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CAN SCIENCE MUSEUMS TAKE HISTORY SERIOUSLY?[1]

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Abstract: *The paper reflects on the irony that, as historians of science become more interested in scientific instruments and apparatus, there is a tendency for museums of science to move away from historical displays of original objects. It describes two recent exhibitions at the Whipple Museum of the History of Science in Cambridge, which were novel attempts to contextualize science in history, and comments on the implications of the position adopted by these exhibitions for the current interest in 'the public understanding of science'.*

Never before has the History of Science had such opportunities and confronted such challenges in the world of museums. On the one hand, recent trends in science history offer new involvement for museum collections and their interpreters. On the other, fashions in the public presentation of science seem to deny historical sensibilities by seeking to isolate transcendent principles from the contingencies of their creation, use and development. Just when historians of science are moving towards material culture, influential lobbies in science museology are retreating from it.

Where science historians formerly sought to trace histories of ideas and to fashion communities of interest on mutualities of theory, they now embrace a much broader scientific culture. Education, popularisation, instrument development and manufacture, laboratory training, and professional and industrial practice, are a few elements in this larger view of science where museums can contribute. Museum collections are an important resource for the historians' programme, since only a tiny proportion of the instruments they contain were ever research tools: the great majority were made for education, training, entertainment, professional practice and so on. Indeed it may have been their very comprehensiveness that formerly marginalized collections in the academic discipline of the history of science; in the former historiography the crux of a theory might be conveyed in part by the instrument used in a critical discovery, but it is less clear where the many cloned instruments might stand in a discipline most truly exemplified by disembodied ideas and their inferential formalism.

The attitudes of historians have changed profoundly and museum practice will have to change to make use of the opportunity for collections to count in the history of science. We need to find ways of representing the generation and use of instruments, whether the work they performed was in the laboratory, the factory, the classroom or the gentleman's

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library. Work here comes in many forms —making the results of experiments, making trained practitioners, making entertainment for customers, making status for a patron, or making authority for a professional such as a surveyor or a physician. These are only a few examples, but to approach the new challenge our displays will have to aim at being —so far as it is possible— both inclusive and contextualized.

Recent developments in collections management and display have not always been helpful. As the goal broadens to no less than a presentation of science in history and society, the trend to reduce the number of instruments on display will have to be reversed. Design imperatives have enforced a norm of fewer and fewer instruments in showcases and less and less supporting material. Minimalist presentations, for all their value in focusing attention on the qualities of particular objects, will not help us to show science as a pervasive and multifaceted influence in the formation of modern culture and so will eventually undermine the purpose and mission of the museum. Worse still is the trend actually to remove collections from galleries and replace them with designed environments themed for representations of contemporary science. Many of our former collection displays were uninspired, unimaginative and unchallenging, but collections are the foundations of all the great museums and to forget our responsibility to mediate them to our public is to fail. Displayed storage is a welcome and positive idea, but as an addition to the techniques of object management, not as a substitute for exhibition.

So we must have more objects on display and more information available to make sense of them. We must also be creative in the stories we tell about them. Linear accounts of conceptual development are the most straightforward for the museum staff to devise and probably for the visitor to read, but only because they are consistent with ingrained assumptions about development and progress. They have their place, since they are appropriate to a good many topics in science history, but we should be prepared to develop other models, other dynamics to inform our displays. Two recent exhibitions in the Whipple Museum of the History of Science in Cambridge have addressed these issues by experimenting with the use of the exhibition as a medium.[2]

Empires of Physics

All science historical exhibitions must try to contextualize, to say that science was formed in history with all the contingencies that this simple but apparently disturbing truth implies. Do our public see this message in our exhibitions? Probably not. We all know that visitors reach for the safe resource of the quaintness, the naivety, even the stupidity

[2] Other teaching, research and museum staff involved with this work were Robert Brain, Kate Bycroft, Simon Schaffer, Otto Sibum, Richard Staley and Judith Thursby. A fuller account can be found in the four books published in connection with the exhibitions: J. Bennett, R. Brain, K. Bycroft, S. Schaffer, H.O. Sibum, R. Staley, *Empires of Physics. A Guide to the Exhibition*; R. Brain, *Going to the Fair. Readings in the Culture of Nineteenth-Century Exhibitions*; R. Staley, ed., *The Physics of Empire* (public lectures by B. Brain, J.C. Maxwell, H.O. Sibum, S. Schaffer, A. Warwick); J. Bennett, R. Brain, S. Schaffer, H.O. Sibum, R. Staley, 1900: *The New Age. A Guide to the Exhibition*. All were published by and are available from the Whipple Museum, Free School Lane, Cambridge.

displayed in the past —it is something other, and thankfully not a part of what science has become. Even though science has indeed evolved from this primitive state, it has become something different, of which its former condition is no part —the model for its development is not so much developmental growth as the emergence of a perfect butterfly from an unpromising chrysalis. So the historian is thwarted and science remains ahistorical: such ideas and practices were all very well then, but we know better.

We tried to approach the problem of contextualizing science in a different way, which made it less easy for the thoughtful and sensitive visitor to avoid. We made use of the topography of the Whipple Museum to present two views of the same subject and displayed late nineteenth-century physics simultaneously in two galleries. The galleries occupy the same floor area, one directly above the other, and are linked by staircases at either end. Our special exhibition thus came in two instalments —the first, on the lower floor, with the sub-title "The Laboratory", the second "The Exhibition". Downstairs, then, was the private world of the experimental physicist, upstairs the public space of the many science displays of the time, often linked to international exhibitions. Downstairs we evoked the Cavendish Laboratory and the Cambridge Scientific Instrument Company in the late nineteenth century; upstairs was derived from the generality of exhibitions, but with some particular reference to the Electrical Exhibition in Paris in 1881. Downstairs demonstrated that a great deal of training of operators and refining of delicate instruments and arcane techniques has to take place to create a successful laboratory science; upstairs all this work and difficulty had been lost in a presentation that was direct, engaging and untroubled.

The visitor was not meant to feel completely comfortable in the "The Laboratory". She had trespassed into a private world, which was not designed to entertain or to assist the outsider. Thus the environment was not particularly helpful. There were no labels as such, though we contrived to leave around such clues as instrument catalogues, laboratory instruction manuals, and shelf labels for insuring that apparatus was correctly replaced after use. Rather the serious visitor used a guide, like a tourist in a foreign country. Giant photographs successfully evoked the laboratory and workshop ambience. Some cases were lined with wood, like cupboard interiors, to hold all manner of instruments and apparatus -contrary to current designer dogma, these cases were as crowded as possible. Experiments from the teaching laboratory were set up ready for use, with manuscript instruction books, and schedules were posted allocating pairs of students to individual experiments. Everything was done to create a sense of suspended activity, and to suggest an unstable compromise between the ordered regime of education and the unpredictability of experiment. It was just this instability that so worried some College Tutors in Cambridge, who saw students of experimental physics engaged in a dubiously insecure and contingent regime, instead of challenging themselves with the intellectual and moral certainties of classics and mathematics.

Another area in "The Laboratory" dealt with the research project that was central to the work of the Cavendish in this period, namely the production of a standard of resistance. It was here that the title of the special exhibition, "Empires of Physics", began to take meaning. In the lower gallery it was a metaphor for the kind of influence that the creators of such standards sought to exert, from the imperial centre of the laboratory workshop through the burgeoning electrical networks of communication and power. This project, centring on delicate electrical measurement and the development of the instruments

and apparatus to carry results and techniques into the world outside the laboratory, linked directly with the work of a manufactory —the Cambridge Scientific Instrument Company— displayed nearby.

Visitors emerged from the dim and disorientating "Laboratory" into the well-lit "Exhibition" upstairs with some relief. Here they could be much more at ease -this really was an exhibition, and here they knew how they were expected to behave. The display reinforced this difference. Colour was eschewed downstairs, embraced upstairs. Black curtains characterized the "Laboratory", rich red the "Exhibition". There were roughly-made, bare, pine display stands downstairs, finished, painted stands upstairs, and so on. Three stars of exhibition technology —the telephone, the telegraph and the phonograph— were presented upstairs, each in an engaging way with a working exhibit for the visitors to try. The telephone display, for example, recreated the live relays of opera performances that so astonished visitors to the Paris Electrical Exhibition in 1881.

We showed also that the exhibitions were competitions, with medals awarded as prizes, and we highlighted the rivalry between Great Britain and Germany. Here, then, the imperial theme took on a more overtly political significance, but one that mirrored the struggle over standards already encountered downstairs. National displays from Germany and Britain dealt mainly with electrical and optical instruments. Other echoes from downstairs were noted as the Cavendish was seen to buy sets of German thermometers through the Special Loan Collection Exhibition in London in 1876, and the Cambridge Scientific Instrument Company to display its wares and win a medal in Paris in 1900. Throughout we tried to remind visitors that this apparently very different world, where all the training and work were lost to view, in fact depended on the world of the lower floor.

As visitors then returned downstairs, as they had to do to leave the Museum, they saw the "Laboratory" world in a different perspective. Moving between the two presentations of the same subject —presentations derived from the period— their view was to some degree contextualized. They had, we hoped, been seduced by the exhibition, and so might engage more thoughtfully with what it obscured. At this point, if they were going round in one of our organized workshops, visitors were invited to attempt a replicated experiment of the period. We decided that providing an opportunity for laboratory experience was important in an exhibition which argued that the work of making physics is part of what physics becomes, and cannot be hidden without an enormous loss of context. The experiments on offer were measuring Joule's mechanical equivalent of heat or measuring an unknown resistance by a Wheatstone bridge. Both used carefully replicated apparatus. It may sound as though the Whipple had joined the 'interactive' vogue, and in terms of encouraging active visitor involvement this was so, but our expectations were very different. Far from making experiments untroubled and fun, we relished the enormous difficulties both we and our visitors experienced in getting anything like the 'expected' results, for it sensitized all of us to a more realistic appreciation of both "The Laboratory" and "The Exhibition".

It is true that visitors required guidance from demonstrators, but the experimental adventure was as open-ended as possible. We allowed visitors to come to a realization of the unwritten practical and tacit skill that must be integrated into the total virtuosity of the experimenter. This in itself gave them some sense of the assumptions unspoken in the world above. Visitors who raised questions and difficulties about the integrity of the experiments clearly expected, from their laboratory training at school or elsewhere, a resolution of the

problems from the demonstrator. Instead their difficulties were taken seriously, implications for the integrity of the experimental result were discussed and the questioners in turn were invited to consider the consequences. We were applying disciplinary techniques of the humanities to a practical study of experimental science —a risky strategy and one to which our visitors were unaccustomed. In offering a different channel of appreciation of science past, we were able to show that tacit skill comes to be taken for granted and that other kinds of negotiation must be undertaken, beyond appealing to the transparency of an empirical result, to secure something so complex as the mechanical equivalent of heat.

In using the topography of our exhibition galleries to present the message of "Empires of Physics", we sought to promote the special potential of the medium of the exhibition; too often the model of the book is unthinkingly transferred to the gallery. The dynamic of the exhibition was thus not progressive or chronological. The visitors moved freely between the private and public worlds, examining afresh their relationships and their constructed distinctions. The showcases were filled with instruments —not there only to represent a result, an insight or a discovery, but to evoke a broader scientific culture as it appeared in the laboratory and the exhibition.

"Empires of Physics" was a challenge to the slight resources of the Whipple Museum; it was also a challenge to our public. We tried to make it accessible in a variety of ways. The "Guide" deliberately did not follow the usual conventions of an exhibition catalogue -it was more a combined tourist guide and a workbook or resource book. The style was that of a French "cahier", to indicate that even the visitor had to do some work at this exhibition. There were public lectures, the first a re-enactment of a lecture on the subject of the telephone given by Maxwell in Cambridge in 1878. There were workshops for student and school parties and for any visitors who signed up; these included sessions with the experiments. There was, finally, a lecture course for our own students in the Department of History and Philosophy of Science.

Our initiative provoked critical attention as well as interest and discussion from fellow museum professionals and historians of science. Certainly the exhibition served to raise the Museum's profile as an institution of commentary and criticism in an increasingly unchallenging science museum environment. Our visitors, however, it must be admitted, often did not get the rather subtle point at the centre of the whole project. But we did discover that if someone spent a few minutes outlining the structure and the significance of the two levels before they entered the special exhibition, they responded very positively, saw what we were trying to do and felt obliged by that simple human contact to give the idea a chance. This was one reason for our increasing such contact in the second exhibition.

The New Age

The second of our pair of exhibitions, "1900: The New Age", also experimented with presenting different views of a subject in two galleries. Here visitors were taken back to 1900 and upstairs were presented, as observers, with a technological programme for the twentieth century; downstairs, in a reversal of roles, they were then the objects of observation in a complementary human programme.

"1900: The New Age" showed how the twentieth century was anticipated at its very beginning -a natural source of curiosity in our own *fin de siècle*. To present the prospect of the twentieth century in 1900, we chose one of the most spectacular and ambitious of the extraordinary series of Universal Exhibitions which followed from the Great Exhibition in London in 1851. This was the enormous *Exposition Universelle* in Paris, one of the largest and most extravagant the world has seen.

Visitors were transported to Paris in 1900 in the Museum's version of the time machine of H.G. Wells. His brief description of 1895 left us plenty of scope for imagination and we settled on rather a quaint and comfortable vehicle for time travel: the furnishings were those of a domestic interior of the time, with a console equipped with devices appropriate to the period. At the end of their journey visitors found themselves in the exhibition of 1900, though strangely contracted from the vast area of Paris it originally occupied.

In the upper gallery, we tried to recreate something of the excitement of the original, while focusing on two of the many pavilions —the Optical Palace and the Electricity Palace. Projected images of Paris "en fête" in 1900 showed that there was much to see beyond these pavilions, but here scientific instruments and optical entertainments were the focus of attention. There was film from the very beginnings of the cinema. There were X-ray and other radiation tubes. Telescopes, microscopes, spectroscopes and other instruments from the leading European makers competed for awards from the international jury. There was a selection of the enormous literature generated by the *Exposition* -from souvenir postcards and photographic albums to the vast 60-volume official report. The Electrical Palace presented the hardware of an astonishing new technology and left no doubt that electric lighting and electric power would revolutionise life in the coming century.

Everywhere upstairs we tried to simulate the atmosphere of the time -in sound as well as vision. Rich materials were used wherever possible. No fluorescent tubes were allowed anywhere in the Exhibition. The whole was lit by bulbs -not discretely placed but boldly and confidently displaying the vigour and brilliance of electricity.

From the excitement of the show upstairs visitors moved to quite a different experience in the lower gallery, to the "Salle Bertillon" of the Paris exhibition, named after the French anthropologist and criminologist Alphonse Bertillon. Perhaps the most obvious message upstairs was one of progress and improvement -confidence in expansion and advancement, generated by the potential of new technologies. Downstairs introduced the notion that a programme of improvement might apply also to people.

Upstairs visitors examined what we presented for their instruction and entertainment. Downstairs the view was reversed and we examined the visitors. Each person had been given a souvenir card -a record card for their personal profiles, a *portrait parlé* in the terminology of the time- and here they began to complete its different sections by going round a series of stations, where various measurements and records were noted. First a photograph was taken, followed by finger-prints and by various "anthropometric" measurements —stature and head dimensions. A contemporary weighing machine was used to record individual weight. Aspects of the individual's phrenology were recorded, as well as their eye colour and their performance on physiological and psychological tests of strength, reaction time and colour vision. Finally, to be true to the period, we had to

represent X-ray recording, but every visitor found the X-ray booth out of order on their visit -quite a few were visibly disappointed.

All these tests were current in 1900, the regime of testing was displayed in the 1900 *Exposition*, and extensive surveys of populations and groups were undertaken in the period and their results published. While almost all our visitors enjoyed this novel interactive gallery, most also sensed the more sinister aspects of the human programme; they were made aware that recognising inferior and criminal types in populations came to be associate with such recording, and that the identification of "degenerates" could and did lead to programmes for their management and suppression.

Our visitors dutifully handed in their cards, which were processed and then posted to them: photographs were applied, measurements recorded, phrenological and other tests decoded, and so on. To remain as true as we can to the surveys of the period, after the exhibition closes each participant will receive a statistical report on the entire population of visitors.

History and Public Understanding

Whatever responses are adopted in particular museum environments to the challenge of a more inclusive and historicized approach to past science, museums must remain institutions for criticism in the proper sense. We learn science in schools, colleges and universities and go to museums not just for reinforcement but for commentary. Whatever critical perspectives they adopt, exhibitions must therefore take up the challenge of being meta-presentations with respect to science. Our visitors deserve this facility, which they will not readily find elsewhere, and history of science provides one of the most interesting, appealing and profound resources for an enriched understanding —a "public understanding of science", to use the fashionable phrase—, which goes beyond a simplified, sanitized, trickle-down account of current or —more likely— recent scientific theory.

The most authoritative statement of the philosophy of the "public understanding" programme in relation to museums is perhaps found in the Science Museum's publication of 1992, *Museums and the Public Understanding of Science* (Durant, 1992). However there is little encouragement in this volume that the Whipple's recent approach fits easily with the aims and experience of others.

John Durant's introduction is an exception, because of his sensitivity to the dangers of presenting science as certain and unequivocal, and divorced from its social context, and because he points to the importance of portraying science in the making (Durant, 1992: 7-11).

Other papers are less accommodating to different sensibilities. Miles and Tout, for example, are very negatively disposed to the value of what they call "real objects" in science exhibition communication. They say that "... it is sometimes suggested that the use of real objects in exhibitions makes possible a unique understanding. There is apparently no evidence to support this proposition", and judge that "... the non-verbal language of real things is no more than museological conceit" (Miles and Tout, 1992). This assertion is possible only when coupled with a particular, and very narrowly focused, assumption about what constitutes the essence of science —of what is to be conveyed and understood— namely

its disembodied principles. The visitor questionnaire then measures the exhibition's achievement in this sense alone.

This attitude may derive from the special position science has constructed for itself in contemporary life, distinguished from other areas of human endeavour, one aspect of which is that its generation and use are not an essential part of what it is, and belonging outside, perhaps vaguely assigned to history or politics. Experience of these aspects does not contribute to understanding in a proper sense. Only on the basis of assumptions of that sort can Miles and Tout's assertion be made; in other museological areas it would simply be absurd. Imagine how one might react to the following claims. Looking at paintings contributes nothing to our understanding of Renaissance art. Looking at the Houses of Parliament does not enrich our understanding of Gothic revivalism. Seeing the Elgin Marbles does not enhance our appreciation of classical Greece. Visiting the Pyramids tells us nothing about ancient Egyptian civilization. Seeing a gable-end street painting in contemporary Belfast adds nothing to our sense of the historical imperatives of Irish conflict. It is not difficult to construct a *reductio ad absurdum* argument of this sort because the proposition is absurd in all contexts other than that where science is only an intellectual system of principles and rules.

In Patrick Sudbury's wide-ranging piece on techniques and approaches to museum education, he deals with some of the problems of hands-on demonstrations in science centres. "We have experienced", he says, "some weaknesses in the method because most experiments allow for some ambiguity which is inevitably picked up in the visitor's response. This kind of ambiguity can lead to visitor frustration and disappointment if there is no recourse to a demonstrator" (Sudbury, 1992). In "Empires of Physics", on the contrary, we used such ambiguity and frustration to show the visitor that experimental science is not a straightforward affair, and to hint at the work —technical, political, social, rhetorical— which must be performed to secure it. Sudbury's response is quite different; he invokes a social and material management in the Museum to head off doubt and conflict, paralleling the management originally employed in science. We have seen that he invokes the role of the demonstrator; he then says: "The ultimate solution to this kind of problem is better scientific input, better design, and a grouping of related experiments which give a consistent and sustainable result without losing the sense of discovery". A different solution would be to allow, indeed to celebrate, the fact that science has more in common with other creative endeavours than this approach admits; understanding is enriched, not compromised, by its human and social dimensions and might equip us better to value science properly and use it realistically.

There is a tendency for science museums to stand at the present and from there to offer views of the past, the present or the future. A museum which takes its collections seriously as historical resources must, on the other hand, allow what is recoverable from the past to refine our understanding of both the past and the present. In the museum world, it is perhaps only in the field of science museums that so obvious a point about historic collections needs to be made, but most science museums were established for science education, not for history of science (Butler, 1992). This is as true of the great historic collections —the Science Museum, the Conservatoire Nationale des Arts et Métiers, the Deutsches Museum— as it is of the modern science centres. Science museums traditionally

perform the role of public showcases for science, always accentuating the positive, and they risk becoming earnest and condescending facilities for self-improvement.

Yet the older foundations were collections-based. They emphasised the applications of science, embodied in actual instruments and machinery, or, where appropriate, in scale models. Familiarity with these was expected to improve the quality of everyday working life by spreading scientific utility. This at least meant that when immediate utility had passed, the museum had a collection of historic material. The shift in methodology –where specially created demonstrations have replaced the instruments and machines, and entertainment and understanding replaced utility– reflects a changed view of science –more secure now in its principles than in its assurance of universal utility. Faced with public doubt, concern and disenchantment, the science educator retreats to first principles, and the current interest in public understanding of science is at least partly motivated by the belief that if only the public *understood*, they might return to confidence.

Improving science education is important to us all, but a museum environment can encourage a richness and variety of perspectives. The lessons of history may be that all sorts of contingencies contribute to the development of science, that industrial and technological circumstances cannot be divorced from its creative context, that political and social structures and values have influenced its outcome, that it is formed in controversy as well as in consensus, and that the organization and conventions of the scientific community have helped to shape how it has emerged. Taking seriously the simple fact that science is formed in history implies a different meaning to "the public understanding of science", but one that might engender a more realistic attitude to the vagaries of the scientific enterprise.

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