred on the importance of experiencing the 'real thing' as a means to illuminate history and draw attention to historical events.[9] But overall we knew that doing so required a significant shift in regarding why and what we collect.

This shift therefore provided a new context in which to consider not only what I collected but how I presented artefacts to the public. In particular, it encouraged the use of contextual constructions such as three-dimensional dioramas to illustrate such themes as the changing relation of the human observer to the machine. This decision was also confirmed by a series of formative (pre-exhibition) evaluations in which we brought artefacts to the public, with test labels and graphics, and studied their response: how they reacted to the objects and what they needed to enhance their understanding.[10] An early evaluation of the Palomar prime-focus spectrograph provided an important finding. The object was a mystery to visitors unless we showed clearly where it fitted into the telescope, and how a human observer actually used it. This relational and contextual approach proved to be the best way to 'uncongeal' an artefact for the casual visitor: to present the artefacts not as ornaments, but as characters on a living stage, making them the centre of the action. We wanted our visitors to understand how the experience of doing astronomy developed in concert with changes in instrumentation. To do this, we needed to put the visitors and the instruments in the right display context.

But we had neither the space nor funds to build extensive dioramas in the gallery's floor area of less than 5000 square feet. Our goal, by necessity, was more limited: to create mini-dioramas that placed an artefact, especially those associated with transformative historical developments, in its immediate technological and historical context. The gallery uses this technique for showing Tycho's 'hands-on' use of an equatorial armillary sphere (Colour plate 13); William Herschel's method of sweeping the heavens in his back yard, standing on, and hence within, his telescope, but exposed to the open air (Colour plate 14); Hubble's direct manipulation of the 100-inch telescope within a dome (Colour plate 15); and the Old Mills radial-velocity spectrograph at Lick Observatory (Figure 1), mounted in a

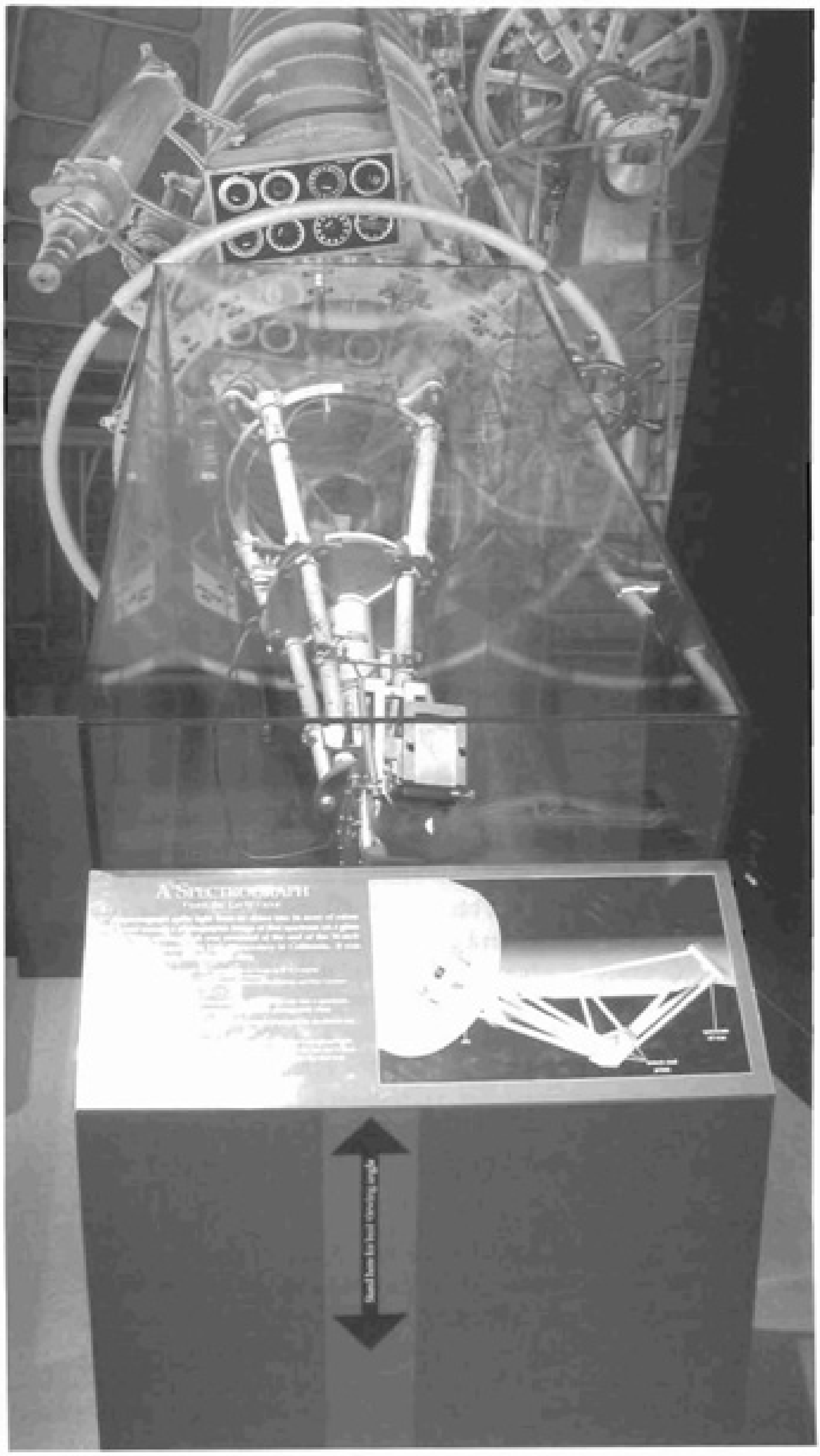

Figure 1 Direct view of the Lick spectrograph, showing it in its proper relationship to the 36-inch refractor, dome and slit. (David DeVorkin)

photographic diorama illustrating its relationship to the telescope. I would have loved to place the Palomar prime-focus spectrograph within its actual observer's cage, but that would have taken up a large chunk of the gallery. We found an elegant compromise by situating the instrument at the vertex of a blue cone of light representing the beam from the 200-inch mirror, and using photographs and digital media to tell the whole story of where the instrument sat within the telescope and how the observer used it, and, finally, how the astronomer processed the data. In the 'Digital Universe' section, we highlight a historic transition in the human–machine relationship: the gradual removal of the human observer from the telescope, both on the ground and in space, largely through the application of electronic and now digital means of detection, imaging and remote control (Figure 2).

Figure 2 The 'What's New' section invites visitors to 'observe' at electronic kiosks, in the same way that the astronomer depicted in the picture on the right is observing remotely using the 4-metre Mayall telescope at the National Optical Astronomy Observatory. The 'observing sessions' reveal where various satellites are in space at the moment and also offer other interactives. (Eric Long/Smithsonian National Air and Space Museum)

Conclusions

In each of these dioramas, the presence of the original instrument engaged in discovery promotes a sense of experiencing an actual event in history, an event validated by the survival of the physical artefact itself, as well as by the survival of knowledge about its role in the process of exploration and discovery that helped to shape our understanding of the universe. When the instruments survive, they attest to these achievements, in ways that are still being uncovered as historians continue to search for new forms of analysis and interpretation.[11]

One extensive post-opening evaluation of 'Explore the Universe' has been conducted. In that survey, 55 per cent of visitors interviewed after exiting the gallery understood the primary theme: 'How astronomical tools have changed our view of the universe'.[12] Although an interactive thermal-infrared imaging camera was the most popular single item mentioned by visitors, the exhibition attributes that most enhanced visitor experience (85 per cent) were 'Telescopes and other objects'.[13] One visitor expressed amazement at the sheer size of the Herschel telescope, whereas another visitor interviewed for the project expressed his frustration generally with the necessary precautions one has to take in exhibitry: remarking about an aircraft engine, he wanted to rip off the plastic cover and actually feel the pieces. An engineer visiting the museum wanted to 'see some of the real items that had actually gotten into space and had some historical significance. I wanted to see them for myself.' And another visitor preferred direct experience 'rather than looking at them in a book or having someone tell me about them. I just want to see stuff.'[14] This evaluation was not designed to determine if seeing the 'real thing' was important to our visitors, but these examples suggest that the actual artefacts lent impact and authority to the displays.[15]

Overall, however, this exercise convinced me that fully-contextual exhibits do require three-dimensional dioramas that place artefacts in their historical settings. This, again, is nothing new in the museum field, but it is a reminder that the direction many museums are taking today, from explanatory labelling, graphics and video to the use of electronic simulations and immersion, might not be an effective educational strategy if the artefacts of the enterprise are abandoned or reduced to mere ornamentation.

This observation directly impacts how and what we collect. It also creates a challenge that, in purely economic terms, is not easy to meet. That is, when considering an instrument or object for collection, it is not enough to collect only the object itself without also collecting, in some form or another, as much information about its surrounding frameworks: those that brought it into being and those required to make it work. This leads to a specific collecting method: to collect the key object, in my case the detector, and then as many elements of its context as possible – the instrument of which it was a part, the satellite bus and the infrastructure that enabled the creation of the detector and its associated systems.

Few, if any, of the environments that surrounded these detectors have been preserved. Laboratory space in any scientific institution is valuable property, quickly cannibalised once a project is completed. The effort required to reconstruct them, and indeed to be sure that the pieces are authentic, is enormous and prohibitively expensive.

Possibly the only complete environment preserved in the Smithsonian collections pertaining to astronomical history is the workshop of Henry Fitz from the mid-nineteenth century.[16] This does not mean that the situation is hopeless. Far from it. Very effective means have been developed to preserve detailed graphics and textual descriptions, either from original sources or through structured oral and video-history interviewing.[17] As the capability of simulation improves, indeed, this medium may help to recapture the feeling of being there. But the link with the past will only remain solid if an undeniably clear material record survives. And since icons breed myth and legend, only full contextual display should be the goal of the art of curation.

Notes and references

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15 Note 12

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