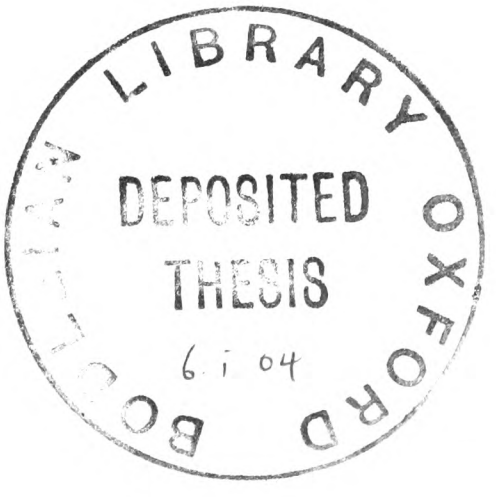
# Sites of Salvage: Science History Between the Wars

**Tom Scheinfeldt**

**St Edmund Hall, University of Oxford**




**Submitted in requirement for the degree of D.Phil.**

**Trinity Term 2003**

None of this exists without the love of my wife.

I would also like to thank my supervisor, Jim Bennett, for his unflagging encouragement, unselfish advice and unwitting inspiration. I am likewise indebted to Mandy Taylor of the Science Museum Library; Tony Simcock of the Museum of the History of Science Archive, Helen Weakly of the Wellcome Library; Pam Henson, Bill Cox and Tracy Robinson of the Smithsonian Institution Archives; Art Molella, Barney Finn, Jim Gardner and Deborah Warner of the Smithsonian Institution's National Museum of American History; Ron Brashear and Kirsten van der Veen of the Smithsonian Institution's Dibner Library; Roy Rosenzweig, Dan Cohen and Jim Sparrow of the Center for History and New Media at George Mason University; and to the good people of the Modern History Faculty, St Edmund Hall, The Bodleian and Radcliffe Science Libraries, Harvard University's Widener and Houghton Libraries, the British Library, the New York Public Library, the Library of Congress, and the Carnegie Institution of Washington. Last but not least, I want to thank my family for their constant support and encouragement. Not only an education in history, this thesis has been an education in human generosity and kindness.

For my father, Joe Scheinfeldt, who taught me history.

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# Short Abstract

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During the 1920s and 1930s, science history achieved widespread cultural success, featuring prominently in universities, museums and international expositions throughout Britain, America and much of the rest of the world. Maintaining that the broad advance of interwar science history cannot be sufficiently understood without reference to its broader cultural context, it is the main contention of this thesis that both the extent and diversity of interest in science history can be more productively examined in light of a common cultural memory — the memory of war. In the wake of the Great War science history stood as a site of salvage, allowing for both continuity with the past by proclaiming the cultural and historical universality of science and the possibility of a better future in its accepted positivity. Although like other aspects of the past science could be implicated in the failure of the pre-war order and in wartime atrocities, its history could still stand as a positive seat of cultural memory from which a post-war future might be built — a *lieu de mémoire* sympathetic to both reflection and reconciliation. In this the post-Great War rise of science history was essentially a post-Great War phenomenon. In the aftermath of war, science history emerged offering hope to a fractured and uncertain world.

# Long Abstract

**Sites of Salvage: Science History Between the Wars**

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**St Edmund Hall, University of Oxford**

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During the 1920s and 1930s, science history achieved widespread cultural success, featuring prominently in universities, museums and international expositions throughout Britain, America and the rest of the world. Perhaps because of its striking diversity, historians have not considered these developments of a piece. Existing histories of university developments have not often taken account of parallel developments in museums, and science museum historians have not often considered their institutions in relation to academic history of science. Moreover, too many authors have fallen victim to an original bias, judging past science history by current standards, according to what it may or may not have contributed to the present state of the field. Finally, existing accounts have failed to recognise science history in relation to contemporary cultural movements.

Maintaining that the broad advance of interwar science history cannot be sufficiently understood without reference to its broader cultural context, it is the main contention of this thesis that both the extent and diversity of interest in science history can be more productively examined in light of a common cultural memory — the memory of war. In the wake of the Great War science history stood as a site of salvage, allowing for both continuity with the past by proclaiming the cultural and historical universality of science and the possibility of a better future in its accepted positivity. Although like other aspects of the past science could be implicated in the

failure of the pre-war order and in wartime atrocities, its history could still stand as a positive seat of cultural memory from which a post-war future might be built — a *lieu de mémoire* sympathetic to both reflection and reconciliation. In this the post-Great War rise of science history was essentially a post-Great War phenomenon. In the aftermath of war, science history emerged offering hope to a fractured and uncertain world.

This thesis broadly pursues six aspects of the interwar history of Anglo-American science history. Chapter 1 explores the construction and communication of science history — the nature and status of science historical knowledge, the definition of research and disciplinary boundaries, the operation of publication and exhibition, and the institutional structures behind these — and how this reflected the post-war hopes and reconstructive intentions of science historians. The Belgian-American historian of science, George Sarton features prominently in these discussions. Undoubtedly, Sarton was the subject's greatest protagonist, a skilled and prolific practitioner and the primary force behind its academic institutionalisation. More than any other interwar historian of science, however, Sarton personally suffered the consequences of war, and the experience would mark his efforts. On the one hand, his exile and wartime career uncertainty would leave Sarton somewhat defensive of his and his discipline's security. On the other hand, the war provided Sarton with a sense of purpose. This was nothing less than the creation of new and better world through a unifying New Humanism and an encyclopaedic and ecumenical programme of science historical study. If this seems incredible, consider that Sarton was not alone in these sentiments. Among certain British museum practitioners, for instance, museums of science and industry were reconceived as peace museums, places where mankind's history of peaceful scientific progress could be displayed and furthered.

Likewise, in America, a movement was founded to establish a comprehensive and unifying network of science museums, among them the New York Museums of the Peaceful Arts. Finally in more popular contexts, such as the Wembley British Empire Exhibition of 1924-5, science history was presented literally as a history of bridge-building and as an means and reflection of imperial peace.

Chapter 2 turns to the practitioners of science history and the disciplinary identities and communities they constructed. Academic historians of science conceived of themselves as a new breed of humanised scientist. Here George Sarton, along with his long-time friend and colleague Charles Singer, believed that a strong identification of historians of science with scientists *per se* would facilitate their unifying intellectual and cultural aims. Museum practitioners, on the other hand, established a model for practitioner identity that valued scientific achievement and military or civil service in equal measures. The nascent American science museum movement, for example, chose civil engineer and Deutsches Museum founder Oskar von Miller as their model for practitioner identity and scientific service. Similar notions of scientific service were well articulated in the Science Museum, London, both in examples provided by senior staff and in policy documents written for their juniors. In all cases, practitioner identities conformed to and reinforced the post-war belief in science history as a means of social and cultural betterment.

At the same time, and across the field of interwar science history, practitioner identities were amplified and defined by the audiences they targeted. Indeed, while the university-based new scientist and the museum-based scientific servant were really quite similar, they were in fact dissimilar enough to implicate very different sorts of publics. These publics are the subject of Chapter 3. Populism was an important part of the rhetoric of science history in all its contexts, coinciding with its

ambitious and unifying reconstructive aims. On both sides of the Atlantic, museum galleries and programmes were designed for and directed at a large public. In the case of the Science Museum, moreover, it is clear that these populist ambitions were ultimately realised in greatly increased public attendance and attention. The situation was somewhat more complicated for university-based historians of science. While their rhetoric was similarly populist, their product patently was not. In fact, academic historians of science planned and founded exclusive and strictly scholarly institutions and outlets for their work. Perhaps paradoxically, however, both the inclusive rhetoric and the exclusive actions of academic historians of science seem to have been determined by the same effort to make science history more useful to post-war reconstruction. While Sarton and his colleagues understood the need to reach a wide audience to effect widespread change, they also believed that science history had to maintain the standards of pure science to effect its pure and noble aims. Ultimately they were unwilling to betray this purity even to realise their populist rhetoric.

This emphasis on purity did not exist in the museum. Indeed, the museum's populism was not entirely pure, and its efforts in the public interest were not entirely disinterested. Consider, for example, the Science Museum's educational aspirations. Throughout the interwar period, the Science Museum pursued a vigorous programme of education for students at all levels as a way of imparting subtle and not so subtle vocational and political lessons. Similar lessons were on hand at Wembley. Academic historians of science, by contrast, rejected the notion of formal classroom teaching of history of science. Instead they suggested both a looser and more central educational involvement of science history, whereby science history would not feature directly in the classroom, but would provide intellectual coherence and guiding principles to the rest of the curriculum. These debates over the appropriate

educational role of science history — whether inside or outside the classroom, as lower or higher education, conjoined with the sciences or the humanities, or with vocational and technical education — are the subject of Chapter 4.

Though it was suffused with history, the educational mission of science museums and exhibitions was directed first and foremost towards contemporary problems. Many of these concerned industry and the problems of industrial society. Chapter 5 will consider transactions between science history and industry, including attitudes towards pure and applied science, the status of material culture, ideas about the import of science history for industrial progress and role of industrial patronage in science historical practice. While museums on both sides of the Atlantic accepted a central role for industry in their operations and outlook, academic historians of science rejected industry and even the material culture of the museum and exhibition as impure and unworthy of science history's more noble aspirations. Indeed the divide became more pronounced as the interwar period wore on. The Science Museum, for example, became increasingly dominated by industrial concerns in middle and late 1930s, especially in a new programme of special exhibitions planned and installed by industry. Meanwhile the American science museum movement had from the outset been dominated by powerful and wealthy industrialists. Finally these differing attitudes toward industry were also reflective of differing visions of the post-war reconstructive power of science history. In fact the museum and exposition were always more concerned with maintaining industrial peace than with inspiring the grander sort of international and humanistic peace propounded by Sarton and his academic colleagues.

In the end a changing economic and political climate accentuated these divisions within the culture of interwar science history and revealed fault lines in the

sturdy cultural bedrock it alleged to provide. Chapter 6 traces these changes, placing the culture of science history among contemporary political negotiations — the appropriate response to economic crisis, the changing face of empire, the transition from liberal to social democracy, the values of nationalism and internationalism, the relationship of victor to vanquished, and ultimately the rise of European fascism and the return to war. Sadly, in the end, the once powerful strain of hopeful interest in science history could not be maintained amidst these serious political and social challenges. By the middle years of the 1930s, events on the ground made science history's earlier aspirations seem naïve and even silly. By the end of the decade, the hopes so many placed in science history were dashed.

# Introduction

In the wake of the Great War science history took wing. During the 1920s and 1930s, science history came to great institutional, disciplinary and popular success. In the academy, the museum and such popular contexts as wireless and World's Fairs, science history held a position of unprecedented — and as yet unmatched — cultural prominence.

In the academy, this took form in new courses, teaching positions, libraries, institutes, journals and societies devoted specifically to the history of science. On the continent, Aldo Mieli's multilingual journal, the *Archivio di Storia della Scienza* — later *Archeion* — was founded in 1919, consolidating an international public for the first *Comité International de l'Histoire des Sciences* in 1927, its successor the *Académie Internationale* in 1935 and the first International Congresses of the History of Science in 1929, 1931, 1934 and 1937.[1] In Britain, Charles Singer was installed in the Bodleian Library's new Section for the History of Science and by 1924 was teaching a graduate degree in the 'Principles, History and Method of Science' at University College, London.[2] In America, undergraduate and graduate courses in the

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[1] See Antonio di Meo, 'Aldo Mieli: La storia della scienza fra "programma nazionale" e "internazionalismo"', in Antonio Di Meo (ed.), *Cultura ebraica e cultura scientifica in Italia* (Roma, 1994); Christoph J. Scriba, 'The Beginnings of the International Congresses of the History of Science', in Fritz Kraft and Christoph J. Scriba (eds.), *XVIIIth International Congress of the History of Science, 1989: Final Report* (Stuttgart, 1993), pp. 3-10; Pierre Costabel and M. D. Grmek, *L'Academie internationale d'histoire des sciences: Cinquante ans, 1927-1977* (Paris, 1977).

[2] For Singer's activities in Oxford see J. Morrell, *Science at Oxford, 1914-1939: Transforming an Arts University* (Oxford, 1997), pp. 262-3. For Singer's involvement at UCL see Charles Singer, 'Courses on the History of Science at University College, London', *Isis*, 3 (1920), 419-20. See also George Sarton, 'The Teaching of the History of Science at the University of London', *Isis*, 6 (1924), 406-7; A. Wolf, 'The Teaching of the History of Science in the University of London', *Science Progress*, 26 (1931), 275-9; Angus Armitage, 'The Teaching of the History of Science in the University of London', *Lychnos*, (1936), 302-7; W. Smeaton, 'History of Science at University College, London, 1919-1947', *British Journal for the History of Science*, 30 (1997), 25-8 and A. K. Mayer, 'Roots of the History of Science in Britain, 1916-50' (University of Cambridge Ph.D. Thesis, 2003), Chapter 2.

history of science became commonplace at Harvard, Columbia, Berkeley and other major universities, while the world's first international History of Science Society was founded in 1924 in association with George Sarton's newly re-launched journal, *Isis*.[3]

The story of this institutionalisation and increasing discipline in the interwar period is a familiar one in the small corpus that constitutes the history of the history of science; it is the story told by both of our discipline's most prominent and dedicated historians, Arnold Thackray and Louis Pyenson.[4] Thackray has conceived of the

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[3] For university teaching in the United States see for instance, Frederick E. Brasch, 'The Teaching of the History of Science: Its Present Status in Our Universities, Colleges and Technical Schools', *Science*, 42 (1915), 746-60; 'The David Eugene Smith Gift of Historical-Mathematical Instruments to Columbia University', *Science*, 83 (1936), 79; George Sarton, 'The University of California, History of Science', *Isis*, 20 (1933), 6-14; George Sarton, 'Notice on the Teaching of History of Science at Harvard', *Isis*, 8 (1926), 159; George Sarton, 'Harvard University, History of Science', *Isis*, 26 (1936), 154; George Sarton, 'Harvard University, History of Science', *Isis*, 28 (1938), 95-6; Joy Harvey, 'History of Science, History and Science, and Natural Sciences: Undergraduate Teaching of the History of Science at Harvard, 1938-1970', in Margaret W. Rossiter (ed.), *Catching Up with the Vision: Essays on the Occasion of the 75th Anniversary of the Founding of the History of Science Society* (Chicago, 1999), pp. S270-94; I. B. Cohen, 'A Harvard Education', *Isis*, 72 (1984), 13-21. For *Isis* and the History of Science Society see for instance, George Sarton, 'Avant-propos', *Isis*, 2 (1919), 313-4; George Sarton, 'Early Volumes of Isis', *Isis*, 9 (1927), 117-8; George Sarton, 'The History of Science Society and its Relationship with Isis', *Isis*, 16 (1931), 125-6; Dorothy Stimson, 'Dr. Sarton and the History of Science Society', *Isis*, 48 (1957), 283-4; Harry Woolf, '*Isis*: 1913-1963', *Isis*, 54 (1963), 5; Robert Fox, 'Sartonian Values in a Changing World: The Case of Isis', in Marco Beretta, Claudio Pogliano and Pietro Redondi (eds.), *Journals and History of Science* (Florence, 1998), pp. 109-19; I. B. Cohen, 'The *Isis* Crisis and the Coming of Age of the History of Science Society', in Margaret W. Rossiter (ed.), *Catching Up with the Vision: Essays on the Occasion of the 75th Anniversary of the Founding of the History of Science Society* (Chicago, 1999), pp. S28-42; Michael M. Sokal, 'The History of Science Society, 1970-1999: From Subscription Agency to Professional Society', in Margaret W. Rossiter (ed.), *Catching Up with the Vision: Essays on the Occasion of the 75th Anniversary of the Founding of the History of Science Society* (Chicago, 1999), pp. 135-81.

[4] This kind of institutional historiography often favour among most historians of the history of science and dominates the occasional retrospective issues of such journals as *Isis* and *the British Journal for the History of Science*. See Walter Artelt, *Wege und Ziete: Ruckblicke auf ein vierteljahrhundert der deutschen Gesellschaft fur Geschichte der Medizin, Naturwissenschaften und Technik, 1930-1955* (Wiesbaden, 1961); Frans Verdoorn, 'History of Science Institutions and Their Universities', *Janus*, 58 (1971), 278-88; Pierre Costabel and M. D. Grmek, *L'Academie internationale d'histoire des sciences: Cinquante ans, 1927-1977* (Paris, 1977); Rolf Winau, *Deutsche Gesellschaft fur Geschichte der Medizin, Naturwissenschaft und Technik, 1901-1976* (Wiesbaden, 1978); Tore Frangsmyr (ed.), *History of Science in Sweden: The Growth of a Discipline, 1932-1982, Uppsala Studies in History of Science 2* (Stockholm, 1984); T. S. Kuhn, 'Professionalization Recollected in Tranquility', *Isis*, 72 (1984), 29-32; Tore Frangsmyr, 'History of Science in Scandinavia', *Archives Internationale des Histoire des Sciences*, 35 (1985), 400-7; Frederick Gregory, 'The Historical Investigation of Science in North America', *Zeitschrift fur Allgemeine Wissenschaftstheorie*, 16 (1985), 151-66; Juan Jose Saldana, 'History of Science in Latin America', *History of Science in America: News and Views*, 4 (1987), 1-4; H. A. M. Snelders, 'History of Science in the Netherlands', *British Journal for the History of Science*,

interwar period as stage in the discipline's 'pre-history'.[5] By this account, the history of science in the 1920s and 1930s achieved a 'new equilibrium', which marked the discipline's transition from a 'recognisable activity' to its 'partial institutionalisation without academic establishment'.[6] This dubious success was achieved through the strenuous efforts of popularisers and propagandists like Singer, Mieli, and especially Sarton, who provided the history of science with an 'institutional identity' if not a 'cognitive identity'.[7]

Pyenson similarly focuses on the disciplinary history of academic history of science, although he offers a somewhat more nuanced account of these developments. Here Pyenson shows how history of science in this period coalesced around the positivist intellectual challenge of defining Western civilisation and the 'good' of science.[8] In other work Pyenson demonstrates the importance of such practices as

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20 (1987), 353-8; T. S. Kuhn, 'The Histories of Science: Diverse Worlds for Diverse Audiences', *Organon*, 22 (1988), 9-16; Trevor H. Levere, 'The History of Science of Canada', *British Journal for the History of Science*, 21 (1988), 419-25; Vincenzo Cappelletti, 'History of Science and Philosophy: The Italian Experience', *Impact of Science on Society*, 40 (1990), 237-44; Alberto Elena and Javier Ordonez, 'History of Science in Spain: A Preliminary Survey', *British Journal for the History of Science*, 23 (1990), 187-96; Christoph J. Scriba, 'The Beginnings of the International Congresses of the History of Science', in Fritz Kraft and Christoph J. Scriba (eds.), *XVIIIth International Congress of the History of Science, 1989: Final Report* (Stuttgart, 1993), pp. 3-10; Arnold Thackray (ed.), *Sarton, Science and History, A Special Issue of Isis, Volume 75* (Chicago, 1984); John Brooke (ed.), *A Special Issue of The British Journal for the History of Science, Volume 30, Part 1, No. 104* (Cambridge, 1997); Margaret W. Rossiter (ed.), *Catching Up with the Vision: Essays on the Occasion of the 75th Anniversary of the Founding of the History of Science Society, A Supplement to Isis Volume 90* (Chicago, 1999).

[5] Arnold Thackray, 'Five Phases of Prehistory, Depicted from Diverse Sources', *Isis*, 66 (1975), 107-14; Arnold Thackray, 'The Pre-History of an Academic Discipline: The Study of the History of Science in the United States, 1891-1941', in Everett Mendelsohn (ed.), *Transformation and Tradition in the Sciences: Essays in Honor of I. Bernard Cohen* (Cambridge, 1984), pp. 395-420.

[6] Arnold Thackray, 'The Pre-History of an Academic Discipline: The Study of the History of Science in the United States, 1891-1941', in Everett Mendelsohn (ed.), *Transformation and Tradition in the Sciences: Essays in Honor of I. Bernard Cohen* (Cambridge, 1984), pp. 399, 405-14.

[7] See Arnold Thackray and Robert K. Merton, 'On Discipline Building: The Paradoxes of George Sarton', *Isis*, 63 (1972), 473-95.

[8] Lewis Pyenson, 'Prerogatives of European Intellect: Historians of Science and the Promotion of Western Civilization', *History of Science*, 31 (1993), 289-315; Lewis Pyenson, 'What is the Good of History of Science?' *History of Science*, 27 (1989), 353-89. See also Nathan Reingold, 'Uniformity as Hidden Diversity: History of Science in the United States, 1920-1940', *British Journal for the History of Science*, 19 (1985), 243-62.

inventory and bibliography, which allowed Sarton and others to 'control' secondary literature, 'organise ... a disciplinary universe' and advance personal career goals.[9]

However interesting and relevant this story of disciplinary development, it is not the story I aim to tell; or more precisely, I will only tell it insofar as it pertains to what I believe is a more fundamental and more inclusive narrative. To my mind, these disciplinary accounts leave much to be desired. First, subtle ontogenic distinctions such as Thackray's 'pre-history', 'partial institutionalisation' and 'academic establishment' seem an altogether too shaky and arbitrary — not to mention, whiggish — foundation upon which to base a history, especially a history of what will prove to be so widespread a cultural force as science history. Second, both Thackray and Pyenson focus entirely on developments within the academy without taking account of parallel developments in other settings, for example in science museums or wireless programming. Finally, by focusing only on the disciplinary evolution of university history of science, both authors fail to recognise these academic developments as part of wider cultural movements. To use a timeworn distinction, these authors offer more or less straightforward 'internalist' accounts of science history's development, at the expense of a potentially more thorough and more rounded 'externalist' account. In this I will depart from my predecessors, choosing a narrative that places the story of disciplinary development in a wider context of contemporary cultural interest in science history.[10]

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[9] Lewis Pyenson, 'Inventory as a Route to Understanding: Sarton, Neugebauer, and Sources', *History of Science*, 33 (1995), 253-82.

[10] It is for this reason that I use the term 'science history' rather than 'history of science'. Throughout, when referring to historical interest in science in its varied forms, I will use the term 'science history'. I reserve the more specific term, 'history of science' for reference to science history as practised and organised as an academic and university discipline.

Indeed, if academic history of science saw a tremendous growth and consolidation in the interwar period, then science history in the museum experienced a revolution. During this period very nearly every major science museum in the world was either founded or underwent unprecedented expansion. The long list includes Florence's Museo di Storia della Scienza, founded in 1924; Oxford's Museum of the History of Science, installed in 1924 and officially founded in 1935; the Deutsches Museum, founded in 1903 but securing its grand lodgings only in 1925; the Science Museum, London, which like its German counterpart had been founded some years before, but only acquired sufficient lodgings in 1928; and the Museum of Science and Industry in Chicago, which in 1933 opened as the first major American science museum. To this list might be added other important developments in the history of science museums: the abortive foundation from 1922 of the Smithsonian's National Museum of Engineering and Industry in Washington; the opening in 1936 of the now-defunct New York Museum of Science and Industry (Museums of the Peaceful Arts); and in 1936 the launch of the 'Exhibition of Historic Scientific Apparatus', an event which marks the beginnings of history of science at Cambridge and the first step towards the foundation of that university's Whipple Museum of the History of Science.[11]

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[11] Most of these developments are considered in greater detail in what follows. Moreover, this growing list of foundations, openings and re-openings is easily expanded to include the opening of Technisches Museum in Vienna in mid-1918; the centenary celebrations and opening of a new Technology Wing of the Franklin Institute of Philadelphia in 1924; the re-opening of the Wellcome Historical Medical Museum in 1926; and the opening of what would become the Museum Boerhaave in Leiden in 1931, among others. See, for example, Stella V. F. Butler, *Science and Technology Museums, Leicester Museum Studies* (Leicester, 1992); Brigitte Schroeder-Gudehus, Eckhard Bolenz and Anne Rasmussen (eds.), *Industrial Society and Its Museums: Social Aspirations and Cultural Politics, 1890-1990* (Reading, 1993); Giovanna Baroncelli and Massimo Bucciantini, 'Per una storia della istitutzoni storico-scientifiches in Italia: L'Istituto e Museo di Storia della Scienza di Firenze', *Nuncius*, 5 (1990), 5-52; A. V. Simcock, *Robert T. Gunther and the Old Ashmolean* (Oxford, 1985); Otto Mayr, *The Deutsches Museum: German Museum of Masterworks of Science and Technology, Munich* (London, 1990); D. Follett, *The Rise of the Science Museum under Henry Lyons* (London, 1978); Jay Pridmore, *Inventive genius: The History of the Museum of Science and Industry, Chicago* (Chicago, 1996);

Similarly, science history in the popular sphere took on a new importance. Beginning in the 1920s, displays of science's history took place alongside more familiar displays of current innovations at World's Fairs and expositions. For instance, at London's British Empire Exhibition, the Royal Society's treatment of the 'Phases of Modern Science' took pride of place in the Pavilion of His Majesty's Government, and Chicago's 1933-4 World's Fair was entirely retrospective in its theme — 'A Century of Progress'.[12]

This litany and its significance have not been assimilated by existing histories of the history of science. Despite their striking coincidence and the similarity of their subject matter, historians of the history of science have for the most part considered these other institutions — even those with clear university ties like the Oxford and Cambridge museums — outside of their domain. Rather the history of science museums in particular has most often been taken up by practising museum professionals, who have produced the same kind of internal, institutional narratives of

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Arthur Molella, 'The Museum That Might Have Been: The Smithsonian's National Museum of Engineering and Industry', *Technology and Culture*, 32 (1991), 237-63; Philip G. Riley, *The Museum of the Peaceful Arts* (New York, 1977); J. A. Bennett, 'A Museum of the History of Science', *Cambridge Review*, 114 (1993), 18-21; Hannelore Burger, *Maschinenzeit, Zeitmaschine: Technisches Museum Wien, 1918-1988* (Vienna, 1991); Stephanie A. Morris, *The Franklin Institute and the Making of Industrial America* (Bethesda, MD, 1987); Wellcome Institute for the History of Medicine, *The Wellcome Institute: A Brief Historical Sketch* (London, 1982); Christa Habrich, 'Wunderkammer der Wissenschaften: Das Neue Museum Boerhaave', *Tractrix*, 4 (1992), 49-58.

[12] For Wembley see, for example, Royal Society of London, *Phases of Modern Science: Published in Connexion With the Science Exhibit Arranged by a Committee of the Royal Society in the Pavilion of His Majesty's Government at the British Empire Exhibition, 1925*, 2nd edn (London, 1925); Royal Society of London, *Handbook to the Exhibition of Pure Science* (London, 1924). For Chicago see, among other archives in Chicago and Washington, Smithsonian Institution Archives RU 70, 'Exposition Records'. See also Donald R. Knight and Alan D. Sabey, *The Lion Roars at Wembley: British Empire Exhibition, 60th Anniversary 1924-1925* (New Barnet, 1984); Alan Q. Morton, 'The Electron Made Public: The Exhibition of Pure Science in the British Empire Exhibition, 1924-5', in Bernard Finn, Robert Bud and Helmuth Trischler (eds.), *Exposing Electronics, Artefacts: Studies in the History of Science and Technology* (Amsterdam, 2000); Robert W. Rydell, 'The Fan Dance of Science: American World's Fairs in the Great Depression', *Isis*, 76 (1985); Robert W. Rydell, *World of Fairs: the Century-of-Progress Expositions* (Chicago, 1993).

science museum history that practicing historians of science have produced for the history of the history of science.[13]

Written mostly by interested professionals, existing histories of the science museum centre on origins and pursue institutions separately. Most often these practitioners' histories take the form of short papers offered as part of a special journal issue or as part of an anniversary or other celebration. Pressed for time with day-to-day duties and more topical research, museum professionals in most cases provide histories that are straightforward, chronological and highly anecdotal. If longer accounts appear, they are often the pastime of retired practitioners. Moreover, this institutional focus almost always binds the practitioner-author to an ontogenic narrative. When considering the history of his own institution, the practitioner's main concerns inevitably lie more with the state of his modern institution than with its historic situation. The practitioner frames his museum's past in terms of its more familiar present. The things that seem important are the things the practitioner still sees around him in his everyday work. In most cases, comparative or synthetic comments are confined to the introduction, conclusion or footnotes and are often linked with commentary on the present state or future of the practitioner's home museum. Even in broader surveys of science museum history this focus remains. Various institutions are still considered separately and are simply tendered in turn — most often in the order of their foundation, and with little to tie them together.

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[13] As Ludmilla Jordanova has recently pointed out, the neglect of museums and other types of public history as constituent of historical practice is common among academic historians of all kinds. See Ludmilla Jordanova, *History in Practice* (London, 2000). Chapter 6, 'Public History' and the 'Postscript' in particular provides convincing arguments for the inclusion of museums, exhibitions and other media in discussions about the nature and history of historical practise. For science museums in particular, see R. G. W. Anderson, 'The Need for a History of Science Museums', *Studies in History and Philosophy of Science*, 30 (1999), 493-9.

In the case of the Science Museum, for instance, each of the three most thoroughgoing histories were produced by Science Museum employees or former employees to mark anniversaries. Frank Greenaway's 1951 history was published to coincide with one hundredth anniversary of the Great Exhibition at Hyde Park, an institution from which the Science Museum descended. Six years later, Director F. Sherwood Taylor commissioned another substantial work to celebrate the one hundredth anniversary of the opening of the South Kensington Museum, another Science Museum ancestor. A more recent title — and one still on sale in the Museum Shop — was written by David Follett, a retired Director of the Museum 'to mark the fiftieth anniversary of the opening of the present lodgings of the Museum'.[14]

Each of these histories locates the origins of the Science Museum in the Great Exhibition of 1851. Each traces a clear descent from the Great Exhibition through the foundation of the South Kensington Museum in 1857, the opening of the exhibition of the Special Loan Collection of Scientific Apparatus in 1876, the report of the Departmental Committee chaired by Sir Hugh Bell, and so on. Greenaway, for example, entitles the first section of his account, 'The Great Exhibition of 1851 and its sequels' — the latest sequel being, of course, the Science Museum.[15] Those shorter histories that are not anniversarial take the same tack. The first section of Stella Butler's chapter on the Science Museum is similarly entitled 'The Great Exhibition of 1851' and begins with the phrase: 'The Science Museum owes its origins to the great industrial exhibitions of the mid nineteenth century ...'[16] An even

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[14] F. Greenaway, *A Short History of the Science Museum* (London, 1951); T. C. S. Morrison-Scott, *The Science Museum: The First Hundred Years* (London, 1957); D. Follett, *The Rise of the Science Museum under Henry Lyons* (London, 1978).

[15] F. Greenaway, *A Short History of the Science Museum* (London, 1951), p. 3.

[16] Stella V. F. Butler, *Science and Technology Museums*, *Leicester Museum Studies* (Leicester, 1992), p. 15.

more recent history of the Science Museum makes a stronger ontogenic and historiographical statement, arguing that the 'starting point to any account of the development of the Science Museum has inevitably to be the Great Exhibition of Industry of All Nations in 1851.'[17]

The importance of the Great Exhibition of 1851 to the history of the Science Museum is beyond question, and these historians are not wrong to argue it. Indeed most modern museums of science and industry owe something to the culture of the great nineteenth century industrial exhibitions. Recent work in both the history of museums and in the history of nineteenth century exhibition culture bears this out.[18] Yet while many of the structures of Victorian exhibition culture linger on in the Science Museum and its cousins, nevertheless an ontogeny of clear and direct descent from this culture should not be uncritically accepted. Although well-researched and well-written, each of the histories discussed above to some extent subjugates the past to the present. In the case of the anniversarial histories the reasons are intrinsic to the endeavour. While the cause for celebration is ostensibly an historical event, the event has only assumed its joyous meaning because of the continued and present success of the institution. It is always difficult for the anniversarial history to be anything more than clear and simple account of direct lineage, because it is the unbroken-ness of the

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[17] Derek Robinson, 'Exhibitions', in *Clio in Museum Garb: The National Museum of American History, the Science Museum and the History of Technology*, *Science Museum Papers in the History of Technology 4* (London, 1997), pp. 11-20. Another recent example can be found in Lance Day, 'A Short History of the Science Museum', *Science Museum Review*, (1987), 14-8.

[18] For recent work in the history of industrial exhibitions, see J. A. Bennett, *1900: The New Age* (Cambridge, 1994); R. Brain, *Going to the Fair: Readings in the Culture of Nineteenth-Century Exhibitions* (Cambridge, 1993); Paul Greenhalagh, *Ephemeral Vistas: The Expositions Universelles, Great Exhibitions and World's Fairs, 1851-1939* (Manchester, 1988); J. Allwood, *The Great Exhibitions* (London, 1977). For the relationship between science museums in general and the great industrial exhibitions, see Eugene Ferguson, S., 'Technical Museums and Industrial Exhibitions', *Technology and Culture*, 9 (1965), 75-85; Bernard Finn, 'The Science Museum Today', *Technology and Culture*, 6 (1965), 74-82; Edward P. Alexander, *Museums in Motion: An Introduction to the History and Functions of Museums* (London, 1979), Chapter 4; Kenneth Hudson, *Museums of Influence* (Cambridge, 1987), Chapter 5; Bernard Finn, 'The Museum of Science and Technology', in Michael S. Shapiro (ed.), *The Museum: A Reference Guide* (New York, 1990), pp. 59-83.

lineage that is cause for celebration. Those shorter histories that are not anniversarial but remain focused on origin are also fundamentally unhistorical; the search for origins inevitably leads to a progressive chronological account that always ends at present. Like anniversarial accounts, these histories assume an institutional periodisation in which the most important dates are the origin and now. All intervening events are defined in relation to these end points and valued according to their perceived contribution to institutional development. In turn, development must be identified as directional movement between the predetermined end points, that is, as progress towards the present state of affairs. Finally, many of the existing histories that don't search for origins and deal instead with intervening periods, still highlight those events such as building improvements and provision increases that have clearly contributed to current successes. In the historiography of the Science Museum this tendency is especially strong, and the dominant theme of most histories remains the century-long administrative struggle to secure increased lodgings.[19]

Fortunately, the historiographical situation is quickly and profoundly improving. With regard to academic history of science, much of the credit goes to Anna-Katherine Mayer. In her recent doctoral thesis, Mayer provides a wide-ranging and richly contextualised analysis of history of science in early twentieth century Britain.[20] Drawing on new research and her previously published work, Mayer shows that British science history in the period straddled several contemporary academic and

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[19] See Dave Rooney, *The Events Which Led to the Building of the Science Museum Centre Block, 1912-1951*, *Science Museum Papers in the History of Technology 7* (London, 1998); D. Follett, *The Rise of the Science Museum under Henry Lyons* (London, 1978). Particularly relevant are Follett's Chapter VII, 'The Building of the East Block' and Chapter VIII, 'The Pressure for the Centre Block'.

[20] A. K. Mayer, 'Roots of the History of Science in Britain, 1916-50' (University of Cambridge Ph.D. Thesis, 2003).

popular currents — most important among them a new 'educationism'.[21] Similarly, historians of interwar science museums have done a better job relating the histories of individual museums to larger movements within science museum culture, the culture of science history and the interwar world at large. Some of this work has been done by generalists. Tony Bennett, for example, has tried to conceptualise museum history as part of a broader history of 'showing and telling', conceptualising the public museum along with the fair, the amusement park and the department store as part of a nineteenth century 'exhibitionary complex'.[22] Steven Conn has linked the rise of museum culture in late nineteenth century and early twentieth century America to the parallel rise of object-based epistemologies in American intellectual life.[23] With particular regard to the Science Museum in London, Xerxes Mazda has traced the changing ways in which history has played out in the Science Museum's galleries, and Robert Bud has traced the Science Museum's role in the disciplinary development of British history of science.[24] Likewise, for science museums in the United States — whose earlier historiography suffered from the same problems — Russell Douglass Jones has provided a rich narrative of the ways in which American

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[21] A. K. Mayer, 'Moralizing Science: The Uses of Science's Past in National Education in the 1920s', *British Journal for the History of Science*, 30 (1997); A. K. Mayer, 'Setting Up a Discipline: Conflicting Agendas of the Cambridge History of Science Committee, 1936-1950', *Studies in the History and Philosophy of Science*, 31A (2000); A. K. Mayer, '"A Combative Sense of Duty": Englishness and the Scientists', in Christopher Lawrence and A. K. Mayer (eds.), *Regenerating England: Science, Medicine and Culture in Inter-war Britain*, *Wellcome Institute Series in the History of Medicine* (Amsterdam, 2000); A. K. Mayer, 'Fatal Mutilations: Educationism and the British Background to the 1931 International Congress for the History of Science and Technology', *History of Science*, 40 (2002).

[22] Tony Bennett, *The Birth of the Museum: History, Theory, Politics*, *Culture: Policies and Politics* (London, 1995). Bennett builds on earlier work by Eilean Hooper-Greenhill and others. See Eilean Hooper-Greenhill, *Museums and the Shaping of Knowledge* (London, 1992); Peter Vergo, *The New Museology* (London, 1989).

[23] Steven Conn, *Museums and American Intellectual Life, 1876-1926* (Chicago, 1998). See also Susan M. Pearce, *Objects of Knowledge*, *New Research in Museum Studies 7* (London, 1990); Gaynor Kavanagh, *Museum Languages: Objects and Texts* (Leicester, 1991).

[24] Xerxes Mazda, *The Changing Role of History in the Policy and Collections of the Science Museum: 1857-1973*, *Science Museum Papers in the History of Science 3* (London, 1996); Robert Bud, 'History of Science and the Science Museum', *British Journal for the History of Science*, 30 (1997), pp. 47-50.

industrial museums of the early twentieth century promoted a deterministic history of technology as a means of maintaining industrial and social order.[25] Finally, even science history as displayed in the exhibition is beginning to receive some attention, for instance in Alan Morton's work on the role of notions of 'purity' in the Royal Society's exhibits at Wembley.[26]

This thesis is an attempt to take these efforts further. Like Mayer, I will try to tie interwar developments in academic history of science to parallel developments in other social and cultural contexts. Like Mazda and Jones, I will try to tie the institutional histories of science museums to the parallel history of academic history of science. And yet, the sum of these histories is greater than the parts. While recent efforts have attempted to explain the history of interest in science's past in terms of contemporary cultural realities, I will try to explain a culture of interest in science's past. While others have attempted to write a cultural history of science history, I will attempt to write a history of interwar science history culture.

It is a subtle distinction, but an important one. The interwar period cradled a vast and diverse culture of science history, which despite its vastness and diversity, can be treated as a discrete unit of analysis, albeit one with clear outliers as well as clear trends. I like to think of it as a richly woven piece of fabric, maybe like a

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[25] Russell Douglass Jones, 'Engineering History: The Foundation of Industrial Museums in the United States' (Case Western Reserve University Ph.D. Dissertation, 2001). Jones draws on earlier work by Art Molella and Pam Henson. See Arthur Molella, 'The Museum That Might Have Been: The Smithsonian's National Museum of Engineering and Industry', *Technology and Culture*, 32 (1991), pp. 237-63; Pamela M. Henson, '"Objects of Curious Research": The History of Science and Technology at the Smithsonian', in Margaret W. Rossiter (ed.), *Catching Up with the Vision: Essays on the Occasion of the 75th Anniversary of the Founding of the History of Science Society* (Chicago, 1999), pp. S249-70. For examples of the earlier, original or developmental historiography with which Jones is contrasted, see Paul Henry Oehser, *The Smithsonian Institution, Praeger Library of U.S. Government Departments and Agencies 21* (New York, 1970); Philip G. Riley, *The Museum of the Peaceful Arts* (New York, 1977).

[26] Alan Q. Morton, 'The Electron Made Public: The Exhibition of Pure Science in the British Empire Exhibition, 1924-5', in Bernard Finn, Robert Bud and Helmuth Trischler (eds.), *Exposing Electronics, Artefacts: Studies in the History of Science and Technology* (Amsterdam, 2000).

Persian carpet, which although it has many and varied patterns, colours and textures, nevertheless certain threads run across and through these patterns and colours, and somehow it all holds together. Tracing even one of these structural threads across the carpet, we see on all sides the colours and textures of patterns that had once seemed unconnected, but are in fact held together by our tracing thread and many others like it. And while it may be difficult to describe the carpet in its entirety, it is not difficult to describe our own thread and to trace it across the carpet.

It will be the main contention of this thesis that both the extent and diversity of interest in science history can be more productively examined in light of a common cultural memory — the memory of war. By following the thread of post-war memory across the Persian carpet of interwar science history, it will be possible to move beyond simple institutional, developmental and even national narratives, to glimpse a culture of interwar science history in its colour, texture and variety, and perhaps to better isolate its uncommon prominence in the broader interwar culture. Tracing this thread will show that in the wake of the Great War, science history stood as a site of salvage, allowing for both continuity with the past by proclaiming the cultural and historical universality of science and the possibility of a better future in its accepted positivity. Although like other aspects of the past science could be implicated in the failure of the pre-war order and in wartime atrocities, its history could still stand as a positive seat of cultural memory from which a post-war future might be built — a *lieu de mémoire* sympathetic to both reflection and reconciliation. In this the post-Great War rise of science history was essentially a post-Great War phenomenon. In the aftermath of war, science history emerged offering hope to a fractured and uncertain world.

In every case, the thesis will look as much to rhetoric — to science history as envisioned by its practitioners and publics — as it will to actualities. Ultimately, in an effort to understand science history as it pervaded the cultural discourse, the thesis must be less concerned with successes and failures and more concerned with hopes and visions. It is also for this reason that I must ask my readers' patience with certain long quotations. In most cases, these heartfelt hopes and visions are best expressed by the actors themselves. Moreover, the thesis will focus in large part on the differences that existed between the contexts of science history. The examination of controversy and divergence will highlight the variety of ways in which science history was used and — perhaps more importantly — seen as useful. Finally, by confronting the range of difference, the thesis will seek out those commonalities and shared cultural concerns through which science history may be perceived in its entirety. Here the thesis will concentrate on one such commonality as a framework for understanding — the memory of war. A wide-ranging record of the workings and manifestations of this memory as articulated in varied British and American interest in science history will be its goal.

# Prologue: George Sarton's Preoccupation: *War & Civilization*

No discussion of interwar science history can make short work of George Sarton. Undoubtedly, Sarton was the subject's greatest protagonist, a skilled and prolific practitioner and the primary force behind its academic institutionalisation. Just as certainly, any discussion of the operation of post-Great War memory in the culture of science history must pay special attention to Sarton.

George Alfred Léon Sarton was born in Ghent in 1884, the only child of Alfred Sarton, Engineer-in-Chief of the Belgian State Railroads. George's mother had died in his infancy, and George's childhood was one of alternating loneliness and excitement: the loneliness of an only, motherless child brought up by servants and attendants, and the excitement of living in a household of lavish dinner parties, a famous wine cellar, visiting dignitaries, and all that entailed. Though Alfred Sarton was a vehement anti-cleric and sometimes freemason, George received a Catholic baptism, perhaps at the request of his staunchly Catholic grandmother. Though he decided at nine to quit the Church, Sarton would always remain something of a Catholic, enjoying the continuity of ritual, the music of the Mass and marking the confluence of saints' days with happenings in his calendar. Sarton was educated in the best schools of Ghent, but his real education took place at home, where from the earliest age Sarton was made to sit at the dinner table and listen in on the high conversation of Belgian notables. After toying with poetry and philosophy, Sarton settled on a scientific degree, studying chemistry, crystallography and mathematics with distinction at the University of Ghent. In 1911 he received his doctorate in

mathematics with a dissertation entitled, 'Les principes de la méchanique de Newton'. That same year, Sarton married Eleanor Mabel Elwes of London, whom he had met some years earlier while she was studying painting in Belgium. The two settled in Wondelgem, a village outside Ghent, in a house that Sarton bought with profits from the sale of his deceased father's wine cellar. It was here that May, their only child, was born; where Sarton penned the first pages of what would become his *Introduction to the History of Science*; and where the young doctor founded *Isis*, his '*Revue internationale consacrée à l'Histoire et l'Organisation de la Science*'.

Yet hardly sooner had they unpacked than war arrived in Wondelgem. More than any other interwar historian of science, Sarton personally suffered its consequences. In the very earliest days of the war — in August 1914 — Sarton was forced to suspend publication of *Isis*, and to abandon his library, bury his notes, and flee his home in occupied Belgium. From Belgium he travelled to England, where he survived by pawning heirlooms and boarding his family with English relatives. Arriving in the United States in 1915, he spent the best part of five years searching for steady work in the history of science. His new insecurity and refugee's poverty were hard adjustments after the bourgeois comforts he had enjoyed in pre-war Belgium. Only with war's end would Sarton secure a reliable income for his family and the makeshift position he would hold for most of his career. Lodged in Harvard's Widener Library as a special associate of the Carnegie Institution of Washington, Sarton would re-launch *Isis* and set about building a discipline.[27]

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[27] Though much needed, no thoroughgoing biography of Sarton has yet been written. The following will provide certain additional details, although it cannot provide a full account of Sarton's distinguished and complicated life and career. At present the best sources on Sarton are by his daughter, the poet and novelist May Sarton. See May Sarton, *I Knew a Phoenix: Sketches for an Autobiography* (London, 1959); May Sarton, 'An Informal Portrait of George Sarton', *Texas Quarterly*, Autumn 1962; May Sarton, 'Looking Back at My Father', in Carolyn Anthony (ed.), *Family Portraits: Remembrances by Twenty Distinguished Writers* (New York, 1989), pp. 189-203. See also I. B. Cohen,

The experience of war would mark his efforts. On one level, his exile and wartime career uncertainty would leave Sarton somewhat defensive of his and his discipline's security. But on another less self-serving and perhaps more fundamental level, the war also provided Sarton with a real, if somewhat starry-eyed, sense of purpose — 'the creation of new and better world'.[28] This purpose he laid out in the first post-war issue of *Isis*.

If throughout his life the history of science was George Sarton's main occupation, then his main *pre*-occupation — both in the sense that it absorbed much of his energy and also in that it substantially informed his primary product — was captured in the title of his first post-war contribution to *Isis*: a preface entitled 'War and Civilization'.[29]

In this piece, Sarton speaks first to the rising tide of disillusionment and despair that has followed in the wake of the Great War. In the past, he observes, the severity and immediacy of post-war famine and disease had always pre-empted any thoughtful reconsideration of wars just ended. Modern war, by contrast, is largely free of these epidemic consequences: it is, therefore, newly liable to afterthought and moral questioning. Thanks to the rise of battlefield medicine, public health,

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'George Sarton', *Isis*, 48 (1957), 286-300; Charles Singer and Dorothy Singer, 'George Sarton and the History of Science', *Isis*, 48 (1957), 306-10; Katherine Strelsky, 'Bibliography of the Publications of George Sarton', *Isis*, 48 (1957), 336-50; Arnold Thackray and Robert K. Merton, 'On Discipline Building: The Paradoxes of George Sarton', *Isis*, 63 (1972), 473-95; Arnold Thackray and Robert K. Merton, 'George Alfred Leon Sarton', *Dictionary of Scientific Biography*, XII (1975), 107-14; Lewis Pyenson, 'Inventory as a Route to Understanding: Sarton, Neugebauer, and Sources', *History of Science*, 33 (1995), 253-82.

[28] Christoph Meinel, 'Sarton, Science and the End of History', *Berichte zur Wissenschaftsgeschichte*, 8 (1985), 174. In introducing Sarton's moral convictions and the influence of his wartime experience, Meinel's short opinion piece anticipates some of what follows. However, while Meinel's purpose is to recommend these convictions to his colleagues, mine is more historical — to trace the workings of post-war memory in Sarton and in the culture of science history more generally.

[29] George Sarton, 'War and Civilization', *Isis*, 2 (1919), 315-21.

humanitarian aid and other technological and social developments, the aftermath of modern war is marked not by bodily plagues, but rather by plagues of conscience:

> In olden times, when War left our home ... it was not unusual that Famine and Pestilence stood grinning at the threshold. Most civilized peoples are now spared these ultimate terrors, however long and ferocious war may be, because of our technical progress ... These scourges were far more effective and dreadful than war itself, and the fear of them was so great that when they appeared at his doorsill, man could think only of them and of the curse of God, — he had no mind left to think of the evil of war, of its causes, of his own responsibility. Now that these terrors are spared to us or so mitigated that the fear of them is almost hushed, we can listen more deliberately to the voice of our conscience. On the morrow of a great war, whether victor or vanquished, any man who is not utterly devoid of imagination, rubs his eyes and looks around him, aghast.[30]

Yet even in this grim situation, Sarton saw little reason for lasting despair. He argued instead for hope — a hope rooted firmly in the positive history of science — and insisted that those who would despair had overlooked this history. Mankind's post-war anxiety was merely a circumstance proceeding from his newfound freedom from disease and itself a living proof of the positive history of science. The disillusioned had simply misunderstood the true thrust of history, laying undue emphasis on the 'obvious activities of the rulers and of the masses' and ignoring 'the really progressive but less evident achievements of mankind.' This was mankind's 'secret history' of purposeful and peaceful scientific progress, which had been wrongly subordinated to the accidental and temporary, though tumultuous, history of politics, business and warfare. Compared to this secret history of civilisation, Sarton said, the history of war was like a storm at sea: no matter how violent, the storm of war always left the ocean of civilisation unchanged, without 'in the least interrupt[ing] the life immeasurable which grows in its bosom.'[31] Accordingly, even

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[30] Ibid., 315.

[31] George Sarton, 'Secret History', *Scribner's Magazine*, 67 (1920), 187.

the Great War could be seen as little more than 'a temporary regression' in the progress of civilisation. Sarton wrote:

> The duties of war, however urgent and sacred, are only occasional duties. When our home is on fire, our sole duty is to fight and master the fire, we can think of nothing else; when our country is in danger, our chief duty is to fight for her, — but we are no more soldiers than firemen and the real purpose of our lives is different. The paramount duty of man is to produce a higher order of realities, these intellectual realities which he alone is able to produce: beauty, truth, justice, love. All other human activities are vicarious activities subordinated to this ultimate purpose.

While the catastrophe of the war would require 'a period of sober reckoning' and 'plain and inglorious duty' in order to 'readjust the social relations which were dislocated in the emergency', nevertheless these dislocations would in due course be repaired as man returned to his ultimate purpose.[32] It was thus 'from the summit of modern science' and 'with the whole of human experience at his disposal' — in other words, with his knowledge of science's secret history — that Sarton could face the post-war world 'with a heart full of hope.'[33]

Nor was it an idle hope. Though Sarton believed deeply in the positivist certainty of reconstruction, he believed equally in his own and science history's importance in the task. For Sarton the history of science didn't just passively reveal the hopeful progress of humankind; his positivism was considerably more complex. Rather the study of the history of science should actively promote such progress. Science history must play a practical role in the work of reconstruction. Here Sarton

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[32] George Sarton, 'War and Civilization', *Isis*, 2 (1919), 316.

[33] George Sarton, 'The Faith of a Humanist', *Isis*, 3 (1920), 5. For more on 'secret history', see also George Sarton, 'The New Humanism', *Isis*, 6 (1924), 14-6; George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), pp. 5-7, 38-43.

advanced what he repeatedly called 'The New Humanism'.[34] It was at once a philosophy and a formula for post-war reconstruction.

Not unlike Teilhard de Chardin and other francophone scientist-humanists of his generation, Sarton was always and ultimately concerned with unity, and the New Humanism held unity as both its logical underpinning and paramount aim.[35] As Thackray and Merton explain, Sarton was 'culturally oriented toward universal history and the progressivist philosophies that found their basis in positive science and their end in the imminent and universal brotherhood of man.'[36] Broadly Comtean in his positivism, Sarton saw science as a mirror of nature and believed that the unity of one implied the unity of the other. According to Sarton, scientific progress occurs as the unity of nature becomes reflected in increasingly unified scientific knowledge. Moreover, science can be the only truly progressive human activity, because science alone provides a revelation of natural unity that can be passed along and built upon by successive generations. While art, for instance, might also reveal the unity of nature in its beauty, it cannot be progressive for the secret of its revelation dies with its

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[34] Sarton did not use the phrase casually. It furnished, for instance, the climatic closing for 'War and Civilization' and supplied the title for some of Sarton's most enduring works. George Sarton, 'War and Civilization', *Isis*, 2 (1919), 319-20. Elsewhere Sarton's first paper entitled 'La nouvelle humanisme' appeared in 1918. An enlarged English version followed in 1924. A full-length book appeared in 1931. Effectively Sarton's manifesto, *The History of Science and the New Humanism* ran to several editions in the interwar period and after, the most recent appearing in 1988. See George Sarton, 'La nouvel humanisme', *Scientia*, 23 (1918), 161-75; George Sarton, 'The New Humanism', *Isis*, 6 (1924), 9-42; George Sarton, *The History of Science and the New Humanism* (New York, 1931); George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937); George Sarton, *The History of Science and the New Humanism*, Reprint, 2nd edn (Cambridge, MA, 1962); George Sarton, *The History of Science and the New Humanism*, Reprint, 2nd edn (New Brunswick, NJ, 1988). The closing words of 'War and Civilization' declare: 'Our readiness to acknowledge truth, beauty and charity wherever we may find them is the supreme virtue without which all the others avail nothing. *Isis*, so far as she is able, will teach this virtue; *Isis* will be the international organ of the *New Humanism*.'

[35] For an introduction to Teilhard's philosophy and in particular his ideas on unity, see Thomas M. King and James F. Salmon (eds.), *Teilhard and the Unity of Knowledge: The Georgetown University Centennial Symposium* (New York, 1983). Sarton and Teilhard were near contemporaries and counted many friends in common, most notably Julian Huxley. See Julian Huxley, 'Introduction', in *The Phenomenon of Man, by Teilhard de Chardin* (London, 1959).

[36] Arnold Thackray and Robert K. Merton, 'George Alfred Leon Sarton', *Dictionary of Scientific Biography*, XII (1975), 109.

author. In turn, because scientific knowledge is cumulative — that is, unified across time and space — when considered historically, the unity of science also reveals the unity of mankind. That is, peoples of different times and places are unified in their contributions to the collective scientific intelligence:

> *Unity of knowledge and unity of mankind are but two aspects of one great truth.* Their correlativeness has been proved a great many times. Each body of scientific doctrine might be compared to a chain or to a combination of chains holding together, but of which the links are very different and cannot be interchanged. As they must follow one another in a definite order, we may imagine that they are numbered. Now the student of the history of science soon realizes that these chains have not been built, as one might expect it, link after link, in the very order in which they finally appear. Time after time it has happened that particular links or series of links were made, independently, in many places very remote from each other. Sometimes links would be missing and many years would pass before it became possible to construct a whole chain, that is, to complete the theory. A good example of this may be found in the present development of physics: the theory of quanta offers adequate explanations of such facts as resonance potentials or the constitution of the hydrogen spectrum but is still insufficient to account for many other optical facts. Pursuing our illustration we may say that some of the links of that theory are still missing. They will eventually be discovered, though nobody could tell when or where. It may be in Japan, or in France or in Australia. The pregnant fact to keep in mind is that each theory, or group of theories, each branch of science and, indeed the whole of science, are made up of a series of numbered links each of which may have been found independently from some of the others (possibly not in the order of succession) and in very different places. Yet finally all these links constitute a chain so strong that it is exceedingly difficult to break it, though subsequent discoveries may oblige one to improve its arrangement. How could such combinations of circumstances ever happen (and they happen again and again apropos of the building up of each new theory) if science was not one single body of perfect congruency and if the men of many climes who collaborate in this grand undertaking were not actuated by the same fundamental motive?[37]

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[37] George Sarton, 'The New Humanism', *Isis*, 6 (1924), 11-2. These ideas are more fully elaborated in George Sarton, *The History of Science and the New Humanism* (New York, 1931)., especially Chapter 1, 'The History of Science and the History of Civilization'. See also George Sarton, *Introduction to the History of Science*, *Carnegie Institution of Washington Publication 376* (3 vols., Baltimore, MD, 1927-32). For an in depth account of Sarton's positivism, see Tore Frangsmyr, 'Science or History: George Sarton and the Positivist Tradition in the History of Science', *Lychnos*, (1973-4), 104-44. For Sarton's philosophical background in general, see Arnold Thackray and Robert K. Merton, 'On Discipline Building: The Paradoxes of George Sarton', *Isis*, 63 (1972), 480-2; Arnold Thackray and Robert K. Merton, 'George Alfred Leon Sarton', *Dictionary of Scientific Biography*, XII (1975), 107-14; Lewis Pyenson, 'What is the Good of History of Science?' *History of Science*, 27 (1989), 353-89; Robert Fox, 'Sartonian Values in a Changing World: The Case of Isis', in Marco Beretta, Claudio Pogliano and Pietro Redondi (eds.), *Journals and History of Science* (Florence, 1998), pp. 109-19.

This vision of unity held for Sarton important implications for the study of science history and its role in post-war reconstruction. It follows from the 'correlative' unities of knowledge and mankind, that just as scientific progress is to be found in a clearer reflection of the unity of nature, human progress is to be found in a fuller realisation of mankind's common scientific endeavour. Put another way, human or moral progress can be measured by the extent to which mankind's manifest history of division and war is collectively foresworn in favour of their secret history of unity and civilisation. Sarton wrote: 'the real significance of human progress ... is the gradual transformation of that potential or hidden unity into an actual unity, one that all can see and no one can deny.'[38] As the primary means by which these correlative unities are laid bare — by which mankind's secret history is revealed — the study of science history thus stood for Sarton as a powerful engine of moral progress.

Reasoned negatively, the correlative unities of knowledge and mankind also mean that divisions in knowledge are part and parcel of divisions among men. Stated this way, human progress resides in the mending of tears in the fabric of knowledge, and any moral power that science history might have should stem from its capacity to mend these tears. In fact, Sarton argued that 'the most ominous conflict' of his time was the rift between the arts and sciences. While 'old' humanists had grown frightened and disdainful of science, scientists had become too specialised and ignorant of the arts. Between these groups Sarton saw 'but one bridge', the construction of which was 'the main cultural need' of his time. Only science history could restore the unity of knowledge that underlay these artificial divisions. Only

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[38] George Sarton, *Introduction to the History of Science*, *Carnegie Institution of Washington Publication 376* (3 vols., Baltimore, MD, 1927-32), i, 31.

science history could restore the reflection of nature's unity in both knowledge and mankind. The ultimate restoration of these correlative unities by means of science history was Sarton's anticipated 'New Humanism':

> The only cure for the [old humanist] is to make him realize the real meaning, the cultural value of science, which far transcends all its applications, and this may be done best by teaching its history. The only cure for the [scientist] is the contemplation of the past, the whole past, but especially the development of civilization as focused upon the very efforts of his predecessors. Let us lift up to their eyes the great mirror of history, and teach them to use it as a mirror not of their own good selves but of the whole of mankind.
>
> Between the old humanist and the scientist, there is but one bridge, the history of science, and the construction of that bridge is the main cultural need of our time. An immense task to be sure but one worth every pain it may cost. I do not know who is poorer: the old humanist without understanding of science, or the scientist without appreciation of beauty, without urbanity, without reverence. I do not know which is worse: idealism without knowledge, or knowledge without idealism. We need both equally in order to go forward and prepare the dawn of a new age, — the age of a New Humanism.[39]

More specifically in terms of post-war reconstructive requirements — that is, in the terms of 'War and Civilization' — Sarton maintained that the Great War had resulted from an imbalance in mankind's technical and moral faculties. He argued that mankind's technological development had outpaced his moral development, and that too much scientific and technological power had accumulated in the hands of men morally unequal to its stewardship. It was their mismanagement of scientific and technological knowledge that had raised human conflict to the new and unprecedented level of violence witnessed in the Great War. Only with better stewardship could similar violence be prevented in the future. Man's moral stature must be raised to match his technical stature in order for peace to prevail:

> The task before us is immense. The moral failure which the war implied must not dishearten us. After all, this catastrophe could have been foreseen: mankind had not yet morally adapted itself to

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[39] George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), pp. 57-8.

> its technical development. The problems of war and peace are at the bottom neither economic or political, but moral. When the moral standard of nations and communities is brought up to the level which obtains among individuals, then alone will wars become as obsolete as feuds. If one sees clearly the root of the evil, that is, the unequal development of moral and technical progress, there is no reason to lose hope and every reason to husband one's patience.[40]

Of course, Sarton's hope and patience were grounded in his unshakable belief in science history's capacity to adjust these inequalities. Through 'that mixing of the historical with the scientific spirit, of life with knowledge, of beauty with truth', Sarton believed that science history would humanise science and moralise technology. Real post-war recovery was to be grounded in this New Humanism, and Sarton very seriously devoted himself to its achievement:

> The war has helped us understand more clearly that science can be used for sinister purposes, as well as for good ones. This shows us that knowledge is no absolute good. It is not *what* we know that matters, but *how* we know it. No amount of knowledge can make up for a lack of charity and intelligence. In other words, science must be tempered by humanity, and the best way of doing this is to explain its organic development, and also to show all that was really great, beautiful and noble in these civilizations of old, all that our conceited scientists have too often forgotten and disdained. We must teach reverence for the past, — not simply for its own sake or because it is still full of treasures, — but for the sake of the present which it will aid us to appreciate, and for the sake of the future in which it will help us walk with dignity.[41]

For Sarton science history was always directed to a higher purpose — the correlative unities of knowledge and mankind. While the past was his subject, the future remained uppermost in his mind: *'Le passé si beau qu'il soit est moins beau que l'avenir. Il ne peut nous attarder longtemps. C'est l'avenir qui importe. Le Nouvel Humanisme est tendu vers lui.'*[42] In the wake of the Great War, the choice of science history was more fundamentally the choice between war and civilisation; between an

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[40] George Sarton, 'War and Civilization', *Isis*, 2 (1919), 317.

[41] Ibid., 319.

[42] George Sarton, 'La nouvel humanisme', *Scientia*, 23 (1918), 175.

all-too-evident history of strife and a secret history of peaceful progress; between idle disillusionment and the work of redemption. In every instance, Sarton chose the latter — 'The war is over, but the destruction remains. We have got to make it good.'[43]

[43] George Sarton, 'War and Civilization', *Isis*, 2 (1919), 316.

# Chapter 1: Intentions

## The Encyclopaedic and Ecumenical History of Science

'The only remedy for a calamity of this size is *work*, — loving, cheerful, persistent work.'[44] This is a typically Sartonian turn of phrase in both its brio and its message. Though Sarton first described the New Humanism philosophically as 'a conception of the organic unity of knowledge' and only secondly as 'the reincarnation of that unity in our everyday life', in fact, the second ingredient is probably more important than the first.[45] That is, Sarton's philosophy was really a means to more practical ends, rather than an end in and of itself. As Thackray and Merton — somewhat disparagingly — point out: 'high theory and a rigorous consistency were less urgent to [Sarton] than sustained appropriate action.'[46] Thus if Sarton's fully elaborated philosophy of the 'organic unity of knowledge' at times seems a bit confused, it is only because he devoted himself more seriously to the practical work of that unity's 'reincarnation'. In a climate of post-war reconstructive necessity, Sarton's New Humanism was less an article of faith and more a rule of good works:

> The study of history, and especially of the history of science, may thus be regarded, not only as a source of wisdom and humanism, but also as a regulator for our consciences: it helps us not to be complacent, arrogant, too sanguine of success, and yet remain grateful and hopeful, and never to cease working quietly for the accomplishment of our own task.[47]

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[44] Ibid., 318.

[45] George Sarton, 'Preface to Volume 9', *Isis*, 9 (1927), 228.

[46] Arnold Thackray and Robert K. Merton, 'George Alfred Leon Sarton', *Dictionary of Scientific Biography*, XII (1975), 109.

[47] George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), p. 191.

The works that accompanied Sarton's vision comprised his ambitious research and institutional programmes. Sarton believed that the history of science was nothing less than the entire history of civilisation, and his own science historical work would be a practical reflection of this belief. If scientific and human unity were the cornerstones of the New Humanism, then historical and institutional unity were the cornerstones of Sarton's practical programme.

Some of the earliest existing outlines of Sarton's plans are found in a series of letters to the polymath Robert S. Woodward, first president of Washington's Carnegie Institution. During the early years of his wartime exile, Sarton had latched on to Woodward and the Carnegie Institution as a potentially sympathetic — and certainly well endowed — source of support. Primarily a scientific institution most famous for its Mount Wilson Observatory, the Carnegie Institution nevertheless supported a division of historical research. While this was always more focused on archaeology and historical anthropology than on the history of science, Sarton nevertheless thought that the existing conjunction of scientific and historical interests at the Carnegie Institution might provide an opening for his researches.

At the same time, President Woodward himself maintained a private interest in science history and had published a number of papers on the subject. Later in their relationship, Sarton would refer to two of these in particular. One, entitled 'The Century's Progress in Applied Mathematics', appealed to Sarton's own mathematical training and research interest in the history of mathematics. Another, a lecture entitled 'The Claims of the Humanists', appealed to Sarton's emerging New

Humanism. Taken together, these institutional and philosophical sympathies pointed Sarton doggedly toward Woodward and the Carnegie Institution.[48]

Sarton's courting of Woodward and his designs on the United States coincide almost exactly with the outbreak of war in Europe and the German invasion of Belgium: Sarton's first and only Belgian letter to Woodward was dated September 26, 1914.[49] In it Sarton introduced *Isis* and its dire financial situation. Sarton explained that because of the war, his only external source of funding — an annual grant from the Belgian King — will 'of course be suspended', while his European subscribers 'will be forced by circumstances to withdraw their subscriptions'.[50] Never one to mince words — nor to refrain from manipulating conscience — Sarton asked Woodward explicitly for cash. He wrote:

> Could the Carnegie Institution possibly come to [*Isis*'s] rescue? A grant of a few thousand francs during a few years would save the results of efforts whose lofty ideal you will no doubt appreciate. Must the Belgian work be allowed to perish for the want of a few thousand francs? Or, may I not count upon America's financial help, until Europe's wounds and more particularly those of poor little Belgium, have had time to heal up?[51]

Sarton's next letter to Woodward would be written in exile in England.[52] Failing to find work in England, Sarton came quickly to the United States, where he obtained a series of temporary lecturer positions at George Washington University, at

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[48] See Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 23 June 1918. Also Robert S. Woodward, 'The Century's Progress in Applied Mathematics', *Bulletin of the American Mathematical Society*, 6 (1899), 133-63. For Sarton's mathematical predisposition, see Nathan Reingold, 'Uniformity as Hidden Diversity: History of Science in the United States, 1920-1940', *British Journal for the History of Science*, 19 (1986), 243-62. For Woodward's brand of scientific humanism, especially his commitment to the unity of knowledge, see also Harvard Houghton Library, bMS Am. 1803 (2045): Robert S. Woodward, 'Letter to George Sarton', 24 July 1916.

[49] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 26 September 1914. The German demand of free passage through Belgium, which precipitated Great Britain's declaration of war, was issued only on 2 August.

[50] Ibid., pp. 2-3.

[51] Ibid., p. 3.

[52] Ibid.

the University of Illinois and finally at Harvard.[53] When Harvard decided not to extend his teaching appointment beyond the spring of 1918, Sarton appealed again to Woodward.[54] The Carnegie Institution finally took pity on Sarton and arranged for him a small stipend and the title of 'Special Research Associate'.

Newly employed by a Washington institution, Sarton was nevertheless determined not to leave Harvard. Now in yet another display of his resourcefulness, he convinced Woodward to let him stay in Cambridge. He even had Woodward call in a favour and arrange a room for him in Widener Library.[55] It was the sweetest imaginable situation. Though lodged at Harvard, as an employee of the Carnegie Institution Sarton was free of most normal teaching and administrative duties. Though employed by the Carnegie Institution, he was miles away from Washington and totally unsupervised. Few professional academics have ever had such freedom.[56]

Most amazingly, Sarton was able to secure this appointment without ever submitting a research proposal. Prior to the appointment, Sarton only briefly

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[53] On his appointment to George Washington University, see New York Public Library Berg Collection: George Sarton, 'Letter to Eleanor Mabel Sarton', 11 April 1915. and Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 21 April 1915.; on his appointment to Illinois, see New York Public Library Berg Collection: George Sarton, 'Letter to Eleanor Mabel Sarton', 11 April 1915.; on his lectureship at Harvard, see Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 6 May 1916.

[54]Harvard Houghton Library, bMS Am. 1803.1 (762): George Sarton, 'Draft of Letter to Robert S. Woodward', 30 March 1918. See also Carnegie Institution of Washington, George Sarton Papers: Robert S. Woodward, 'Letter to George Sarton', 3 April 1918; Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 23 June 1918; Harvard Houghton Library, bMS Am. 1803 (2045): Robert S. Woodward, 'Letter to George Sarton', 8 April 1918.

[55] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 23 June 1918; Carnegie Institution of Washington, George Sarton Papers: Robert S. Woodward, 'Letter to William Lane', 27 August 1918. Also Lewis Pyenson, 'Inventory as a Route to Understanding: Sarton, Neugebauer, and Sources', *History of Science*, 33 (1995), 253-82.

[56] For Sarton's association with the Carnegie Institution and Harvard University more generally, see George Sarton, 'Report to the Trustees of the Carnegie Institution of Washington', *Yearbook of the Carnegie Institution of Washington*, 18-48 (1919-1949); George Sarton, 'Robert Simpson Woodward', *Isis*, 7 (1925), 112-4; George Sarton, 'The History of Science and the Carnegie Institution', *Osiris*, 9 (1950), 624-38; James Bryant Conant, 'George Sarton and Harvard University', *Isis*, 48 (1957), 302; I. B. Cohen, 'A Harvard Education', *Isis*, 72 (1984), 13-21. See also Arnold Thackray and Robert K. Merton, 'On Discipline Building: The Paradoxes of George Sarton', *Isis*, 63 (1972), 293-4.

explained his practical programme. For instance, in his first letter, Sarton said only that he hoped 'to carry further, under a more systematic and collective form, the lofty intellectual work undertaken of old by several philosophers and especially by Comte and Spencer.' He continued that '*Isis* would collect all material necessary to the exploration of human experience in its highest aspect: scientific thought.' Finally and even more ambitiously, he argued that his work should form 'the very heart of the whole history of civilization, and the rational basis of all truly scientific philosophy and organization.'[57] His other wartime letters were all equally vague. It was, in fact, several months after Sarton took up his post with the Carnegie Institution before he provided Woodward with a 'confidential' outline of his plans 'to promote the history of science.'[58]

Sarton aimed high. The grandeur of the New Humanism required an equally grand practical programme. The plan he offered Woodward in January 1919 comprised thirteen typescript pages, outlining 'the work of fifty years at least'. In addition to the continued publication of *Isis*, Sarton proposed an annual monograph series; a multi-volume general history of science and civilization; a history of nineteenth century physics; a treatment of ancient science and technology; facsimile copies of scientific manuscripts and rare books; a Chinese encyclopaedia; a science museum or exhibition of the progress of science; a catalogue of scientific instruments to 1900; and an international centre for the history of science.[59]

Responding to this grand proposal and over Sarton's strenuous objections, the Carnegie Institution separated Sarton's research aims from his institutional aims, and

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[57] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 26 September 1914, pp. 1-2.

[58] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 23 January 1919.

[59] Ibid.

agreed only to fund the former. Sarton was charged with producing the survey of the history of science and civilisation that would eventually be published as his *Introduction to the History of Science*. *Isis* — along with Sarton's hopes for an institute, an annual, a museum, and his other institutional plans — were left to fend for themselves.[60]

On the one hand, Sarton's vision of scientific and human unity demanded a unifying research programme. This implied both breadth and synthesis. At the beginning of the *Introduction* Sarton wrote: 'there are no real discontinuities in the intellectual life of the world if we take into account the achievements of all peoples in every direction. Our survey must be comprehensive in two ways: it must be encyclopaedic and ecumenical.'[61]

By any measure, the *Introduction* was encyclopaedic. Published over a quarter century, the *Introduction* ran to three oversized volumes in five separate bindings. It contended with twenty-three centuries of science history, from the ninth century B.C. to the fourteenth century A.D. It considered everything from Egyptian mathematics, Babylonian astronomy and Hebrew mining to Greek natural philosophy, Islamic geography and medieval medicine. In passing it contributed significantly to the histories of art, religion, music, philology, historiography and *juris prudens*.

Still, the published *Introduction* pales in comparison to Sarton's original plan for the work, and in the preface to Volume One, Sarton outlined the 'creation of three series of books.' The first series would provide a 'purely chronological survey in the

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[60] Sarton later recounts these developments for Woodward's successor as president of the Carnegie Institution, John C. Merriam. See Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Memorandum Prepared for President Merriam to Explain the Needs of the Section on the History of Science', 1932-3.

[61] George Sarton, *Introduction to the History of Science*, *Carnegie Institution of Washington Publication 376* (3 vols., Baltimore, MD, 1927-32), i, 30.

form of cross-sections of civilization for each half century', which would require eight or nine volumes. The second series would consider the science of different civilisations separately. For this Sarton suggested an additional eight volumes: Pre-Hellenic; Classical Antiquity and Iranian Civilization (to the Hegira); Semitic; Mediaeval (Latin and Greek); Hindu and Central Asiatic; Far Eastern; Prehistoric and Ethnologic; and an Index. The third series would consider each science separately, again in eight or nine volumes: Logic and Mathematics (knowledge of forms); Physical Science (knowledge of inorganic nature); Biological Sciences (knowledge of organic nature); Sciences of the earth (implying a knowledge of both inorganic and organic nature); Anthropological and Historical Sciences (knowledge of man, past and present); Medical Sciences; Educational Sciences (the methods of imparting and diffusing knowledge); Philosophy (main concepts of science, its unification and classification); and an Index. Finally, in addition to the twenty-seven-odd volumes contained in his three series, Sarton suggested an indeterminate number of supplementary atlases, charts and facsimiles. In a manner of speaking, Sarton planned for the *Introduction* not simply to be *encyclopaedic*, but rather to be *an encyclopaedia*.[62]

Of course, in its allied mandate of 'ecumenism', the *Introduction* would intentionally diverge from the standard encyclopaedia. Sarton saw his task not only to consider the range of scientific ideas and traditions, but also their relations. Or more precisely, Sarton believed that breadth of knowledge — encyclopaedism — was simply a prerequisite to depth of knowledge or synthesis — ecumenism. It was for this reason that throughout his career Sarton insisted on the distinction between the

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[62] Ibid., i, 34.

study of 'l'histoire de la science' and studies of 'l'histoire des sciences'.[63] He explained that 'the history of special sciences is very useful for many purposes, technical and philosophical, but totally insufficient, if our purpose is to explain the development of mankind and the organization of knowledge.'[64] Only in points of chronological, geographical or substantive convergence could the dual unities of knowledge and mankind be revealed. Instances of unity could be expressed as coordinates of these axes. Here Sarton drew explicit parallels to cross-sections of a Cartesian plane. Proposing a model for science historical study and, in particular, for university teaching, Sarton provided both a verbal and visual illustration:

> One of the best means of obtaining a relative mastery of the whole field is to make judicious cross-sections of it, and every scholar engaged in these studies should try to carry out as far as possible three different types of cross-sections and to remain sufficiently familiar with them throughout life. He should make a special study of:
>
> (1) The development of one branch of science, say, astronomy, or of a smaller field, say, geodesy.
>
> (2) The development of science and learning during a special period, say, the fourteenth century.
>
> (3) The development of science and learning within a certain country, or by the people of a special race or faith, or by the people using a special language. E.g., Italian science, Arabic or Islamic science, the scientific content of post-classical Latin literature …
>
> These three cross-sections, it should be noted, are never independent; each includes projections of the two others and completes them … [65]

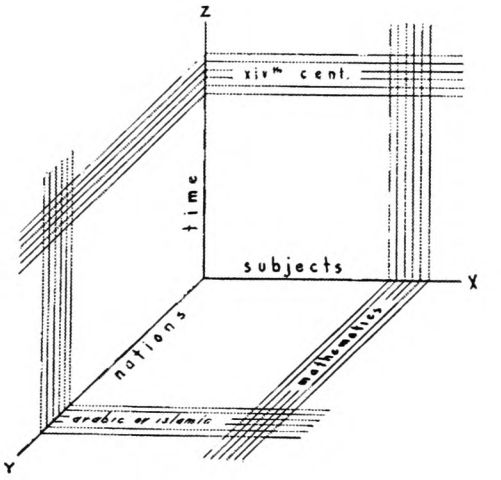


Fig. 6

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[63] George Sarton, 'L'histoire de la science', *Isis*, 1 (1913), 3-46; George Sarton, 'Le but d'Isis', *Isis*, 1 (1913), 193-6.

[64] George Sarton, *Horus: A Guide to the History of Science* (London, 1952), p. 53. Sarton makes a similar point in the *Introduction*: 'In the first place we must consider not the history of one or of many sciences, but the history of every branch of positive science. That history is considerably more than the arithmetical sum of the histories of all sciences, for it explains not only the progress of each science, but its relations to all others.' George Sarton, *Introduction to the History of Science*, *Carnegie Institution of Washington Publication 376* (3 vols., Baltimore, MD, 1927-32), i, 30.

[65] George Sarton, *The Study of the History of Science* (Cambridge, MA, 1936), pp. 27-9. That Sarton meant to extend this model to university teaching can be further gleaned from his correspondence with

In fact, these three axes corresponded directly to the three series Sarton suggested for his *Introduction*, in which much the same material is considered first chronologically, then geographically, and finally topically in order to emphasise connections. Sarton wrote:

> It is clear that when these three series are completed ... we shall have a fairly good notion of the progress of civilization. Each of these surveys is necessary and none is sufficient. The Chinese, who have a knack at expressing things in a pithy way, love to say that the four essentials of true education are the comparative, the historical, the universal, and the special. That is, everything must be considered from these four points of view, and it is only when we have learned to make these points of view converge upon any topic that we may claim to understand it.[66]

This convergence was always Sarton's ultimate aim. While necessity might demand divisions, the correlative unities of science and mankind demanded that the aim of Sarton's research programme always be synthesis.

On the other hand, if Sarton's research programme seems ambitious even for a scholar of his energy, then it must be remembered that he always intended for an institutional structure of sufficient grandeur to stand behind it. The fact that the Carnegie Institution would only fund research for his *Introduction* was little barrier. Sarton continued funding *Isis* entirely out of pocket and never ceased his hounding of the Carnegie Institution on its behalf.[67] Neither did Sarton give up his insistence that his research and institutional programmes were indivisible, nor his vision of whole communities of scholars, librarians, curators and publishers working side by side on

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his Harvard colleagues and from other publications. See Harvard Houghton Library, bMS Am. 1803.1 (129): George Sarton, 'Letter to James Bryant Conant', 12 December 1934; Harvard Houghton Library, bMS Am. 1803.1 (285): George Sarton, 'Letter to Lawrence Joseph Henderson', 17 May 1935; George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), pp. 135-46.

[66] George Sarton, *Introduction to the History of Science*, *Carnegie Institution of Washington Publication 376* (3 vols., Baltimore, MD, 1927-32), i, 35.

[67] See, for instance, Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to John C. Merriam', 1 April 1922; Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Memorandum on the History of Science Prepared for President Merriam', 20 November 1922; Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Memorandum Prepared for President Merriam to Explain the Needs of the Section on the History of Science', 1932-3.

all aspects of science history. Just as the New Humanism's correlative unities of knowledge and mankind required an encyclopaedic and ecumenical research programme, so too did they require a wide-ranging and consolidated institutional effort.

The extent of Sarton's original institutional programme is demonstrated in an article published in *Science* in 1917, entitled 'An Institute for the History of Science and Civilization'.[68] In this piece, Sarton contended that because of its enormous scope and humanising importance, the history of science requires more than the standard regime of university courses and departments. Rather, in order to be done properly, the history of science requires a dedicated research facility, a kind of 'centre for advanced science historical studies'. Indeed, like the larger research laboratories, Sarton envisaged an fully autonomous facility, independently endowed and in no way 'hampered by any question of degrees or credits, remaining free to do for the advanced student what it feels will be of service in establishing the highest standards of research and scholarship.'[69]

Never afraid to shoot the moon, Sarton insisted not only on independence, but also on scale. Sarton listed the following among the institute's necessary activities. First and foremost, the institute should 'offer qualified students the best equipment for work and the advice, assistance and encouragement of a small corps of experts in the history of science.' In this connection, the institute should provide conference facilities 'to offer to scientists interested in history, to historians interested in science,

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[68] George Sarton, 'An Institute for the History of Science and Civilization', *Science*, 45 (1917), 284-6. The following year Sarton responded to critics of this piece in a second article by the same title. See George Sarton, 'An Institute for the History of Science and Civilization', *Science*, 46 (1918), 399-402. See also George Sarton, 'An Institute for the History of Science and Civilization', *Isis*, 28 (1938), 7-17; Harvard Houghton Library, bMS Am. 1803.1 (129): George Sarton, 'Letter to James Bryant Conant', 21 July 1940.

[69] George Sarton, 'An Institute for the History of Science and Civilization', *Science*, 45 (1917), 284-6.

and to cultivated philosophers a meeting place worthy of their respect.' Furthermore, the institute should provide a clearinghouse for manuscripts and other source materials, both on site and through a facsimile service — naturally engaging nothing less than 'the best available technicians, with the best types of apparatus, working both in foreign libraries and in the laboratory of the institute.' In fact, Sarton argued that the institute might assemble its own store of 'prints, instruments and other early material bearing on the history of pure and applied science' to provide in America a collection to rival the great European collections of the Conservatoire in Paris, the Deutsches Museum in Munich and the Science Museum in London. Finally, the institute should publish both popular and scholarly journals — the latter on the pattern of *Isis* — and mobilize 'the best critical talent' to coordinate 'the most thorough bibliographical work' possible. To add weight to his petition, Sarton employed a favourite tactic. Mobilizing the authority of the scientific elite, Sarton listed the names of nearly one hundred sympathetic scholars, including Alexander Graham Bell, James Henry Breasted, Harvey Cushing, George Ellery Hale, Percival Lowell, George Herbert Mead, Robert Millikan, David Eugene Smith and Henry Osborn Taylor.[70]

Of course for all his apparent support, Sarton never realised his grandiose institutional scheme.[71] The best he could manage between the wars was the establishment of graduate degrees at Harvard in 1936, the founding of a History of Science Society in 1924, and, most importantly, the maintenance of *Isis* throughout the period. Indeed *Isis* was always the cornerstone of Sarton's institutional efforts.

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[70] Ibid.

[71] This came much to the ever-optimistic Sarton's surprise. As he wrote his wife in 1925, '... on that same day, Haskins had announced to me that the Rockefeller people had decided not to subsidize our Institute (we expected a gift of one million dollars). Now to lose a million dollars is rather tough, and though I already dismissed the matter from my mind, it kept creeping in insidiously and disturbed my equanimity.' New York Public Library Berg Collection: George Sarton, 'Letter to Eleanor Mabel Sarton', 5 April 1925.

Even the History of Science Society was originally intended as an insurance policy for *Isis* and its editor. In announcing the Society's formation, Sarton wrote:

> Upon the initiative of a number of scholars, a History of Science Society has recently been founded in America. Its purpose is to promote the study of the History of Science, and more particularly to support the publication of *Isis*, which has become its official organ. This is very gratifying, especially because as long as *Isis* remained a private undertaking, its existence was naturally precarious. This existence is now assured. *Isis* may slumber yet, but die — never![72]

Sarton's regard for *Isis* rested firmly in his belief in the journal's integrating potential. In one of the many petitions addressed to the Carnegie Institution on behalf of *Isis*, Sarton spelled out this importance. Sarton explained that in order for the history of science to be established on a more solid footing, it must reduce its dependence on the 'capricious efforts' of 'free-lances' and 'proceed with more method.' Thankfully, he said, the Carnegie Institution has taken the first step in this direction, charging him with the creation of a much-needed 'elementary textbook'. Nevertheless, Sarton continued, 'to establish a new discipline, to bring order into this chaos, books do not suffice.' 'The only way', according to Sarton, 'to establish the history of science on the level of any other scientific study is to publish a review regularly which is a center of information, of rally, of criticism.' In conclusion he reiterated this unifying note, 'these studies must be organised; the scholars engaged in them must be brought together; their work must be analysed and scrutinized by experts to keep the standards high. The tool to do all this exists. It is *Isis*.'[73]

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[72] George Sarton, 'Preface to Volume 6', *Isis*, 6 (1924), 4. See also George Sarton, 'The History of Science Society and its Relationship with Isis', *Isis*, 16 (1931), 125-6. and I. B. Cohen's recent memoir, I. B. Cohen, 'The *Isis* Crisis and the Coming of Age of the History of Science Society', in Margaret W. Rossiter (ed.), *Catching Up with the Vision: Essays on the Occasion of the 75th Anniversary of the Founding of the History of Science Society* (Chicago, 1999), pp. S28-42.

[73] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to John C. Merriam', 1 April 1922, pp. 2-3. See also George Sarton, 'Le but d'Isis', *Isis*, 1 (1913), 193-6.

The sheer range of subjects covered by *Isis* in the interwar period provides an easy indication of the journal's unifying purpose, and Sarton worked diligently to keep its contents 'sufficiently varied'.[74] By bringing scholars of many subjects together under one publications regime, Sarton hoped to encourage the convergence of their efforts and provide an institutional home for unified knowledge. A case in point is Sarton's own contribution. Sarton's research often overflowed the banks of his *Introduction* and usually spilled over into *Isis*. The breadth of these publications is similar to that of the *Introduction*. For instance, in 1936 alone, Sarton published articles in *Isis* on subjects ranging from Indian and Minoan mathematics to Chinese glass making and Babylonian astronomy.[75]

In actual practice though, *Isis'* unifying purpose is most evident in its 'Critical Bibliography'. This is not as unlikely as it may at first appear. Sarton's concern for unity was matched only by his dedication to bibliography. At one point Sarton went so far as to say that 'to know the best source or the best book on a topic is almost as good as to know that topic.'[76] In fact, Lewis Pyenson has argued that Sarton's defining scholarly characteristic was bibliographical — a 'profound need to control the sources'.[77] Pyenson shows how Sarton's bibliographical bent was manifest from the earliest days of his academic life, and explains further how the requirements of

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[74] See George Sarton, 'Preface to Volume 19', *Isis*, 19 (1933), 6-10.

[75] See, for example, George Sarton, 'Minoan Mathematics', *Isis*, 24 (1936), 375-81; George Sarton, 'A Hindu Decimal Ruler of the Third Millennium', *Isis*, 25 (1936), 223-6; George Sarton, 'Chinese Glass at the Beginning of the Confucian Age', *Isis*, 25 (1936), 73-9; George Sarton, 'Date Culture in Ancient Babylonia', *Isis*, 26 (1936), 95-8. See also Katherine Strelsky, 'Bibliography of the Publications of George Sarton', *Isis*, 48 (1957), 336-50.

[76] George Sarton, *Horus: A Guide to the History of Science* (London, 1952), p. 14.

[77] Lewis Pyenson, 'Inventory as a Route to Understanding: Sarton, Neugebauer, and Sources', *History of Science*, 33 (1995), 256,61-62.

bibliography motivated most of his major career decisions, especially his insistence upon remaining at Harvard's enormous Widener Library.[78]

In this light, it is unsurprising that the first issue of *Isis* was taken up substantially with Sarton's 'First Critical Bibliography'. In nearly every issue thereafter there appeared about 1000 new critical notes, and by 1933 Sarton could report a grand total of 26,618, the coverage and arrangement of which were the same as that of the *Introduction*.[79] The Critical Bibliography was, in Sarton's words, 'a systematic and continuous table of contents to all the reviews and serials dealing with the history and philosophy of science, and to all the similar materials published in other journals or anywhere.'[80] Likewise, it should come as no surprise that Sarton believed the Bibliography to be 'the most useful part' of *Isis*.[81] In fact, its usefulness was directly proportional to its unifying potential.

According to Sarton, the Bibliography would at once promote societal, disciplinary, institutional and philosophical unity. He hoped the Critical Bibliography would 'spread the notion of the History of Science as a well defined discipline.'[82] He furthermore hoped it would provide an institutional meeting place for scholars of diverse interests, arguing that the work of bibliography was first and foremost 'a

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[78] Ibid., 263-4. See also Harvard Houghton Library, bMS Am. 1803.1 (285): George Sarton, 'Letter to Lawrence Joseph Henderson', 12 July 1925; May Sarton, 'An Informal Portrait of George Sarton', *Texas Quarterly*, Autumn 1962, p. 107. In this last, May Sarton recalls Sarton's affection for Widener, quoting from his journal, 'I do not love Harvard so much, a hard stepmother, but I love the library, and I am grateful to all its officers, from the top Dr. Metcalf, to the girls who replace books on the shelves.'

[79] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Memorandum Prepared for President Merriam to Explain the Needs of the Section on the History of Science', 1932-3, p. 6.

[80] George Sarton, *The Study of the History of Science* (Cambridge, MA, 1936), pp. 62-3.

[81] George Sarton, 'The New Humanism', *Isis*, 6 (1924), 37.

[82] George Sarton, 'Synthetic Bibliography, with a Special Reference to the History of Science', *Isis*, 3 (1920), 169.

matter of solidarity'.[83] And he at once intended the Critical Bibliography to provide a material symbol of the dual unities of science and mankind, to actively promote this ecumenical view, and to impel practical work in its direction. Here he explained that the Critical Bibliography's range and arrangement would both 'offer, so-to-say, a continual illustration of the unity of mankind and of the unity of science' and at the same time would 'oblige the reader to consider the development of mankind — not simply one province but of the whole of it ...'[84] In these ways — by enhancing the disciplinary reputation of the history of science, by consolidating scholarly efforts, and by encouraging an ecumenical view of science history — the Critical Bibliography was a grandly conceived practical step towards Sarton's vision of unity. In introducing nearly every edition of the Critical Bibliography, Sarton summarized these connections. As he wrote in 1925:

> The ultimate aims of this bibliography are: 1) to establish the History of Science as an independent discipline; 2) to demonstrate inductively the Unity of Knowledge and the Unity of Mankind; 3) to serve as a center of information and rallying ground to the scholars engaged in our studies. I can not succeed entirely without their assistance and they can help me in many ways. To serve them as well as I can, is both my duty and my pleasure. Critical work must be approached in a spirit of service or left untouched.[85]

In discussing what they call the 'Paradoxes of George Sarton', Thackray and Merton wonder how a man 'who until his last years largely devoted himself to critical bibliography' could seriously and unabashedly espouse the idealistic rhetoric of the New Humanism.[86] They ponder the apparent irony that though 'ambitious for the total vision, it is yet for bibliography, documentation, and the establishing of

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[83] Ibid., 170.

[84] George Sarton, 'The New Humanism', *Isis*, 6 (1924), 37.

[85] George Sarton, 'Preface to the Eighteenth Critical Bibliography', *Isis*, 8 (1926), 528.

[86] Arnold Thackray and Robert K. Merton, 'On Discipline Building: The Paradoxes of George Sarton', *Isis*, 63 (1972), 473-95.

historical standards and facts that Sarton is most often remembered.' They lament that Sarton's 'hoped-for proof of the unity of knowledge and mankind never came' and that his 'insistence on first collecting and analysing the facts so filled his life that it kept him from undertaking the synthesis for which he labored.' And they disappointedly conclude that although Sarton succeeded in building a 'professional' or institutional identity for the history of science, he nevertheless failed to establish a lasting 'cognitive' identity for the discipline — that is he failed to convert a following to the ideals of the New Humanism that he held so dear.

In fact, in judging Sarton by his ultimate influence on later historians like themselves, Thackray and Merton miss the point. Far from antithetical to Sarton's vision, bibliography, documentation and the establishment of historical standards were the practical keys to the New Humanism. The collecting and analysing of facts were themselves acts of unity. The establishment of consolidating institutions *was* the fulfilment of his cognitive intentions. As they themselves admit, high theory was always less important to Sarton than sustained and targeted action. In a climate of post-war reconstructive necessity, Sarton's unifying endeavours were their own reward. Even in his first letter to Woodward, Sarton stressed the centrality of *work*:

> You will be surprised perhaps, to receive such a letter from Belgium, at the very moment that this poor country is invaded by the enemy; but, notwithstanding that other duties are laid upon me by the war, I have persisted in my belief that my first duty was to carry on, as much as possible, the intellectual work I have undertaken: a work of peace and faith, in the noblest sense of those terms, more necessary today than ever, and here more than anywhere else.[87]

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[87] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 26 September 1914.

In the end, moreover, it was this same practical bent that allowed Sarton — not uniquely among interwar science historical practitioners — to hold out hope until the last: until the coming of a second and more terrible war.

## A Pageant of Progress

It is a sorry omission by the historical profession that so little has been written about the British Empire Exhibition of 1924-1925. Arguably the most important cultural event in interwar Britain, historians have somehow forgotten all about it. Not a single learned monograph and only a handful of scholarly articles have been dedicated to the Wembley exposition.[88] Even works dealing with great expositions more generally tend to gloss over the British Empire Exhibition.[89] Undoubtedly, the profession's understandable preoccupation with the volatile political and economic climate of the period is at least partly to blame for its oversight. The fact the Exhibition has been widely seen as a failure has also played a role in its neglect.

The impression of failure is due to the fact that the Exhibition ended its two-year run with a deficit of nearly £2,000,000. This is in striking contrast to the enormous profits made by earlier London expositions, beginning with the Great Exhibition of 1851, the earnings from which still contribute to the nation's cultural

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[88] The only book-length publication is in fact little more than a collection of contemporary newspaper clippings. See Donald R. Knight and Alan D. Sabey, *The Lion Roars at Wembley: British Empire Exhibition, 60th Anniversary 1924-1925* (New Barnet, 1984). More serious and especially relevant for this discussion is Alan Q. Morton, 'The Electron Made Public: The Exhibition of Pure Science in the British Empire Exhibition, 1924-5', in Bernard Finn, Robert Bud and Helmuth Trischler (eds.), *Exposing Electronics, Artefacts: Studies in the History of Science and Technology* (Amsterdam, 2000). Otherwise, recent scholarship is outstandingly lacking.

[89] For example, Allwood devotes less than five heavily illustrated pages to the British Empire Exhibition. The other standard histories present much the same (lack of) emphasis. See J. Allwood, *The Great Exhibitions* (London, 1977); Robert W. Rydell, *World of Fairs: the Century-of-Progress Expositions* (Chicago, 1993); Paul Greenhalagh, *Ephemeral Vistas: The Expositions Universelles, Great Exhibitions and World's Fairs, 1851-1939* (Manchester, 1988); Kenneth W. Luckhurst, *The Story of Exhibitions* (London, 1951).

life. Yet aside from its finances, it is difficult to classify the British Empire Exhibition a failure. Physically the Exhibition played on the grandest stage. The Palaces of Engineering and Industry were at the time the largest buildings ever constructed for an international exposition. They were also the largest ever constructed of reinforced concrete — then a very modern material and a particular source of pride for the Exhibition and British industry.[90] Combined the Palaces covered an area twelve times larger than Trafalgar Square, housed their own railroad depot for installing and removing the colossal industrial exhibits, and contained contributions from literally thousands of firms and industrial organisations. Politically and internationally, the Exhibition received support from all quarters. In Britain, Parliament wholeheartedly backed the project, hearing little dissent and funding special visits for thousands of students from the provinces. Similarly and despite a worldwide economic depression, every Imperial dominion and nearly every crown colony designed, financed, erected, contributed and staffed its own pavilion. Publicly, the Exhibition targeted and received an audience of nearly 30 million people. In 1924, Whit Monday alone saw more than 300,000 visitors. Finally in cultural circles, the Exhibition took hold of the popular imagination. Dozens of learned societies and social organisations chose the Exhibition as a meeting place. Rudyard Kipling named its avenues, and Edward Elgar composed music for its pageants and tattoos. Thousands were entertained in yet another enormous concrete building, and one that has retained its hold on the popular mind. Indeed it is indicative of the more general neglect of the British Empire Exhibition that Wembley's twin-towered stadium is not often considered by historians alongside the

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[90] E. Owen Williams, *Wembley: The First City of Concrete: A Little Talk and a Little Tour Which Will Open Your Eyes* (London, 1925).

Eiffel Tower and the Crystal Palace as an icon of the international exposition movement.

So while the Exhibition may have had its financial problems, it is a mistake to call it a failure. To do so is to ignore the effort and interest it commanded in its own day. Much of this interest involved the memory of war and the requirements of reconstruction. As the *Times* reported in its year-end review for 1924:

> How great the value of Wembley has been ... we shall never know ... But in the utterances of the Press of a score of countries, and in the personal testimony of innumerable individuals, we do know that it has been very great. Above the floods, the Exhibition has stood a solid rock of comfort and safety — an Ararat; more, a rainbow-promise in the skies returning sunshine and fair weather. Not everything was in flux — there must still be hope — when the British Empire could thus coolly set its feet again in the ordered paths of peace and industrial progress.[91]

Contrary to later analyses that have made it a failure, contemporaries judged Wembley on its ability to engender hope. The way in which it did so was to set its feet in the old ordered paths, to appeal to histories of science and peace. The extent and effect to which it communicated these histories made the British Empire Exhibition, by post-Great War standards, a trumpeting success.

Wembley opened on St George's Day in 1924 with an elaborate royal procession and ceremony. Bishops, soldiers and government ministers mingled with exotic peoples from around the Empire on and around the Royal Dais. Equipped with the latest advances in loudspeaker technology, the Dais itself seated 1,500, was dressed in scarlet and gold, canopied in purple and fitted with a golden crown-shaped balcony. Arriving in state coaches, the King, Queen and Princes were greeted by a full stadium of 110,000 and the thousands more that lined their procession.

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[91] 'Wembley Exhibition in Retrospect: Its Value to the Empire', *The Times*, 1 November 1924.

From the outset, the British Empire Exhibition stressed unity above all else. Wembley would be a bold statement of the correlative unities of science and mankind as manifest in Empire history. All would be directed at the promotion of peace and post-war reconstruction. On the morning of the opening, the *Times* laid out the hopeful vision:

> From the ashes of war arose a new Commonwealth of Nations with a new strength of purpose and a new faith in the future. Its structure, perhaps, was changed ... but the old foundations of mutual trust and mutual affection remain. War has been succeeded by a troubled peace, and to-day, from the political confusion and the industrial depression that still fetter the world, the white pavilions of Wembley stand out in bold relief. In the eyes of the world the Exhibition is an impressive reminder of the unity which alone could have made recuperation possible ... [92]

First to the podium that day was the Prince of Wales, speaking also as President of the Exhibition. Straining to be heard over the audible whispers of schoolgirls, he stressed the progressive aim of the undertaking and appealed to the history of the British Empire as an inspiration and source of peace. Requesting the King open the Exhibition, he hoped the Exhibition would remind the audience of their 'glorious heritage', strengthening their resolve to 'work unitedly and energetically' for the good of the Empire and 'for the benefit of mankind generally.'[93] Accepting the stage, the King elaborated these themes:

> [Wembley] stands for a co-ordination of our scientific knowledge and our common effort to overcome disease, and to better the difficult conditions which still surround life in many parts of the Empire ... And we hope, further, that the success of the Exhibition may bring lasting benefits, not to the Empire only, but to mankind in general. No nation or group of nations can isolate itself from the main stream of modern commerce; and if this Exhibition leads to a greater development of the material resources of the Empire and to an expansion of its trade, it will at the same time, be raising the

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[92] 'A Symbol of Unity', *The Times*, 23 April 1924.

[93] 'The Prince's Speech: A Living Picture of Empire', *The Times*, 24 April 1924.

> economic life of the world from the disorganisation caused by the war.[94]

Just as the king finished his speech, his sentiments were made manifest in a somewhat over-the-top display of scientific showmanship. Dramatically emphasising the potential for unity as demonstrated by empire and science, the King's opening words were flashed across the five continents of the British Empire and through dozens of countries by wireless and on telegraph lines. Even before the applause had died down, a telegraph boy entered the stadium, climbed to the dais and solemnly delivered the King's words back to him. The *Times* described the demonstration as yet 'another marvel of modern science which helps to knit the Empire together', saying, '"Peace hath her victories"; and this, the latest contribution of science to the requirements of Imperial ceremony, is not the least of them.'[95]

The display makes clear the effort devoted at Wembley to communicating a particular vision of science and its history. Messages of science's progressive past and future promise permeated every pavilion and parade. Indeed if the depth of interwar commitment to science history is best evident in George Sarton's New Humanism, than its extent is best evident at Wembley. Prominent displays of science history were erected by such diverse interests as the British Gas Industry, the Association of British Chemical Manufacturers, the Royal Society and the Ministry of Health. In some cases these displays tied the history of science and to empire directly; in other cases the parallels were merely implied. In all cases the themes of unity, peace, hope and reconstruction were the same.

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[94] Ibid.

[95] 'The Exhibition Opened', *The Times*, 24 April 1924.

In the Palace of Industry, the Chemical Hall contained a working reconstruction of an eighteenth century apothecary's shop, a series of iconic research instruments — with contributions from Earnest Rutherford and J. J. Thomson — and a giant frieze depicting the entire history and range of chemical endeavour. In addition the chemists produced a set of loosely historical publications. A lengthy collection of essays documenting the recent history and present state of pure chemistry was paired with a volume documenting the recent history and current state of the Empire's chemical industries.[96] A range of shorter publications, designed for a more general public, provided concise histories of specific processes and industries. These included a general handbook, entitled *Chemists and Their Work*, which sounded the overall tone of the Hall:

> Chemistry is the key to modern prosperity, to modern civilisation. It is chemistry which has brought the luxuries of this world within the reach of the great mass of the population; it is chemistry which enables this Empire to provide food for its teeming millions; it is chemistry which enables us to wage and endure war and to enjoy the blessings of peace ... It is the object of this pamphlet, prepared at the request of the Association of British Chemical Manufacturers and the Society of Chemical Industry, to explain, very briefly, the manner in which the chemist has effected this very surprising result, and to show the way in which the so contributes to our health and our happiness.[97]

In fact the Palace of Industry was itself designed as a material embodiment of the historical importance of scientific co-operation. Departing from accepted exposition practice, prizes were eliminated and individual firms were not allowed their own displays. Rather, 'representative groups', such as the Gas Industry and the Association of British Chemical Manufacturers, were asked to contribute co-operative

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[96] E. Frankland Armstrong, *Chemistry in the Twentieth Century: An Account of the Achievement and the Present State of Knowledge in Chemical Science* (London, 1924). A. W. Ashe, *Chemicals* (London, 1924). See also Irvine Masson, 'The Role of Chemistry in Physical Science', in E. Frankland Armstrong (ed.), *Chemistry in the Twentieth Century: An Account of the Achievement and the Present State of Knowledge in Chemical Science* (London, 1924), pp. 23-42; Irvine Masson, *Three Centuries of Chemistry: Phases in the Growth of a Science* (London, 1924).

[97] Stephen Miall, *Chemists and Their Work* (London, 1924), p. 5.

exhibits. The idea behind these departures from usual exposition practice was to reinforce the impression of unity. A little more than a week before the opening, the *Times* reported:

> It is no small undertaking to represent under a single roof the whole of the industrial activity of Great Britain; and the problem has been tackled in perhaps the only way in which it could have been successfully done. The interior of the building is in fact an exhibit in itself — quite apart from the individual displays — of the principle of scientific co-operation scientifically applied; that co-operation of which the Empire is the greatest example which the world has ever seen and of which this Exhibition is the latest fruit.[98]

The Palace of Engineering was organised on similar lines. Its five sections and 500,000 square feet of exhibits were maintained by five representative associations, including a general section by the British Engineers' Association, an electrical section by the Electrical and Allied Manufacturers' Association, and a motor display by the Society of Motor Manufacturers. In addition there were sections dealing generally with land and sea transport. History could be found throughout. With the upcoming centenary of the railways in mind, the transport section included a selection of historic locomotives, conspicuously juxtaposing Stephenson's first engine with the state-of-the-art 'Flying Scotsman'. The general section contained a contribution by the National Physical Laboratory, which documented its quarter-century of work in metrology. Even upon entering the Palace of Engineering, the visitor was reminded of the great heritage of British science and engineering at the Watt, Bessemer, Arkwright, Stephenson, Kelvin and Faraday Gates. The engineers' *Catalogue* described the purpose of these exhibits and reconstructive power seated in science history:

> For a hundred years there has not been such a need and such an opportunity as engineering offers the world today. A hundred years

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[98] 'Vast Palace of Industry, A Wembley Triumph, Scientific Cooperation', *The Times*, 15 April 1924.

> ago the condition of Europe was not unlike what its is at the present time. There had been a great and devastating war, in which practically all the civilised nations were engaged. Commerce had been brought to a standstill, finance dislocated, and industry, which had hardly yet begun in the form in which we know it was languishing. Some new impetus was required to give a fresh start to the flow of industrial life. That impetus came from engineering, which took its rise about that time. And it came from Great Britain. This country was the cradle of modern engineering. The greatest of the early pioneers came from here. In that world crisis of a hundred years ago, it is not too much to say that England (and Europe with her) was saved by her engineers. They are ready to come to our help again to-day.[99]

Nor was science history limited to the Palaces of Engineering and Industry. In the Pavilion of HM Government, the history of Imperial development and commerce stood between the Royal Society's Exhibition of Pure Science and the Ministry of Health's history of medicine.[100] The *Times* fitted its pavilion to operate a replica 1788 printing press.[101] And the dominions and colonies proclaimed their own contributions to the 'advance in civilisation'.[102]

Most dramatically, a Pageant of Empire relived the whole of Imperial history twice weekly in the Stadium.[103] Science history was scattered across the three-day pageant in tales of exploration, discovery and industrial advance, and featured most prominently in the 'pageant of learning' on the second day of the show. The main action of the Pageant involved historical characters each laying a brick on the stage, adding to a nascent bridge that took shape as the drama unfolded. As the *Times* reported:

> The Pageant itself is held together by a single motive which runs through it, giving it meaning and reason. This is Mr. Kipling's

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[99] British Empire Exhibition, *Official Sectional Catalogue of the Palace of Engineering* (London, 1924), p. 13.

[100] See British Empire Exhibition, *Guide to the Exhibits in the Pavilion of His Majesty's Government* (London, 1924).

[101] See 'The Times Pavilion: Printing Processes of 1788 Reproduced', *The Times*, 24 April 1924.

[102] British Empire Exhibition, *Nigeria, Its History and Products* (London, 1924), p. 11.

[103] See Charles Oman, *The Pageant of Empire: An Historical Survey* (London, 1924).

> figure of the Bridge of Empire — a bridge started by the heroes of the past and completed by the Dominions and the Colonies, with their achievements and sacrifices for the common cause.[104]

Overall, the theme was unity — human, historical, Imperial and scientific: The history of science and the history of empire were histories of bridge-building. Finally, too, these past achievements were linked to the present and the future. The hopes for post-war recovery that lay in these unities were made dramatically clear in the final scene of the Pageant. The 'Song of the Bridge' ended in the here and now with the bridge's completion. As wounded soldiers lay the last stone, widows, orphans and the entire cast returned to the stage to 'pass and re-pass on the bridge'.[105]

**The Peace Museum**

The Great War was no less deeply felt in the Science Museum, and its wartime history is a troubled one. During the war years and those immediately following, the Science Museum maintained only limited operations and opening hours in its old Western Galleries. Originally built as temporary housing for the 1862 sequel to the Great Exhibition, the inadequacy of these lodgings was long and well recognized. The largely wooden structure presented a serious fire hazard to the Museum's collections, and as early as 1911, a Board of Education committee recommended that new accommodations at least double in size be built to hold the science collections.[106] This report prompted new construction on Exhibition Road, but the limited progress that could be made during wartime would not immediately

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[104] 'The Pageant: "Song of the Bridge", Episodes in the Empire's Story', *The Times*, 23 April 1924.

[105] Ibid. See also 'The Empire in Pageant: Scenes from History Presented in the Stadium', *The Times*, 29 July 1924.

[106] Board of Education, *Report of the Departmental Committee on the Science Museum and the Geological Museum* (London, 1911), p. 5.

benefit the Science Museum. In 1918 wartime imperative allowed the War Cabinet to commandeer this unfinished 'Eastern Block' along with parts of the old Western Galleries. Only with the Cabinet's removal in 1922 did construction begin again in earnest, and the Eastern Block remained officially unopened until 1928.

Yet even these meagre accommodations were threatened in the years immediately following the Armistice. The Imperial War Museum was founded in 1917, and while it enjoyed the direct support of Parliament and Prime Minister Lloyd George, it too was inadequately housed. After unsuccessfully scouting several sites in central London, the War Museum finally settled for a short-term lease of the Crystal Palace in 1920.

The Crystal Palace lacked more than location: Its problems were both spatial and symbolic. On the one hand, the glass panes and painted girders of the Crystal Palace were completely unsuitable from a conservation standpoint. On the other hand, it seemed an altogether too light and airy setting for the War Museum's sombre subject matter.[107] With the Kew lease set to end in 1924, the War Museum sought new arrangements, and the Government presumptuously provided the Science Museum's Western Galleries in 1922.

The move was none too popular in South Kensington. With the Eastern Block still unfinished, the Science Museum was relegated to what was still a construction site and the War Cabinet's few makeshift offices. Fears were aroused that the War Museum might even set its sights on the Eastern Block. The Science Museum could not remain silent, and the public controversy that ensued provides important insights

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[107] Gaynor Kavanagh, *Museums and the First World War: A Social History* (London, 1994), pp. 144-50.. See also Chapter 10 for a discussion of the War Museum's early accommodation struggles. Kavanagh remarks specifically at the incongruity of the exhibits, which set war machines carried from the Flemish mud amidst the potted palms of the Crystal Palace.

into the perceived purposes of both museums. As both were forced to justify their worth, both revealed their aims and aspirations.

Unfortunately for the Science Museum, the Imperial War Museum had on its side the powerful needs of mourning and commemoration. Conceived of as an official location for post-war mourning, the Imperial War Museum stood as a state-sponsored recognition of the human loss of war. It also assuaged the common public anxiety that the dead might be forgotten. Unsurprisingly the War Museum was met by tremendous public enthusiasm. The experience of war was universal in interwar Britain, and the Imperial War Museum received nearly universal support.[108]

It was unclear how the Science Museum might compete this. To disparage the purposes of the War Museum was to disparage the memory of the dead and needs of their bereaved, and the Science Museum could not attack the new museum directly. Unable to *un*-do its rival, the Science Museum would somehow have to *out*-do it. This meant arguing its case in terms of war and peace, and construing its own work in terms of post-war necessities. This placed the Science Museum on an unfamiliar footing. During its accommodation dispute with the Imperial War Museum, the Science Museum was forced to compete by the War Museum's rules.

Advisory Council meetings were occupied with the problem. Formal appeals were made to the Board of Education, and informal appeals were published in the *Times* and *Museums Journal*.[109] Letters of support were obtained from prominent

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[108] Gaynor Kavanagh, 'Museum as Memorial: The Origins of the Imperial War Museum', *Journal of Contemporary History*, 23 (1988), 77-97. See also Jay Winter, *Sites of Memory, Sites of Mourning: The Great War in European Cultural History* (Cambridge, 1998), p. 80.

[109] Published appeals of behalf of the Science Museum include Sir Hugh Bell, 'The Science Museum', *The Times*, 18 December 1923; Sir Hugh Bell, 'The Science Museum', *Museums Journal*, 23 (1924), 200-1; J. Bailey, 'The Science Museum', *The Times*, 18 December 1923; J. Bailey, 'The Science Museum', *Museums Journal*, 23 (1924), 201-2.

members of the scientific and industrial community, and sympathetic members of the museum community were organised in quiet opposition to the new museum.[110]

In each case, the Science Museum and its supporters argued their case in terms of the Science Museum's value to the 'national welfare' in post-war reconstruction. The strategy was to turn attention away from the destruction of wartime and toward the demands of the new peace. The Science Museum thus held itself out as a place to celebrate mankind's constructive achievement and to inspire peaceful progress. The Museums Association's 1924 Wembley British Empire Exhibition meeting heard a Dr Bolton argue the cause:

> Dr Bolton described the Science Museum as the Cinderella of London museums. It was the most important of them all, yet it had been treated the worst. He was impressed with a sense of wonderment that it was possible at this time for a British Government to allow a museum of its character to have its floor space cut down to one-fourth of the minimum which had been laid down years ago, and to have its accommodation restricted in favour of a war museum. It was a curious anomaly that a museum which exhibited the means of destroying all the wonderful achievements of industry should be allowed to take the place that ought to be occupied by a museum which showed people how to better themselves and the whole world. He felt sure that if he asked the meeting for an emphatic opinion as to the propriety or otherwise of the War Museum's being at South Kensington it would object unanimously to its being there (Hear, hear).[111]

Such feelings were not confined to discussions of the Science Museum's accommodation problems. In fact in the immediate post-war period, notions of science museums as museums of global betterment became an important part of their public face and discourse. As early as November 1919 and well before the Science Museum's dispute with the Imperial War Museum, the *Museums Journal* published a

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[110] See Board of Education papers in PRO Ed. 23/521. See also Science Museum Advisory Council, *Reports for the Years 1920-1924*.

[111] Museums Association, 'Discussion', *Museums Journal*, 24 (1924), 118.

piece entitled 'If a Museum of War, Why Not a Museum of Peace?'[112] Written by British Association General Secretary J. L. Myres, the article weighed the merits of museums of science and industry — like the museums at South Kensington — with those of the new Imperial War Museum. It opened with a hint of irony. Not only, Myres argued, was the glass and steel of the Crystal Palace inappropriate for the War Museum's collection, so too was the building's history incongruous with the War Museum's subject matter. More in the spirit of the Crystal Palace's history as 'a landmark in the history of invention', Myers suggested that the site be used to increase the nation's collections of science and industrial art. Indeed Myres argued that the war's recent end provided a unique opportunity to preserve pre-war objects of art and industry. He wrote:

> ... the occasion of the national — indeed world-wide — stock-taking and spring-cleaning, after this 'winter of our discontent' offers chances which will not recur of securing and assembling typical examples of 19th century craftsmanship.[113]

Here Myres offered an alternative notion of post-war remembrance. Real commemoration and respect for the fallen, argued Myres, required not only memories of war, but also memories of the 'material surroundings' of the peace that preceded it. The war must not be remembered only in terms of its losses, but also for the scientific knowledge that emerged from the crisis and the potentialities of 'post-war applications of military devices to civil life'. These applications must also be on display in any institution spawned by the war. Instead of a war museum, Myres

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[112] J. L. Myres, 'If a War Museum, Why Not a Peace Museum?' *Museums Journal*, 19 (1919), 73-6.

[113] Ibid., 73.

argued, the nation should erect a Peace Museum to preserve and memorialise productive and progressive historical monuments.[114]

In its dispute with the Imperial War Museum and after, the Science Museum repeatedly marshalled these arguments. Forced to argue its case in terms of war and peace, the Science Museum took up the mantle of Peace Museum. Thus where the Imperial War Museum proposed a memorial based on the preservation of the experience of war, the Science Museum proffered a memorial based on the history of scientific progress and subsequent hopes for reconstruction. Where the Imperial War Museum supported the nation's need to mourn, the Science Museum supported its hopes for peace. In the wake of the Great War, to support the Science Museum was to proclaim the promise of science's past, to promote the cause of peace and renewal, and to ensure that the fallen had not died in vain.

In the end, the accommodation dispute between the Imperial War Museum and the Science Museum was resolved in a way satisfactory to both parties. The Imperial War Museum soon secured a better site in Lambeth, and the Science Museum moved into the new galleries of the Eastern Block. In an unexpected boon the Science Museum, moreover, the Imperial War Museum's initial move from the spacious quarters of the Crystal Palace to the cramped Western Galleries forced it to divest its aeronautical collections, which the Science Museum happily received in exchange for its own sectioned firearms collections. Indeed this trade in itself is powerful evidence of the two museums' preferred positions *vis-à-vis* issues of war and peace.[115]

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[114] Ibid., 75.

[115] Science Museum Advisory Council, *Report for the Year 1924* (London, 1925), p. 5. See also the testimony Imperial War Museum Director Charles ffoulkes before the Royal Commission on National

Despite the happy outcome, the controversy is important on many counts. The threat of dislocation set the stage for the Science Museum's subsequent obsession with space, and throughout the interwar period and beyond, Advisory Council and Director's reports were dominated by details of the 'struggle' for greater accommodation.[116] More importantly, however, the accommodation dispute with the Imperial War Museum draws attention to the powerful presence and operation of post-war memory in the interwar Science Museum. The interwar Science Museum's particular brand of science history did not remain untouched.

**Museums of the New Age**

Unlike the industrialised countries of Europe, the United States emerged from the Great War without a great science museum to which to turn its hopes and attention. This situation did not escape the newly worldly consciousness of Americans, including many among the industrial and cultural elite. Early in the interwar period a very public call to action went out, announcing the 'national need' for a great museum of science and industry, equal to those European institutions in South Kensington and Munich, and fitting to the new geo-political status and unrivalled industrial might of the Great Republic.

Among the cultural elites who added his voice to the call was Charles Richards, Director of the American Association of Museums. Following from

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Museums and Galleries. Royal Commission on National Museums and Galleries, *Oral Evidence, Memoranda and Appendices to the Final Report* (London, 1929), p. 96.

[116] The depth of this tendency is perhaps best illustrated in the organization of the Science Museum archive itself, where one number is set aside for documents pertaining to 'the struggle for accommodation'. See Science Museum Archive Z 201. In fact the face of later Science Museum historiography is also marked by an obsession with the building programme. See for example Dave Rooney, *The Events Which Led to the Building of the Science Museum Centre Block, 1912-1951*, *Science Museum Papers in the History of Technology 7* (London, 1998); D. Follett, *The Rise of the Science Museum under Henry Lyons* (London, 1978), in particular, Chapter VII, 'The Building of the East Block' and Chapter VIII, 'The Pressure for the Centre Block'.

interest in industrial education at the United States General Education Board and a series of grants to study its provision, the American Association of Museums undertook a study of European science and technology museums. Richards himself spent nearly a year in Europe, visiting museums and museum professionals in eleven countries, among them the Conservatoire des Arts et Metiers in Paris, the Science Museum in London, the Deutsches Museum in Munich and the Technisches Museum in Vienna. An extensive report entitled *The Industrial Museum* was published in 1925.[117] In large part an accounting of European activities and developments, its final chapter, 'Industrial Museums in the United States' provided a clarion call and justification for the establishment of American museums. It was a distinctively American appeal, which unabashedly and perhaps naively linked the interests of mankind to the American national interest and American purposes to the purposes of the Peace Museum:

> The history of industrial progress is the history of the successes that have been won in the ceaseless struggle to conquer time and space. It is at the same time a history of the achievements by means of which human energy, at first consumed entirely by the struggle for mere existence, has been increasingly liberated for less material aims. Upon these achievements rest not only the physical comforts and facilities that we enjoy today but in a large sense our spiritual well-being and intellectual development.
>
> The story is one of great cultural significance. It is a record of the victories that human intelligence has won in harnessing material forces to the service of society. Unless the elements of this history are made a part of our common culture, the individual can hardly obtain any true understanding of the social order in which he lives or comprehend even in a limited way the phenomena by which he is surrounded.
>
> We are today one of the foremost industrial countries of the world. Can we afford to omit from our educational program the story of what has made us? We have developed a high type of industrial organization and as a people we are the first to utilize the fruits of new inventions. Shall we leave other nations to grow wise through the study of our achievements and ourselves neglect their meaning and their inspiration?

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[117] C. R. Richards, *The Industrial Museum* (New York, 1925).

To tell the story adequately we need the industrial museum.[118]

Richards' report provided a constant touchstone for the science museum movement in America. Future calls to action would invariably refer back to Richards as a source of inspiration and authority.[119] Moreover, his report provided a model for future pleas, and the formula whereby a review of European successes combined with a call to American action served to stir up a complex combination of patriotic pride and envy, capitalist ambition, industrial educationism, cosmopolitan desire, international solidarity and humanitarian responsibility would become commonplace.[120] These were the strings that moved the delicate marionette of the American science museum movement. Undoubtedly, it was an uneasy balance and indicative of larger conflicts within the movement and indeed within American identity, culture and politics more generally. Yet for a time it proved tremendously successful, and the American science museum movement flourished — if only in the minds of its promoters.

In fact, the ambitious rhetoric of the American science museum movement reinforced an equally ambitious practical programme, and one that was already well underway when Richards published *The Industrial Museum*. In his report, Richards suggested that America's size and industrial diversity required the establishment of both 'comprehensive' museums in great cities like New York and Chicago and more specialised museums in cities like Pittsburgh and Detroit to 'reflect the particular

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[118] Ibid., pp. 46-8.

[119] See, for example, F. C. Brown, 'The National Need for the Museum of Science and Industry', *The Engineer*, December 1928; 'Extracts from *The Industrial Museum* by Prof. Charles R. Richards', *The Repertory*, April 1928.

[120] See, for example, Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'National Museum of Engineering and Industry, To Be Under the Direction of the Smithsonian Institution, Washington, D.C.' 1924; Charles Gwynne, *Museums of the New Age: A Study of World Progress in Industrial Education* (New York, 1927).

industries of these cities.'[121] In fact in the years immediately before and after Richards' call, committees were convened and articles of incorporation filed in most of America's great industrial centres. In Philadelphia, the venerable Franklin Institution — a publishing house and scientific society — restructured itself with the purpose of becoming a museum of science and technology. Outside Detroit, Henry Ford established the Edison Institute and Dearborn Village, an idealised village of the industrial revolution. In Chicago, Sears & Roebuck, Co. Chairman Julius Rosenwald directed over $3,000,000 toward the establishment of an industrial museum. In New York City, the 1911 bequest of Henry R. Towne, of the Yale & Towne Lock Manufacturing Company, launched plans for a vast complex of industrial museums, collectively labelled the Museums of the Peaceful Arts. And in Washington, a movement emerged to establish a National Museum of Engineering and Industry, to be under the direction of the Smithsonian Institution. Taken together these and other smaller regional developments represented a vast and gathering science museum movement. Like many things American, it would not be marked by subtlety.

The story of the National Museum of Engineering and Industry is certainly the most telling, if also the most convoluted, story in the interwar history of the American science museum.[122] Since at least the 1876 Centennial Exhibition in Philadelphia, from which the Smithsonian Institution had acquired its first large technological collections, science history had been gathering momentum at the Smithsonian. This

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[121] C. R. Richards, *The Industrial Museum* (New York, 1925), p. 48.

[122] This story has been told admirably by Art Molella, among others. See Arthur Molella, 'The Museum That Might Have Been: The Smithsonian's National Museum of Engineering and Industry', *Technology and Culture*, 32 (1991), 237-63. See also Marilyn S. Cohen, 'American Civilization in Three Dimensions: The Evolution of the Museum of History and Technology of the Smithsonian Institution' (George Washington University Ph.D. Dissertation, 1980); Pamela M. Henson, '"Objects of Curious Research": The History of Science and Technology at the Smithsonian', in Margaret W. Rossiter (ed.), *Catching Up with the Vision: Essays on the Occasion of the 75th Anniversary of the Founding of the History of Science Society* (Chicago, 1999), pp. S249-70.

momentum reached a new height under the watch of Carl W. Mitman. Trained as an engineer at Lehigh and Princeton, Mitman had arrived at the Smithsonian in 1911 and in 1918 became chief curator of the Institution's technology collections. In this position, Mitman worked to consolidate these collections and organize them under an independent Department of Mechanical and Mineral Technology, of which he became the first head. Then in 1920 Mitman went further. Amidst competing proposals for the building of museums dedicated to art and the military, Mitman added a call for the Smithsonian's Regents to build a dedicated museum building for the technological collections as they had recently done for the biological and earth sciences collections.[123]

Most importantly, Mitman's call attracted the attention of Holbrook Fitz-John Porter, a New York engineer who, among other things, had directed the very successful Machinery Hall at the 1893 Columbian Exposition in Chicago. Porter moved quickly to undertake a vast fundraising and public relations campaign on behalf of the hoped-for national museum. Right away he enlisted the support of several prominent engineers including Thomas Edison, Orville Wright and Secretary of Commerce Herbert Hoover.[124] By the end of 1922 he had enlisted the four 'Founder Engineering Societies' — the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers and the American Institute of Electrical Engineers — and announced their intention to establish an engineering museum. According to the

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[123] United States National Museum, *Annual Report* (Washington, DC, 1920), p. 141. The National Museum of Natural History was founded in 1911 as the first subject-specific museum of the Smithsonian Institution. The technology, art, history and other collections remained part of and housed in a greater United States National Museum building. For efforts to establish a United States war museum, see Smithsonian Institution Archives RU 192, Box 194, Folder 2. See also 'May Establish U.S. War Museum', *The Brooklyn Union*, 12 April 1918; 'This War's Trophies', *The Boston Evening Transcript*, 20 April 1918; 'As to Museums', *The Boston Herald and Journal*, 20 May 1918.

[124] 'Hoover Indorses Engineer Museum', *The Washington Star*, 26 April 1920.

papers, moreover, Porter had also secured the blessing of the Smithsonian Institution itself, which 'agreed not only to act as custodian of the collection, but urged that it be made the nucleus of a great national museum of engineering and industry.'[125] Finally in 1924, Porter published a more formal prospectus for his museum, now incorporated under the title 'The National Museum of Engineering and Industry, To Be Under the Smithsonian Institution' and announced the Museum's foundation in radio broadcasts and numerous newspaper and magazine articles.[126] He accompanied his announcement with architectural plans for a vast building on the National Mall, and the National Museum of Engineering and Industry even began publishing a quarterly newsletter entitled *The Repertory.*[127]

Porter's plan, as laid out in these promotions, was impressive. At least $10,000,000 would have to be raised to construct museum buildings and to maintain the collections in Washington. Of this total, nearly $5,000,000 would be directed toward an imposing neo-classical structure on the Mall, a building spanning nearly five of Washington's enormous city blocks and nearly double the size of the Smithsonian's recently completed National Museum of American History:

> The parent Museum will be the largest Museum building in the world, 1150 feet long, 250 feet deep and 80 feet high and contain over 25 acres of floor area. This great building erected in sections

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[125] 'Historical Museum for Our Engineers', *The New York Times*, 25 February 1923. See also George Sarton, 'Engineers Planning National Museum', *The New York Daily News*, 11 August 1922; 'The Hall of Fame for American Inventors', *The New York Tribune*, 2 September 1923.

[126] Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'National Museum of Engineering and Industry, To Be Under the Direction of the Smithsonian Institution, Washington, D.C.' 1924. For Porter's publicity push see, for example, 'Mall is Selected for Museum Site', *The Washington Star*, 11 January 1925; Smithsonian Institution Archives RU 297, Box 9, 'Articles & Clippings': '$10,000,000 Engineering Museum Plans Passed: Smithsonian Institution Regents Approve Project for Big National Building', 28 April 1925; 'Exhibits of the Nation's Material Growth', *The New York Times*, 21 June 1925; 'A National Museum of Engineering and Industry', *Power*, 30 June 1925; I. S. Proper, 'The National Museum of Engineering and Industry', *Power*, 14 July 1925; Smithsonian Institution Archives RU 192, Box 253, Folder 4: H. F. J. Porter, 'A Great National Museum of Engineering and Industry, Radio Broadcast from Municipal Station WNYC', 10 March 1925.

[127] Architectural plans and copies of Museum's newsletter, *The Repertory*, can be found in the Smithsonian Institution Archives RU 192, Box 253.

> will gradually replace the antiquated buildings of the Smithsonian Institution by one of the handsomest of the beautiful structures adorning the Mall and aid in making Washington the finest capital city of the world.[128]

Perhaps even more impressive than Porter's designs on Washington were his plans for the rest of the country. Not only did Porter intend for a magnificent national museum to be built in Washington, but also for an entire network of specialized affiliate museums to be founded around the country. He wrote, 'With the parent institution thus functioning in Washington, the present plan calls for the establishment of local museums or industry in New York, Chicago and other great American centers ... around the full chain of America's sisterhood of cities.'[129] In fact Porter envisioned a 'sisterhood' of well over 50 American museums in every State of the Union.[130] Finally — as if this wasn't already enough — Porter proposed a vast program of 'travelling exhibits, illustrated lectures, motion pictures, radio talks, literature, etc.' to meet the needs of those not benefiting from his nationwide network of museums.[131]

Grand plans weren't unique to Porter. Indeed the most outstanding feature of New York's proposed Museums of the Peaceful Arts was simply the physical grandeur of their design. Though considered in Porter's scheme as one of the National Museum's many affiliates, in fact the Museums of the Peaceful Arts had

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[128] Smithsonian Institution Archives RU 192, Box 253, Folder 4: H. F. J. Porter, 'A Great National Museum of Engineering and Industry, Radio Broadcast from Municipal Station WNYC', 10 March 1925. See also Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'A Great National Museum for Industrial America', 1924. and other documents, including architectural plans, in Folder 4.

[129] Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'National Museum of Engineering and Industry, To Be Under the Direction of the Smithsonian Institution, Washington, D.C.' 1924, pp. 6-7.

[130] See, for example, the map provided in Ibid., p. 22.

[131] Smithsonian Institution Archives RU 192, Box 253, Folder 4: H. F. J. Porter, 'A Great National Museum of Engineering and Industry, Radio Broadcast from Municipal Station WNYC', 10 March 1925. Also Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'National Museum of Engineering and Industry, To Be Under the Direction of the Smithsonian Institution, Washington, D.C.' 1924.

little interest in subservience and no intention of starting small. Early in the interwar period, plans for 'A Monumental Museum' were commissioned and a site spanning several blocks and almost fifteen acres in the Bronx procured:

> Accordingly, plans for a huge structure have been prepared for a building containing 400,000 square feet. This building would be 600 feet long and would consist of a square tower 100' x 100', 12 stories high, with two additional stories for the penthouse. There would be two wings, 250' x 100' and six stories high, as well as a basement under the entire building. Access to the upper floors would be gained by four high-speed elevators; two stopping at the sixth floor and two at the twelfth floor. Two freight elevators would be provided, one in each wing. They would accommodate exhibits 10' x 12', which is about as large as can be handled in a museum, except where they are built on the floors. There would be four standpipes and a fire tank containing 7,500 gallons. An automatic electric fire pump would be in the basement, as well as a sanitary pump to supply a 2,500 gallon tank, both in the penthouse. Such a structure would do away with a number of small structures.[132]

Initial construction and endowment costs for this project were estimated at well over $10,000,000. The annual budget was projected at around $350,000.[133] No detail was spared. George Frederick Kunz's 'Presidential Report' — supplied to his Board in nine thick folio volumes — considered everything from the design of exhibit cases, to the typeface of labels, to the placement of turnstiles, and in all cases was laboriously detailed. Water closets even received special attention: Kunz wrote, 'Lavatories in public buildings leave much to be desired, and those in the Museums of the Peaceful Arts should be well-appointed and well-kept. If three is a large volume of visitors a man and a woman attendant (colored) should be provided.'[134]

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[132] Dibner Library MSS 001736 B 1 v. 5: George Frederick Kunz, 'Museums of the Peaceful Arts, Supplement to the President's Report', 8 September 1927, pp. 1-2.

[133] Ibid.

[134] Dibner Library MSS 001736 B 1 v. 2: George Frederick Kunz, 'Museums of the Peaceful Arts, President's Report', 1 July 1927, p. 15. See also Dibner Library MSS 001736 B 1 v. 3: George Frederick Kunz, 'Museums of the Peaceful Arts, Supplement to the President's Report', 15 November 1927. and building plans in Dibner Library MSS 001736 B 1 v. 7: George Frederick Kunz, 'Museums of the Peaceful Arts, Album of Plans to Accompany the President's Report', 1 June 1927.

In both cases, ambitious proposals were justified on the basis that 'the great appeal of a Museum of Science and Technology' demanded a suitably great structure.[135] They were also tied to a well-articulated and deeply held conception of science history. Vast buildings were only fitting for the vast history of science and industry intended for their halls. Just as in the Science Museum in London and in Sarton's ambitious *Introduction*, the scope of the American science museum was to be encyclopaedic in keeping with an overarching ecumenical message of the scientific and historical unity of mankind.

First and foremost, encyclopaedism would mark the exhibition galleries of the American museum movement. For example, the 1914 Charter of the Museums of the Peaceful Arts listed twenty areas of display—items 'a' through 't'—including Electricity, Steam, Astronomy and Navigation, Safety appliances, Aviation, Mechanical Arts, Agriculture, Mining, Labor, Efficiency, Historic Records, Health and Hygiene, Textiles, Ceramics and Clays, Architecture, Scenic Embellishment, Gardening, Roads and road building materials, Commerce and Trade and Printing and Books.[136] Similarly, an endorsement of the National Museum idea in the engineering journal *Power* listed 'minerals, mineral technology, textiles, firearms, boats, railroad models, electrical apparatus, musical instruments, ceramics, graphic arts and photographic progress' among the many subjects to be displayed.[137] Laurence Vail Coleman of the American Association of Museums agreed that the Museums of the

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[135] Charles Gwynne, *Museums of the New Age: A Study of World Progress in Industrial Education* (New York, 1927).

[136] Association for the Establishment and Maintenance for the People in the City of New York of Museums of the Peaceful Arts, *Charter* (New York, 1914). That this was not an isolated instance is demonstrated in Richards' own accounting of the proper scope of the industrial museum, which singles out Agriculture, Mining and Smelting, Iron and Metal Working, Prime Movers and Machines, Electro Technology, Transportation and Communication, Chemical Industries, Agricultural Industries, Fiber Industries, Stone and Earth Industries, Building Construction, Graphic Arts and Safety and Sanitation. See C. R. Richards, *The Industrial Museum* (New York, 1925), pp. 48-50.

[137] I. S. Proper, 'The National Museum of Engineering and Industry', *Power*, 14 July 1925.

Peaceful arts would be indeed be 'an encyclopaedic set of museums of American industry.'[138]

However the best example of the structural manifestation of this encyclopaedic vision of science history is Porter's anticipated national network of museums. Undoubtedly Porter's reasons for proposing this network were in some respects pragmatic. On the one hand, in a country the size of the United States, regional museums would be necessary to service a national audience. On the other hand, records show that the network was at least in part conceived as a means of bringing regional industrial leaders and the promoters of other institutions — for instance the Chicago Museum of Science and Industry and the Museums of the Peaceful Arts — on board.[139] That is, to a certain extent, Porter needed to include existing regional efforts in his planning if he hoped to achieve the national support necessary to found a National Museum.

Nevertheless, there was a deeper and more fundamental motive behind Porter's proposal of a national network of museums. Here can be seen the importance Porter placed on encyclopaedism and the work he intended his network to perform in maintaining it. First of all, Porter and his allies argued that the existence of specialized regional museums would ensure that no aspect of the history of science and technology would be overlooked:

> Chicago is certain to trace the development of sowers and cultivators, harvesters and tractors with sympathetic thoroughness ... Proceeding from Chicago to Minneapolis we may be sure to find that city presenting with completeness the steps which have perfected every detail of her great flourmills. In Detroit will be brought together the outstanding devices which culminate in the automotive arts of this hour. Pittsburgh, we may expect, will

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[138] George Frederick Kunz, 'The Projected Museum of the Peaceful Arts', *Museum News*, 15 November 1924.

[139] Arthur Molella, 'The Museum That Might Have Been: The Smithsonian's National Museum of Engineering and Industry', *Technology and Culture*, 32 (1991), 237-63.

> assemble in striking array the furnaces, machines and engines which stand between iron ore and rails and rods, girders and wires of modern construction ... New York, in the electrical courts of her Branch Museum, may well lead the Union. Her use of electricity for light and transportation, for manufacture and trade, is the most varied and extensive on earth ... [140]

Secondly and more subtly, the network would maintain encyclopaedism by assisting in the effective display in each museum of the fundamental continuity of scientific and industrial progress 'from the earliest rude inventions, through succeeding steps of progress and knowledge, down to the perfections of the modern day.'[141] Here a national network of museums would ensure, through the sharing and distribution of replicas and models, that each museum maintained and displayed a complete, comprehensive and unified record of the progress of science and technology. Porter wrote,

> Each such branch museum, it is planned, may obtain from the Washington institution authentic replicas of all specimens preserved at headquarters, and where actual replicas are not desired by the local institution, photographic representations will be furnished so that there shall be no gap in the evolutionary display of any of the affiliated institutions. Similarly, where a local museum holds an original invention, replicas and photographs will be sent to the national institution to perfect its exhibits.
>
> Thus is established a vital interchange between federal institution and all section institutions, whereby every section of the country will benefit by the work and by the collections of all the other sections.[142]

In this way, then, the national network of museums at once ensured that the encyclopaedism would be maintained both *across* and *within* the many member institutions of the National Museum.

A subtle ecumenism inhered in this encyclopaedic scheme. Indeed the network itself would be a physical embodiment of both ideas. On the one hand the

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[140] George Iles, 'Engineering and Industrial Museums for America', *The Repertory*, July 1928.

[141] Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'National Museum of Engineering and Industry, To Be Under the Direction of the Smithsonian Institution, Washington, D.C.' 1924, p. 5.

[142] Ibid., p. 20. See also 'Mall is Selected for Museum Site', *The Washington Star*, 11 January 1925.

specialised regional museums, taking each subject in turn and together ensuring the completeness of all, reflected the ideal of encyclopaedism. On the other hand the National Museum, comprehensive in its subject matter and pulling from each of the regional museums, reflected unity and ecumenism: 'And so on, throughout our sisterhood of cities, each with a just pride in its own victories and all rejoiced to share the boon of a united and competent control.'[143]

This last statement hints at the broader cultural meanings and societal designs behind the science history proposed by the promoters of the American science museum. These were the purposes of the Peace Museum, and in fact little attempt was made to hide them. Witness first of all the Museums of the Peaceful Arts, an institution whose very name was a statement of societal purpose in itself. Even on the brink of European war, the Museums' founding charter could unabashedly dedicate the institution as 'a permanent and useful memorial to the century of peace and amity that has followed the signing of the Treaty of Ghent on Christmas Eve, 1814.'[144] Perhaps surprisingly, moreover, these sentiments survived the war fully intact. For example, a 1924 article in the American Association of Museums' newsletter, quoted President Kunz as saying:

> If $50,000,000 had been put into industrial museums twenty years ago, it would have saved the country many billions at the beginning of the war. If you educate a man in what has been done, he will know what is going on at present and he will have a better idea as to what is wanted for the future. A creative genius is a man who aids in moving the nation.[145]

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[143] George Iles, 'Engineering and Industrial Museums for America', *The Repertory*, July 1928.

[144] Association for the Establishment and Maintenance for the People in the City of New York of Museums of the Peaceful Arts, *Charter* (New York, 1914).

[145] George Frederick Kunz, 'The Projected Museum of the Peaceful Arts', *Museum News*, 15 November 1924.

Or take the 1927 survey of European museums of science and industry which argued that European nations had wisely 'evolved as one panacea this entirely novel idea of the industrial museum' and that 'for the security of the nation, for the uprightness of the individual, for the welfare of the world, there must be today beyond any other know period, a definite step taken by leaders in all departments to cause everyone everywhere to know something of everything.'[146] Or finally the Museums' 1929 promotional pamphlet which argued the Museums' case on the grounds that, 'Never in the history of mankind has it been made so clearly evident, as in recent days, that the hope of civilization lies in unselfish co-operation and there should be little place for the selfish man or selfish organization in our political, industrial and social fabric.'[147]

In this way the American science museum movement rhetorically tied an encyclopaedic and ecumenical vision of science history to a broader and potential human unity. By entangling science history with post-war hopes for peace, and like the Science Museum in London and George Sarton's *Isis*, the Museums of the Peaceful Arts, the National Museum of Engineering and Industry and their allied institutions of the American science museum movement carved out a space for themselves in the crowded cultural politics of the interwar period and held themselves out for a hopeful moment as sites of salvage and salvation.

The moment would not last long.

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[146] Charles Gwynne, *Museums of the New Age: A Study of World Progress in Industrial Education* (New York, 1927), p. 9.

[147] Dibner Library MSS 001736 B1 v. 1: Museums of the Peaceful Arts, 'The New York Industrial Museum', 1929.

# Chapter 2: Practitioners

## New Humanists, New Scientists

In August 1928, at the Sixth International Historical Congress in Oslo, Aldo Mieli — the Italian editor of the international journal *Archeion* — led six senior historians of science in forming the first permanent Comité International d'Histoire des Sciences. By year's end, this group had grown to twenty-two members, hailing from Britain, America and a half dozen European countries. In 1935 the vastly enlarged Comité would become the Academie Internationale d'Histoire des Sciences, a body still operating today.[148]

By and large, interwar science historical practitioners cannot be easily or neatly categorized. This holds for the twenty-two original members of the Comité. On the one hand, the solitary nature of advanced historical research has always meant that university-based historians of science are — by comparison with their counterparts in the museum — solitary figures. On the other hand, even by comparison with their colleagues in other parts of the university, interwar historians of science lacked the institutional and disciplinary structures such as degrees, departments, libraries and laboratories that function as incubators of group identity. As pioneers of their little subject, the original members of the Comité did not receive the benefits of well-trodden career paths, established qualifications, clearly drawn job descriptions, institutional training manuals and employee handbooks in forging their professional identities.

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[148] Christoph J. Scriba, 'The Beginnings of the International Congresses of the History of Science', in Fritz Kraft and Christoph J. Scriba (eds.), *XVIIIth International Congress of the History of Science, 1989: Final Report* (Stuttgart, 1993), pp. 3-10.

This does not mean, however, that these early historians of science were so idiosyncratic as to be beyond analysis and some generalisation. Rather, as extra-institutional intellectuals, interwar historians of science were simply bound more by their common experiences and mentalities than by any overt social conventions. Most outstanding is the dominance of scientists in the ranks of these early practitioners. Humanists were scarcely to be found. For instance, in a paper presented to the 1919 meeting of the American Historical Association, the senior historian Henry Elmer Barnes complained:

> Aside from the feeling of gratitude and satisfaction over being able to have at one of our Association conferences such a group of eminent scientists, the fact which strikes a historian most vividly with respect to this conference is that at the first session of the American Historical Association on the history of science, three out of four of the formal papers were presented by natural scientists.[149]

Likewise, Anna-Katherine Mayer has shown that, contrary to common misconceptions, scientists and not historians were the driving force behind the establishment of the Cambridge History of Science Committee in the mid-1930s.[150] Indeed, of the seven founding fathers of the Comité, all but one — Lynn Thorndike — was trained as a scientist, mathematician or physician. And of the fifteen other original members, only a handful were formally trained as humanists.[151]

Among the Comité's scientist-founders was the great British historian of medicine and science, Charles Singer. Singer was born in 1876, the son of Rabbi Simeon Singer, editor of the official prayer book of the United Hebrew Congregations of the British Empire. Surrounded by the lofty and learned of the British Jewish

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[149] Harry Elmer Barnes, 'The Historian and the History of Science', *Scientific Monthly*, 11 (1920), 117.

[150] A. K. Mayer, 'Setting Up a Discipline: Conflicting Agendas of the Cambridge History of Science Committee, 1936-1950', *Studies in the History and Philosophy of Science*, 31A (2000), 665-90.

[151] For a list of these members, see George Sarton, 'International Committee of the History of Science', *Isis*, 12 (1929), 323.

establishment, Charles grew up in bourgeois comfort. Trained in zoology at Magdalen College, Oxford and in medicine at St Mary's Hospital in London, Singer started his career in 1903 as a physician. In 1910 he married Dorthea Cohen, also from a prominent Anglo-Jewish family and a historian of alchemical manuscripts. Interested in science history since his student days — when he first heard the historical lectures of Sir William Ramsay — and with the encouragement of his wife, Singer published his first papers in the history of science in 1911.[152] In 1914 he gave up his medical practice, and took up history full-time. Appointed to a special research position by Sir William Osler in Oxford, Singer embarked on a fifty-year career in science history.

If Sarton would become the foremost promoter of science history in America, then Singer would become its outstanding spokesman in Britain. Along with his wife and William Osler, Singer played a pivotal role in the establishment of perhaps the first university-based history of science institution in Britain — the History of Science Reading Room in Oxford's Bodleian Library.[153] Appointed to a lectureship at University College, London in 1920, Singer then helped establish Britain's first graduate degree in History of Science in 1924.[154] About the same time Singer founded the first science history journal in Britain, the short-lived monograph series, *Studies in the History and Method of Science*.[155] Singer then went on, among other

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[152] Charles Singer, 'Benjamin Marten, A Neglected Predecessor of Louis Pasteur', *Janus*, 16 (1911), 81-98; Charles Singer, 'A Forgotten Prophesy of the Microbic Theory of Disease', *Lancet*, 1 (1911), 684-6.

[153] For Singer's activities in Oxford see J. Morrell, *Science at Oxford, 1914-1939: Transforming an Arts University* (Oxford, 1997), pp. 262-3.

[154] For Singer's early involvement at UCL see Charles Singer, 'Courses on the History of Science at University College, London', *Isis*, 3 (1920), 419-20. See also W. Smeaton, 'History of Science at University College, London, 1919-1947', *British Journal for the History of Science*, 30 (1997), 25-8. and A. K. Mayer, 'Roots of the History of Science in Britain, 1916-50' (University of Cambridge Ph.D. Thesis, 2003), Chapter 2.

[155] Charles Singer (ed.), *Studies in the History and Method of Science* (2 vols., Oxford, 1917-1921).

things, to become the sole British founding member of the Comité International in 1928, Chairman of the Second International Congress of the History of Science in 1931, and the first President of the British Society for the History of Science in 1947. As Geoffrey Cantor said in his fiftieth anniversary presidential address before the British Society for the History of Science, 'It is fair to claim that throughout the second quarter of the twentieth century, [Singer] was the key British participant in the international organisations devoted to the history of science.'[156] In addition to his institutional accomplishments, Singer published prodigiously on subjects at least as diverse as Sarton and authored or edited works that remain standard today, including the monumental, five-volume *A History of Technology*.[157]

Yet Sarton and Singer shared more than achievement. Indeed, the two enjoyed a long and deep association, both personal and professional.[158] Personally, Sarton and Singer were great friends. Sarton, for example, was always sure to send a long letter on November the Thirteenth, the Singers' common birthday. Singer did Sarton the honour of a nomination to the Athenaeum, so that he could have a quiet place to work and stay in London.[159] Mrs Sarton and Mrs Singer likewise enjoyed a frequent correspondence. And when May Sarton took her first visit to England, she

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[156] Geoffrey Cantor, 'Charles Singer and the Early Years of the BSHS', *British Journal for the History of Science*, 30 (1997), 15.

[157] A nearly full bibliography of Singer's publications can be found in E. Ashworth Underwood, 'Bibliography of the Publications of Charles Singer', in E. Ashworth Underwood (ed.), *Science, Medicine and History* (2 vols., Oxford, 1953), pp. 555-81. *A History of Technology* was published in 1954, Charles Singer, Trevor Williams and Richard Raper, *A History of Technology* (8 vols., Oxford, 1954). Like Sarton, Singer has not yet been the subject of complete biographical study. The best existing sources for Singer's life can be found in Geoffrey Cantor, 'Charles Singer and the Early Years of the BSHS', *British Journal for the History of Science*, 30 (1997), 5-23. and Julia Shepard, 'Illustrations from the Wellcome Institute Library: Charles Joseph Singer, DM, DLitt, DSc, FRCP (1876-1960): Papers in the Contemporary Medical Archives Centre', *Medical History*, 31 (1987), 466-71.

[158] The Sarton-Singer correspondence can be found at Harvard Houghton Library, bMS Am. 1803 (1444) and at the Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.16.

[159] Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.16: George Sarton, 'Letter to Charles Singer', 13 December 1935.

immediately travelled to Cornwall to call on the Singers at their summer cottage. Many years later, May recalled how 'there at the station in Par, Cornwall, Charlie Singer who had been for me only a name, the "great English historian of science," was suddenly transformed before my eyes from this abstract essence to a beneficent Teddy bear, with curly white hair and a shrewd, kindly smile.'[160]

Professionally, the two shared a consistent working relationship. Very early on — while still exiled in England — Sarton identified Singer as an important colleague. Certainly by war's end, when he advertised his programme to Woodward at the Carnegie Institution, Sarton had made this connection. In a 1919 letter to Woodward, Sarton named Singer as essential to his expansive research and institutional programme. He wrote:

> A great element of success would be secured, if Charles Singer were eventually asked to join me. He completes me perfectly, because his own scientific preparation was chiefly medical and biological, and also because his interest lies in Mss. and palaeography ... I believe that between us, we should be able to make Washington an international centre for the history of science.[161]

That same year Sarton suggested Singer's *Studies in the History and Method of Science* as the necessary supplement to *Isis*.[162] Indeed only after the *Studies* had failed did Sarton conceive his own monograph series, *Osiris*. Even years later the two were

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[160] May Sarton, *I Knew a Phoenix: Sketches for an Autobiography* (London, 1959), pp. 196-7. See also, Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.16: George Sarton, 'Letter to Charles Singer', 8 March 1936; Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.16: Eleanor Mabel Sarton, 'Letter to Dorthea Singer', 20 March 1936; Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.16: May Sarton, 'Letter to Dorthea Singer', 27 October 1936.

[161] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 23 January 1919. In fact, Sarton voiced his hope of being joined by Singer repeatedly. See, for instance, his appeal to James Bryant Conant, shortly after his appointment as President of Harvard University, Harvard Houghton Library, bMS Am. 1803.1 (129): George Sarton, 'Letter to James Bryant Conant', 12 December 1934, p. 4.

[162] See George Sarton, 'The History of Science', *Science*, 49 (1919), 497. and Singer's hand-annotated offprint in the Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.16.

still taken by the idea of a large scale co-operative endeavour, in particular by the idea of 'editing together a History of Science of a size comparable to the Cambridge Mediaeval History, the Cambridge Ancient History and other Cambridge and Oxford standard editions.'[163]

More important than these everyday ties, however, Singer and Sarton shared a vision. As Cantor says, 'the most evident bond between Sarton and Singer has little relevance for founding a discipline but is instead their shared commitment to history of science as a potentially universalising and civilizing force.'[164] Singer was instilled with this commitment from very early on. Singer was among the first generations of Oxford natural science undergraduates to be trained in the University Museum. Conceived by Henry Acland in the 1850s, the University Museum was designed to emphasize the unity of science by bringing all the sciences together under one roof.[165] In 1892 — not long before Singer arrived in Oxford — Acland explained his and the Museum's purpose to the Junior Scientific Club, of which young Charlie was soon to be a member:

> You have now an Institution, limited indeed, but arranged from the first with a view to extension ... It aimed at setting forth the study of the Kosmos as a whole and in its parts, so as to embrace Mathematics, Physics, Chemistry, Astronomy, Geology, Mineralogy, Zoology, Anatomy — in the widest sense, human and comparative — Physiology, Ethnology, Anthropology, the Evolution—material, psychical, racial of Man — Medicine, for Animals and Man, Pathological, Preventative and Curative, and a Scientific Library rekindling the light and memory of Radcliffe, as you recall to-day the memory and character of Boyle.[166]

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[163] Harvard Houghton Library, bMS Am. 1803.1 (129): George Sarton, 'Letter to James Bryant Conant', 12 December 1934, p. 6.

[164] Geoffrey Cantor, 'Charles Singer and the Early Years of the BSHS', *British Journal for the History of Science*, 30 (1997), 20.

[165] Robert Fox, 'The University Museum and Oxford Science, 1850-1880', in M. G. Brock and M. C. Curthoys (eds.), *The History of the University of Oxford Volume VI, Nineteenth Century Oxford* (Oxford, 1997), pp. 641-91).

[166] Henry W. Acland, 'The Inaugural Robert Boyle Lecture', in Henry W. Acland (ed.), *The Robert Boyle Lectures* (Oxford, 1897), pp. 35-6.

Singer carried the lessons of Acland's Oxford system throughout his career as a historian of science. The unity of knowledge he learned at Oxford would become for Singer — as it had for Sarton — the inspiration for his historical researches and the basis for his own brand of New Humanism.

The titles of certain of Singer's works should be evidence enough of his New Humanistic sympathies. In articles like 'Scientific Humanism' and 'One Increasing Purpose: The Spirit of Science in History', Singer employed all the familiar terms of Sarton's New Humanism.[167] For example, commenting in his 1947 inaugural presidential address before the British Society for the History of Science on the founding of UNESCO, of which the Society was to be a part, Singer said:

> This name [UNESCO] leads once more to consideration of the role of the History of Science. There is a striking analogy with that of Humanism five hundred years ago. Both made small beginnings in a disturbed world. In the fifteenth century, scholastic philosophy was breaking down; the Universal Church was ceasing to be universal; economic revolution was displacing the old values based on land ownership. Politically, feudalism was dissolving into the nation states. In Education, Logic was yielding to the humanistic stress on Language. In Philosophy, Theology, Economics, Politics, Education, great discontinuities were temporarily healed by Humanism. Comparable discontinuities in our world may in the next generation be comparably bridged by the evolution of a New Humanism, that historical outlook which may broaden to the survey the History of Civilization itself. The Scientific Age must recognise its need to know and to understand the History of Science.[168]

Crucially — for Singer as well as for Sarton — this New Humanist vision was tightly bound to a complementary vision of practitioner identity. Here emerges the significance of the Comité's profusion of scientists. The New Humanism was to be

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[167] Charles Singer, 'Scientific Humanism', *The Realist*, 1 (1929), 12-8; Charles Singer, 'One Increasing Purpose: The Spirit of Science in History', *The Times Literary Supplement*, 18 July 1936.

[168] Charles Singer, 'The Role of the History of Science', *Bulletin of the British Society for the History of Science*, 1 (1949), 18.

forged not at all by humanists, but indeed by a new breed of scientist: the historian of science.

First consider Singer. Despite his many achievements in history, Singer always identified more with scientists than historians. For instance, when war broke out in 1914, Singer eagerly relinquished his new position at Oxford in order to serve as an Army physician. When he returned to history after the war, Singer was careful to maintain close ties to the scientific and medical establishment, and he corresponded vigorously with the likes of Freud, Cushing and Sherrington.[169] Indeed, Cantor has shown how as first president of the British Society for the History of Science, Singer worked diligently to align the fledgling group with the scientific community and especially with the Royal Society.[170] Here, in the absence of a clear cut role for the new British Society for the History of Science, Singer chose to cast the Society as a new kind of scientific institution and its membership as new kinds of scientists.

Singer made a more subtle assertion of the historian of science's scientific credentials in a 1921 letter to the editor of *Nature*. Entitled 'What is Science', Singer suggested that rather than any body of knowledge, science be treated as process or '*knowledge in the making*'.[171] He repeated this definition in his 1931 presidential address before the Second International Congress, saying 'I would emphasise the word *process*. Science is often discussed as though it could be presented as a body of knowledge or doctrine, but reflection will soon reveal that this point of view cannot

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[169] See Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence.

[170] Geoffrey Cantor, 'Charles Singer and the Early Years of the BSHS', *British Journal for the History of Science*, 30 (1997), 18-9.

[171] Charles Singer, 'What is Science?' *British Medical Journal*, 1 (1921), 954.

be maintained. For is it not the case that science that has ceased to develop soon ceases to be science at all?'[172]

This definition of science as process was surely important to Singer's understanding of science, something best evidenced by his strong research interest in scientific methods. But it was equally important to Singer's understanding of his own discipline, its practitioners and its situation *vis-à-vis* science proper. 'There is a corollary arising out of this view of science as process ...' wrote Singer, 'To understand a process it is inevitably necessary to understand how it came to be what it is. A process is an organic thing — to understand it you must know and understand its history. Thus the teaching of science becomes, in its ultimate analysis, instruction in history.'[173] It followed, of course, that if science was essentially an historical process, then historians of science must surely be its essential practitioners, and it was here that Singer rested his case for the historian of science as scientist. Finally Singer's identification of historians with scientists was also an assertion of the unity of knowledge and an appeal to the ideals of the New Humanism. The historian of science's membership in the scientific community both rested on and gave flower to the unifying principles of the New Humanism. In the same piece Singer continued: 'Thus we see the wheel turn full circle ... For the truth is that knowledge is one, and there is only one true and safe method of advancing it, and that is science.'[174]

George Sarton even more fully elaborated these ideas. Sarton, of course, was also a founding member of the Comité. He too had been trained as a scientist, studying chemistry and crystallography before receiving his doctorate in mathematics.

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[172] Charles Singer, 'The Beginnings of Science', *Nature*, 128 (1931), 7-10.

[173] Charles Singer, 'What is Science?' *British Medical Journal*, 1 (1921), 954.

[174] Ibid.

Like Singer a good part of Sarton's self-image and self-confidence as a historian of science was grounded in his scientific background. Sarton believed that before anything else his status as a scientist qualified him to be a historian of science. He argued that while the historian of science needed certain 'obvious' philosophical and linguistic qualifications, he should always be 'primarily a scientist'.[175] Early on in his career, Sarton compared the science in science history to the chicken in chicken pie, quipping, 'The chief requisite for the making of a good chicken pie is chicken; nay, no amount of culinary legerdemain can make up for the lack of chicken.'[176] Around the same time, Sarton explained himself in a letter to Woodward. Describing his plans for a book on 'the teaching of the history of science', he wrote:

> One of the main points of this book [will be] that the history of science must be taught by one who is primarily a scientist and secondly an historian, — not by a philosopher having only a second hand and superficial knowledge of science. It is essential to explain that at this juncture, because I have very good reasons to fear that such courses — if organized at all — be monopolized by professors of philosophy. That would be worse than anything, as people having had no genuine scientific training are almost bound to blunder even on the simplest principles of science. The teaching of the history of science should be as concrete, as matter of fact as possible ... [177]

Even deep into his career as a historian, Sarton still identified more with scientists. When in 1936 he finally published the book he first proposed to Woodward nearly twenty years earlier, Sarton asked the question: 'Whom shall we consider the best prepared and most expert, him who understands the subject or him who knows the methods? In the *history of science* shall we emphasize the first word

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[175] George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), pp. 146-9.

[176] George Sarton, 'The Teaching of the History of Science', *Scientific Monthly*, 7 (1918), 194.

[177] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 23 June 1918.

or the second?'[178] Sarton clearly preferred the second. Quoting Littré, he wrote: '*Quand on s'est pénétré de la science contemporaine, alors il est temps de tourner vers la science passée*,'[179] and explained further that:

> One cannot study analysis before algebra, nor physiology before chemistry and physics. On the other hand, it is possible, though perhaps unadvisable, to study history in almost any order, and the majority of scholars have obtained their historical knowledge in the most haphazard way. One may be an expert in American history and know nothing whatever of the Sumerians or the Hittites. Some time ago I was obliged to examine the work of a Transylvanian chemist who flourished at the end of the eighteenth century. To appreciate his work it was necessary to consider on the one hand the historical milieu, and on the other the contemporary chemical traditions. I knew nothing of the history of Transylvania at the at time, but it did not cost me much trouble to obtain the information which I needed, or, with the aid of my knowledge of conditions elsewhere, to understand it. Happily I was well acquainted with chemistry and the chemical knowledge of that period in Western Europe and with the so-called 'chemical revolution', subjects in which it would have been impossible for me to remedy my ignorance so readily. I should have been obliged to study chemistry and the complete history of chemistry down to that time![180]

Yet despite his insistence on scientific training and his identification with science, Sarton was constantly frustrated by scientists, in particular by their amateur involvement in history. Sarton railed against their occasional historical lectures, decrying the 'levity' and casual arrogance with which senior scientists and administrators undertook to speak on the history of science. For Sarton this was tantamount to 'hypocrisy'.[181] Exacting in their laboratories, these scientist amateurs were careless in the library and in their historical work. In a word, Sarton believed these scientists to be patently 'unscientific' when it came to history. 'In the search after truth,' wrote Sarton, 'one can never be too cautious or too humble. The good

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[178] George Sarton, *The Study of the History of Science* (Cambridge, MA, 1936), p. 4.

[179] Ibid., p. 6; Emile Littré, *Oeuvres completes d'Hippocrate* (Paris, 1839).

[180] George Sarton, *The Study of the History of Science* (Cambridge, MA, 1936), p. 7.

[181] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to A. V. Kidder', 3 January 1939. See also, George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), p. 148.

scientist understands that very well in his own domain, but he is likely to throw humility and prudence to the winds when he deals with historical subjects.'[182]

For Sarton the problem with scientist amateurs was not their training but their lazy failure to apply this training to history. Indeed Sarton believed that the history of science should be undertaken fully in the spirit of science. Scientific rigour and caution should be applied in the library and at the typewriter just as much as in the laboratory or at the workbench. 'The moral of this,' wrote Sarton, 'is that the historian, like his brother scientist, must accept nothing without investigation and verification':

> ... he must be forever on the alert, and nurse scepticism in his mind until every suspicion has been dispelled ... The difference between careless and careful work is of exactly the same order in the field of history as in that of science. Careless work is easy enough, while every additional precaution increases the difficulty, the slowness, and the tediousness of the endeavour. Even as the good scientist must be prepared to take infinite pains and work over endless trivialities in order to be sure of the accuracy of his experiments, even so the historian must be ready to check and recheck, in as many ways as are available, countless details, each of which may seem unimportant.[183]

In this way, scientific training was vital to the historian of science not only for its concepts, but also for its approach. That is, more than a knowledge of scientific principles, scientific training should provide the historian of science with a knowledge of scientific methods, ethics and rigour. While eminent scientist amateurs might bring a vast repository of scientific experience to bear on historical problems, it was for naught if they neglected their methods. What made a professional historian of science was not his scientific experience, but the full and conscientious application of scientific experience to historical work.

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[182] George Sarton, *The Study of the History of Science* (Cambridge, MA, 1936), p. 18.

[183] Ibid., pp. 15-6.

This, in turn, was the proper basis for humanism. The establishment of a New Humanism rested on the efforts of the good scientist. Professionalism in history was based firmly on professionalism in science. Though directed at the achievement of a New Humanism, the historian of science's initiation began with the full and honest application of his scientific training to humanistic problems.

> [The scientist] is not obliged to do historical work; but if he does, he should remain faithful to his own standards of accuracy and honesty, or else be freely castigated and discredited. Careless historical work is as contemptible as careless experimental work, and errors due to the neglect of well known historical methods are as disgraceful as errors due to the neglect of well known experimental methods. When the scientist realizes all this, and becomes aware of the existence of historical pitfalls similar to the ones wherewith he is familiar in his own laboratory, he is on the road to wisdom, and when he develops a historical conscience as well as a scientific one, his new education may be said to be well begun and his initiation into humanistic studies prepared in the best manner.[184]

Thus rather than 'scientific humanists', Sarton envisioned historians of science as 'humanised scientists'. Indeed, Sarton rarely used the term 'New Humanist' in connection with his 'New Humanism'.[185] Instead, for Sarton as for Singer, a recruit for the New Humanism should really be a 'New Scientist'.

**A German Example**

The issue of practitioner identity is a tricky one for American science museums in the interwar period, for the most part because they were starting from scratch. High hopes and grand plans generally don't have paid employees.

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[184] Ibid., p. 18.

[185] For all the frequency of the term 'New Humanism", there seems but one instance of Sarton's usage of term 'New Humanist'. See George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), pp. 147-9.

At least in the earliest years of the interwar period, President George Frederick Kunz and Vice-President Charles Gywnne — both industrialist financiers — remained the leading figures in New York. In Washington, too, Porter and his financial backers took centre stage in promotion efforts, though Mitman played a key role as Porter's chief sympathiser within the Smithsonian Institution. And in Chicago, Sears Chairman Julius Rosenwald and the other industrialist board members of the Chicago Museum of Science and Industry debated *ad infinitum* the merits of candidates for the post of Director. Thus even as the American science museum movement rolled ambitiously along, only Carl Mitman can rightly be considered a professional museum practitioner, and just as the American science museum remained for the most part simply an idea, so too did the American science museum practitioner.

Yet just as the leaders of the science museum movement had clear ideas and good European models for the form their museums should take, they also had a ready model for the form of their future practitioners: Even in a paper dealing strictly with Anglo-American science museum history, it is difficult to ignore Munich's Deutsches Museum and its famous founder and first director, Oskar von Miller.

Von Miller was born in 1855, the youngest son of Ferdinand von Miller, a prominent Munich foundry man. Early on the elder von Miller determined that his son would be an engineer, and Oskar was enrolled at the Munich Technische Hochschule. In 1878 he graduated at the head of his class and entered a successful career building roads, bridges and tunnels in the German civil service. In 1881, von Miller travelled to Paris for the International Electrical Exposition, where — along with the rest of Europe — he was first introduced to Edison's incandescent light bulb. Von Miller's interest was immediately and powerfully sparked by the possibilities of

the new technology, and by 1883, he had taken on the directorship of the German Edison Company. Finally in 1889, von Miller struck out on his own as an independent consulting engineer in Munich, where for the next forty years he helped plan and manage some of Germany's largest public works projects, including Bavaria's primary electrical grid, the famous Bayernwerk.

Von Miller's abiding interest in electricity was surpassed only by his interest and involvement in the exhibition medium. Immediately upon returning from Paris in 1881, von Miller began planning a Munich International Electrical Exhibition, which opened to great success in 1882. A decade later, von Miller was selected to organize the larger and more broadly based Frankfurt Electrotechnical Exhibition of 1891, another very successful event. These experiences solidified von Miller's belief in the exhibition medium and — along with visits to the science museums of Paris and South Kensington — impressed upon him the need for a permanent German location for the public exhibition of science and technology. In 1903, von Miller and a group of fellow engineers and industrialists chartered the *Deutsches Museum von Meisterwerken der Naturwissenschaft und Technik.* Von Miller and his group quickly secured the financial and political support of the German business community and Imperial nobility, including the direct involvement of Crown Prince Ludwig of Bavaria and the enthusiastic blessing of Kaiser Wilhelm II. By 1906 the Museum had opened temporary galleries and broken ground on an enormous new building on the Kohleninsel in the River Isar. Set for completion in 1916, the intervention of war delayed the Museum's grand opening by more than a decade, but on 7 May 1925 — von Miller's 70th birthday — the six-storey, 300,000 square foot Deutsches Museum

of Masterworks of Science and Technology finally opened as one of the world's largest and most modern museums.[186]

It was just around the time of this grand opening that the various American delegations — led first by Richards and then by Porter, Gywnne and Mitman — arrived in Munich.[187] There they found a spanking new, purpose-built facility with a triumphant von Miller at its helm. They were excited to find embodied in Munich — and indeed in von Miller — the encyclopaedic and ecumenical ideas on which they based their own efforts. Gywnne wrote:

> All of the institutions visited by the delegation are industrial museums. But that is only in the broad sense. Each has its distinct policy. Broadest of all, however, is the policy of the Deutsches Museum. It covers all knowledge. By putting in everything conceivable and giving it in fullest detail, the officials feel that every visitor will find in the ensemble something that he ought to know and that he will find of immediate use in his everyday life. Industry, as has been remarked before, is not confined to cog-wheels. In its widest sense it means every activity of man. So the Deutsches Museum considers music, sculpture and painting, too. Even the universe ...[188]

It was a powerful coincidence, and it is no surprise that the Deutsches Museum became the American ideal and its founder a model for practitioner identity.

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[186] Sources in English for the history of the Deutsches Museum are limited. The best is probably Otto Mayr, *The Deutsches Museum: German Museum of Masterworks of Science and Technology, Munich* (London, 1990). Other useful sources are Kenneth Hudson, *Museums of Influence* (Cambridge, 1987); Bernard Finn, 'The Museum of Science and Technology', in Michael S. Shapiro (ed.), *The Museum: A Reference Guide* (New York, 1990), pp. 59-83. British and American newspaper articles surrounding the Museum's opening in 1925 also provide useful information.

[187] See C. R. Richards, *The Industrial Museum* (New York, 1925); Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'National Museum of Engineering and Industry, To Be Under the Direction of the Smithsonian Institution, Washington, D.C.' 1924; Charles Gwynne, *Museums of the New Age: A Study of World Progress in Industrial Education* (New York, 1927); Waldemar Kaempffert, 'Revealing the Technical Ascent of Man in the Rosenwald Industrial Museum', *Scientific Monthly*, 28 (1929), 483; Jay Pridmore, *Inventive genius: The History of the Museum of Science and Industry, Chicago* (Chicago, 1996), pp. 18-9. See also Smithsonian Institution Archives RU 297, Box 7, 'European Technical Museums'.

[188] Charles Gwynne, *Museums of the New Age: A Study of World Progress in Industrial Education* (New York, 1927), p. 28.

Inspired by their experiences in Munich, the leaders of the American science museum movement twice arranged in 1925 and 1929 for von Miller to visit the United States to aid their promotional efforts. The importance of von Miller's visits in the minds of American leaders is marked by the reception he received. Elaborate banquets were planned in his honour in both New York and Chicago, not only by the likes of Rosenwald and Kunz, but also by Thomas Edison, Felix Warburg and Charles Schwab.[189] Porter, for instance, believed that von Miller's visit would 'start our ball rolling for a campaign for funds' and give 'our project a great impetus over the whole country.'[190] Popular accounts proclaimed, 'Head of Munich Museum to Help Start One Here', 'Institution Suggested Here Like One in Munich' and 'Dr von Miller Here to Aid New Museum'.[191] Across the board the hope was that the 'Daddy of Museums' or 'The Munich Savant' might solidify a future for the fledging American science museum movement.[192]

Much of the press coverage surrounding von Miller's visits took the form of feature profiles.[193] Less than in his efforts on behalf of the American science

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[189] 'For Deutsche Museum', *The New York Times*, 18 November 1925; 'Backs Industrial Museum', *The New York Times*, 24 November 1925; 'Deutsches Museum Head Visits American Cities', *Museum News*, 15 November 1925; 'Propose a Museum of Scientific Lore', *The New York Times*, 16 November 1925; 'Luncheon Promotes Museums of Peaceful Arts', *Greater New York*, 30 November 1925.

[190] Smithsonian Institution Archives RU 297, Box 8, 'National Museum of Engineering & Industry, Correspondence, 1922-5, 1927-8': H. F. J. Porter, 'Letter to Carl Mitman', 26 September 1925; Smithsonian Institution Archives RU 192, Box 253, Folder 4: H. F. J. Porter, 'Circular Letter to Members of the National Museum of Engineering and Industry', 10 October 1925. See also Smithsonian Institution Archives RU 192, Box 253, Folder 4: H. F. J. Porter, 'Letter to Charles D. Walcott', 15 October 1925; Smithsonian Institution Archives RU 192, Box 253, Folder 4: Charles D. Walcott, 'Letter to H. F. J. Porter', 26 October 1925.

[191] 'Head of Munich Museum to Help Start One Here', *The New York Herald Tribune*, 15 November 1925; 'Inventors' Museum: Institution Suggested Here Like One In Munich', *The New York Sun*, 16 November 1925; 'Dr Von Miller Here to Aid New Museum', *The New York Times*, 15 November 1925.

[192] 'Business Men Laud "Daddy" of Museums', *The Brooklyn Daily Eagle*, 7 December 1929.

[193] See 'Museum of Man's Progress', *The Brooklyn Daily Eagle*, 22 May 1927. 'What Next in the Age of Science', *The Philadelphia Public Ledger*, 19 January 1930; 'What Will Science Do in the Next Ten Years', *The New York Evening Post*, 18 January 1930. 'A Showman of Science', *The New York Herald Tribune*, 23 February 1930.

museum, the press was interested in von Miller himself. In every case, press reports presented von Miller not only as accomplished scientist, but also as someone of profound purpose, generosity and compassion. They often pointed to his early work as a civil engineer, stressing not only his technical successes but also his service and dedication to the public works. They also singled out von Miller's tireless and selfless efforts to found the Deutsches Museum as a gift to the German public.

But even more than tangible achievements, newspaper profiles of von Miller pointed to his character. One article in the *New York Herald Tribune*, for example, discussed at length the energy with which the elderly von Miller 'tramp[ed] daily along the nine miles of corridors in the Deutsches Museum.' It similarly described the 'vigor and alert interest' that von Miller showed in his American visits. It even described the gleam in von Miller's eye:

> From under his tufted eyebrows burn hazel eyes that show flashes of yellow flame in moments of enthusiasm ... Those glancing eyes of his gaze off into the distant spaces as he tries to tell in a few moments the significant things of a lifetime. His own career has had some of the momentum of a perfect machine, functioning with stability and even tenor. There was never a time in his life when Dr von Miller was without a definite purpose.[194]

Even more than his scientific accomplishments and even more than his museum, von Miller was admired for his character, and the leaders of the American science museum movement hoped to make him a model.

In fact, practitioner identity was a particularly important issue for leaders of the American science museum movement, and von Miller's example was front and centre. In Chicago, for example, while the impetus for Rosenwald's founding donation came from a visit to the Deutsches Museum, the Museum of Science and Industry's choice of personnel was based on von Miller's example. When organizers

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[194] 'A Showman of Science', *The New York Herald Tribune*, 23 February 1930.

in Chicago finally settled on *New York Times* science editor Waldemar Kaempffert as the Rosenwald Museum's first Director, it was in large measure based on Kaempffert's regard for von Miller and for his eagerness to replicate the work the 'Munich Savant' had done at the Deutsches Museum.[195] Similarly in New York, Gwynne concluded his lengthy discussion of European museums with a section on practitioner identity entitled 'Master Minds'. Von Miller received most of his attention. He wrote:

> Munich — the Deutsches Museum — is privileged to be guided still by its founder. Dr. Oskar von Müller, internationally famed as one of Bavaria's greatest men, lives humbly and in passionate devotion to a mighty dream of public service that is slowly coming true. Past the allotted years of three-score and ten, this universal genius moves daily, with unimpaired vigor, among his beloved people as they visit the halls of the great museum, stopping to explain some intricate machine to a fascinated countryman or to enjoy the naïve wonderment of some little child ...
>
> Conceive, if you will, a man so magnificent in his horizon that his hope for the future embraces no single nation, but the whole world. He would as soon see his ideal museum — which, like all true ideals, is not attainable in one man's lifetime, not attained even here in the marvelous Deutsches — realized in an alien country. He cares not where it is so long as it *is* realized.
>
> "The scientific spirit knows no boundaries," he said, "and America should have the greatest museum because she alone has the wherewith to make it come true."[196]

Like the newspaper accounts above, Gwynne emphasised von Miller's character above his accomplishments. It was his generosity, magnanimity and 'passionate devotion to ... public service' that set von Miller apart as 'master mind'. More to the point, as Gywnne was careful to stress, it was this same magnanimity and

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[195] Russell Douglass Jones, 'Engineering History: The Foundation of Industrial Museums in the United States' (Case Western Reserve University Ph.D. Dissertation, 2001), p. 233; Jay Pridmore, *Inventive genius: The History of the Museum of Science and Industry, Chicago* (Chicago, 1996), pp. 26-8.

[196] Charles Gwynne, *Museums of the New Age: A Study of World Progress in Industrial Education* (New York, 1927), p. 32. Here Gywnne also appeals to the familiar British model of the scientific servant and to the Science Museum's Henry Lyons. He writes, 'All the wonders, all the differences in policy with their admirable special points, all their success, in short, could not exist without coordination. In London that co-ordination is embodied in Sir Henry Lyons, a gentleman-scientist of reputation and marked executive ability. Under his leadership the inspiring Science Museum has prospered and may honestly look forward to a future of greatly increased public service. For his devotion to the cause of industrial education the American visitors have reason to be grateful.'

public mindedness that tied von Miller to the American science museum movement. Here Gywnne claimed for America some small measure of the von Miller persona. Ending *Museums of the New Age* with this claim, Gywnne left his readers with the sure sense that von Miller's noble and effective example would guide the American museum.

**Scientific Service**

Though the American science museum movement took a German as their model, they might equally have chosen an Englishman. Notions of scientific service were essential to practitioner identity in South Kensington. They were also well articulated, both in examples provided by senior staff and in policy documents written for their juniors.

The interwar history of the Science Museum is dominated by two towering figures, Advisory Council Chairman Sir Hugh Bell and Science Museum Director Sir Henry Lyons. Not only were Bell and Lyons central to the physical and conceptual development of the Science Museum, but in many ways their careers provided a template for the construction of identity among other Science Museum practitioners. In particular, each combined a career of scientific or industrial achievement with a potent strain of military or civil service. The combination of these characteristics as manifested in Bell and Lyons provided the Science Museum with a clear and tangible basis for practitioner identity.

Hugh Bell was born near Newcastle in 1844 to a prominent engineer and industrialist, the Baronet Sir Lowthian Bell. After studying chemistry in Edinburgh, Paris and Gottingen, the younger Bell returned home to work in his father's steel

business. Hugh Bell found great success in the steel industry, growing his father's business substantially. In 1899 he helped to bring the business public and became managing director of Bell Brothers, Ltd. In 1904 he succeeded his father to both the company's chair and the baronetcy. In 1923, when Bell Brothers merged with Dorman, Long and Co., Ltd., Bell became the enlarged entity's director and eventually its chairman.

First and foremost an industrialist, Bell also held several posts in education and politics. His association with the Science Museum ran to more than twenty years, beginning with his influential work as chairman of the 1911 Board of Education Departmental ('Bell') Committee on the future of the Science Museum. He served on the Board of Governors of Imperial College and as chairman of the Armstrong College council in Durham. He played a prominent role in party politics, first as a member of the Unionist Party and then as a Liberal, and sat three terms as Mayor of Middlesbrough over a period of nearly forty years. For decades he served as chairman of the Tees Conservancy Commission, using his position as an engineer, industrialist and public figure to implement much-needed navigational and floodplain improvements on the river Tees.

Bell's reputation was based as much on his commitment to public service as it was on his industrial achievement. While his *Nature* obituary applauded his successes in engineering and industry, it argued that Bell's greatest strength was his social commitment:

> Merely to recount the work of Sir Hugh Bell as a successful ironmaster would, however, be to give a very limited and one-sided view of his activities. He was, above all, a great public servant, and rendered services to the community of which it is difficult to speak too highly.

Comparing his qualities to those of his father, the article read:

> Sir Lowthian Bell will be remembered best for his scientific acquirements and their application to technology, whilst Sir Hugh Bell's fame is not that of a man of science, but of a man who devoted his brilliant abilities and keen insight to the service of the community.[197]

More than just an engineer or industrialist, Bell was seen as one who put his engineering and industrial knowledge to good use, and it was this combination of that made him an appropriate chair for the Advisory Council. Not only for his 'clear conception' of the 'field of pure and applied science', Bell was first singled out for appointment because of his proven service in other areas.[198] Similarly at his death Bell's tenure as Advisory Council Chairman was applauded not only on the basis of his wise scientific counsel, but also on the basis of his ready service.[199] From the outset and until the end, Bell's qualifications were judged to rest on his being both competent scientist and able servant. His chairmanship was a powerful image statement, and Bell's model of scientific service was encouraged and affirmed in the Science Museum's other staff.

If Sir Hugh Bell provided an example for the interwar Science Museum practitioner, then Sir Henry Lyons provided the paradigm. He is without doubt the central character in the story of the interwar Science Museum. From 1920 until 1933, Lyons served as the Museum's Director, and from 1933 until 1943 as its Advisory Council Chairman. During this time, Lyons oversaw the opening of new buildings, the growth of the collections and a new public recognition for the Science Museum. As the President of the Board of Education remarked upon Lyons' retirement:

> In 1920, when you were appointed, the museum was a small institution known only to a few ... You had the vision to realize the

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[197] Henry Louis, 'Sir Hugh Bell, Bart., C. B.' *Nature*, 128 (1931), 96-8.

[198] F. G. Ogilvie, Director of the Science Museum, 1911-20, is quoted in D. Follett, *The Rise of the Science Museum under Henry Lyons* (London, 1978), p. 137.

[199] Henry Louis, 'Sir Hugh Bell, Bart., C. B.' *Nature*, 128 (1931), 98.

> position the museum might take and the value it might be to science and industry. By your tact, energy, and ability you have made it what it is and is known to be — a treasure house of past achievements and an inspiring guide to future progress ... We claim for the Museum a foremost place among institutions of its kind, and recognize that it is to you that this is due. You lay down that work with every good wish from all of us for your future happiness and prosperity.[200]

Lyons was born in London in 1864, the son of a career army officer. Following in his father's footsteps, Lyons attended the Royal Military Academy at Woolwich in 1882-4. Commissioned a lieutenant in the Royal Engineers, Lyons entered a course of military engineering at Chatham in 1884-6. From Chatham he was posted to Gibraltar, and finally to Cairo in 1890.

Lyons first became interested in science — specifically in geology — at a young age. He was elected to the Geological Society at only eighteen, and published his first paper in the Society's *Quarterly Journal* while still at Woolwich in 1887.[201] Later working with the Royal Engineers at Aswan Dam, Lyons published several works on the geology, geography and history of Egypt.[202] Finally in 1896, Lyons was singled out to organise a Geological Survey of Egypt, and in 1906 he published the definitive treatment of Egyptian geomorphology.[203] Almost immediately Lyons was elected to fellowship of the Royal Society.

Returning from Egypt in 1909, Lyons accepted a post as University Lecturer at the University of Glasgow. An undistinguished public speaker, Lyons remained at Glasgow for only two years, leaving in 1911 to become Assistant to the Director and Secretary of the Science Museum Advisory Council. His time in this position was cut

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[200] *The Times*, 12 October 1933.

[201] Henry G. Lyons, 'On the London Clay and the Bagshot Beds of Aldershot', *Quarterly Journal of the Geological Society of London*, 43 (1887), 431-41.

[202] See, for instance, Henry G. Lyons, *The History of Surveying and Land-Measurement in Egypt* (Cairo, 1907).

[203] Henry G. Lyons, *The Physiography of the River Nile and Its Basin* (Cairo, 1906).

short by the outbreak of war. In 1914 Lyons was recalled for service and in 1915 began work with the Meteorological Office in Gibraltar. By 1918 he had been given the acting rank of lieutenant colonel and was named Commandant of the Army Meteorological Services and Acting Director of the Meteorological Office. At war's end Lyons left the Army with the rank of full colonel, and returned to the Science Museum in 1919. Within a year he was named Director, a position he held for nearly fourteen years.

Even during the war and throughout his tenure with the Science Museum, Lyons was careful not to sever his ties to the scientific community. In 1915 he was elected president of the Royal Meteorological Society and president of Section E of the British Association. In 1919 he became Secretary-General of the International Union of Geodesy and Geophysics. Later he served as treasurer of the Royal Society, Secretary-General of the International Council of Scientific Unions, President of the Institute of Physics, and founding editor of *Notes and Records of the Royal Society*. This remarkable combination of scientific achievement and long military and civil service was recognised and valued by his contemporaries. Upon Lyons' death, for example, Meteorological Office Director G. C. Simpson wrote, 'What a strange series of occupations: the army, geology, surveying, meteorology, and museum management: yet it contains the key to [Lyons'] great and undoubted success ...'[204] Royal Society President H. H. Dale similarly stressed Lyons' combination of scientific and civic contributions, marvelling at 'so close a succession of duties, enterprises and achievements'.[205] As a measure of Lyons' own regard for this combination, Dale pointed to Lyons' abiding interest in the administrative history of

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[204] G. C. Simpson, 'Obituary, Sir Henry Lyons, F.R.S.' *Nature*, 154 (1944), 328.

[205] H. H. Dale, 'Henry George Lyons', *Obituary Notices of Fellows of the Royal Society*, 4 (1944), 795-809.

the Royal Society, the end result of which was his posthumous publication of *The Royal Society, 1660-1940: A History of Its Administration under Its Charters.*[206] According to Dale, the work was as much an exercise in community building as it was in scholarship.[207] It was also the kind of scientific service that made Lyons a model for practitioner identity in the Science Museum.

In fact, the interwar Science Museum was made up mostly of men like Lyons who had applied scientific training and skills to public, and more specifically, to military positions and projects. Take for instance the period's other directors. On one side, Lyons' predecessor, Francis G. Ogilvie, began his career teaching applied physics in Edinburgh and later moved between positions with the Royal Engineers and the Board of Education. On the other side, Lyons' successor, Colonel E. E. B. Mackintosh, was first a career officer with the Royal Engineers and later a governor of Imperial College and Vice-President of the Royal Institution. Members of the Advisory Council possessed similar backgrounds, among them Colonel Sir S. G. Burrard, Surveyor-General of India, Sir Maurice Fitzmaurice, chief resident engineer of the Aswan Dam, and Sir Philip Watts, Director of Naval Construction in the Admiralty.[208] Even members of the ordinary staff boasted strong public and military service credentials. For example, beginning with Lyons the Museum maintained a policy of hiring only former warrant and non-commissioned officers as gallery

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[206] Henry G. Lyons, *The Royal Society, 1660-1940: A History of Its Administration Under Its Charters* (Cambridge, 1944).

[207] H. H. Dale, 'Henry George Lyons', *Obituary Notices of Fellows of the Royal Society*, 4 (1944), 795-809.

[208] For instance in 1919 the Council included only two academic scientists, Sir J. J. Dobbie and Sir Richard Glazebrook. The remaining members included three civil engineers, three military engineers and three industrialists, along with Bell and Lyons. Throughout the 20s, occasional vacancies were replaced with men of expertise similar to that of their predecessor. When the Advisory Council was reconstituted and enlarged upon recommendation of the National Museums and Galleries Commission in 1931, the proportion of pure scientists was further reduced as the Council's representation by industry was vastly expanded.

attendants — a policy designed to reinforce an ethic of scientific service.[209] Finally the many new members of staff who were hired in the interwar period without such credentials were instructed in the fundamentals of the accompanying ethic. Attempting to codify the standards of a 'Museum Officer's Work', Director Mackintosh recommended they cultivate a combination of 'recognized consultative authority' on matters scientific with service on 'committees', 'promotion boards' and the 'Civil Service Benevolent Fund'.[210]

Thus by both example and decree, the Science Museum officer was intended to occupy a position of scientific service as an Army officer would occupy a position of military service. Perhaps Mackintosh invoked the term 'officer' to suggest this position. Perhaps it was to suggest the military men in charge of the Science Museum as role models. Perhaps even it was for this reason that one of Mackintosh's first directions instructed his officers to 'know the constitution and representation of the Advisory Council.'[211] In any case, Mackintosh's outline for a museum officer's work conforms to the ideal of scientific service embodied by the Museum's Directors and Advisory Council and so admired in their obituaries. On the one hand, this ideal resounded with the post-war rhetoric of the Peace Museum as a place of public betterment. On the other hand, and across the field of interwar science history, practitioners' identities were amplified and, in large part, defined by the audiences they targeted. Indeed, while Sarton's model of the new scientist and the museum

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[209] Science Museum Archive Z 193/1: Henry G. Lyons, 'Science Museum Advisory Council, Director's Report', June 1930. It is interesting that not only did this policy ensure the attendants' qualifications as scientists and public servants, but it also helped ensure that the Science Museum would remain an entirely male domain in the interwar years. A comparison can be made with other Great War-era museums, specifically the Imperial War Museum. In these institutions, women were active not only in the galleries but also in building collections, staging exhibitions and raising funds. See Gaynor Kavanagh, *Museums and the First World War: A Social History* (London, 1994).

[210] Science Museum Archive Z 184: E. E. B. Mackintosh, 'A Museum Officers Work', 1 March 1939.

[211] Ibid.

model of scientific service embodied by Lyons, Bell and von Miller were really quite similar — for instance, they all first and foremost stressed the direction of scientific achievement to humanistic or societal ends — they were in fact dissimilar enough to implicate very different sorts of publics. Small differences in practitioner identity translated to large differences in public posture.

# Chapter 3: Publics

## Pure Science, Pure Scholarship

When it comes to the audiences academic historians of science targeted, there is something of a disconnect between the rhetoric and the reality. While their rhetoric was overtly populist, their product patently was not. In fact, academic historians of science planned and founded exclusive and strictly scholarly institutions and outlets for their work, and at times their deeds and words in private seem even contemptuous of the populace they embraced in public. Paradoxically, moreover, both the inclusive rhetoric and the exclusive sentiments seem to have been determined and justified by the same impulse — the effort to make science history more effective of the New Humanism and more useful to post-war reconstruction. That is, indecision, or perhaps insecurity, over how best to use science history to effect reconstructive aims led practitioners to conflicting postures *vis-à-vis* the public.

Populist rhetoric was ever-present in Sarton's propaganda, most obviously in such inspirational prefaces as 'War and Civilization' and 'The Faith of a Humanist'.[212] The preface to *Isis* Volume 5 was no exception. Entitled 'Knowledge and Charity', the preface spoke to the responsibilities of knowledge.[213] On the one hand, knowledge is a private obligation. Sarton wrote: 'Knowledge is necessary, the acquisition of it is a duty.'[214] On the other hand, knowledge carries with it important public responsibilities. Sarton asked: 'How is it that so many people, even among the

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[212] George Sarton, 'War and Civilization', *Isis*, 2 (1919), 315-21; George Sarton, 'The Faith of a Humanist', *Isis*, 3 (1920), 3-6.

[213] George Sarton, 'Knowledge and Charity', *Isis*, 5 (1923), 2-19.

[214] Ibid., 12.

most conscientious, have yet failed to realize that ... ignorance — avoidable and alleviable ignorance — is always a guilt and sometimes a crime?'[215] Here Sarton argued that one must both 'avoid' ignorance oneself, and also work to 'alleviate' the ignorance of others. Ignorance is not only a private 'guilt', but also a public 'crime'. 'Knowledge' carries with it the public responsibility of 'charity'.

At the same time, the public responsibilities of knowledge were not only moral, but also practical. Sarton continued:

> ... when all is said we will agree with the mystics that heartless knowledge is also worthless. There can be no real understanding without love. Intelligence, however essential, is not sufficient. The dispassionate love of truth must be kindled by the love of men, to win our sympathies and our loyalty. Truth must stand above human failings and passions, yet feelingless truth is repellent and to that extent ineffective. This has been proved many a time in history. Whenever the search of truth has become the privilege, and truth itself the jealously guarded secret, of a chosen few, it has led to failure ... Truthseeking can not be an end in itself, for what would be the sense of discovering it if he who discovers it to-day were simply to take it to his grave to-morrow? The seeking of truth implies the giving of it, liberally, to all who may want it. The man of science is great only to the extent of his devotion not simply to truth, but to other men; to be worthy of his calling, it is not enough to be disinterested, he must be ever so generous.[216]

Private truths are 'worthless' and 'ineffective'. Charity is required for knowledge to work. Knowledge must be made public in order for it to affect the lives of men. These are the practical implications of Sarton's rhetoric, and set in terms of Sarton's own work and priorities they meant that science history kept private would be useless for New Humanist purposes. Sarton's populist bent was a necessary outgrowth of his faith in science historical knowledge as a means of human redemption. How else could the history of science form the basis for widespread post-war reconstruction and lasting peace, if not pursued by and extended among the great mass of people? No,

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[215] Ibid., 2.

[216] Ibid., 14.

the achievement of a New Humanism would require knowledge *and* charity, and the concerted effort of all mankind:

> Cast your bread on the face of the waters, fling the seed — and I do not say that you will reap (why should you?) but there will be a harvest. One must be prepared to sow widely, generously, to cast much bread upon many waters, and to gather in but little and late if at all. The personality of the reaper is unknown, but the reaping is almost certain. That is enough.[217]

It is certainly true that Sarton was friends with and sympathized with the work of science historical popularisers. For instance, Sarton wrote favourably of the Oxford educationist, F. S. Marvin's science historical work in the pages of *Isis*, scolded his student Robert K. Merton for his 'ferocious treatment' of Marvin's work in his lectures, and recommended May to his 'old friend' Marvin on her 1936 visit to England.[218] Sarton was also keen friends with the English naturalist and populariser, Julian Huxley, with whom May became especially close while staying with the Singers in Cornwall.[219] Finally, Sarton was sure to entertain the popular science

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[217] George Sarton, 'Preface to Volume 21', *Isis*, 21 (1934), 500.

[218] For example, George Sarton, '*Science and Civilization*, edited by Marvin', *Isis*, 6 (1924), 119-21. Also Robert K. Merton, 'George Sarton: Episodic Recollections by an Unruly Apprentice', *Isis*, 76 (1985), 470-86; New York Public Library Berg Collection: George Sarton, 'Letter to May Sarton', 30 May 1936. Marvin wrote or edited several popular books on the history of science and civilization, most of which went to several editions. Something of his sympathy with Sarton's programme can be seen in their titles: F. S. Marvin, *Progress and History* (Oxford, 1916); F. S. Marvin, *The Century of Hope: A Sketch of Western Progress from 1815 to the Great War*, 2nd edn (Oxford, 1919); F. S. Marvin (ed.), *The Unity of Western Civilization*, 2nd edn, *Unity Series 1* (Oxford, 1922); F. S. Marvin (ed.), *Science and Civilization*, *Unity Series 6* (Oxford, 1923); F. S. Marvin, *The Living Past: A Sketch of Western Progress*, 5th edn (Oxford, 1931); F. S. Marvin, *Old and New: Thoughts on the Modern Study of History* (London, 1935); F. S. Marvin, *Comte, the Founder of Sociology* (London, 1936). See also Sarton-Marvin correspondence, Harvard Houghton Library bMS Am. 1803 (1004). Marvin will appear again in later discussions.

[219] For Sarton-Huxley correspondence see Harvard Houghton Library bMS Am. 1803 (796) and bMS Am. 1803.1 (311). For May Sarton's friendship with the Huxley's, see May Sarton, *I Knew a Phoenix: Sketches for an Autobiography* (London, 1959), especially pp. 196-222. See also May Sarton correspondence in the Berg Collection, New York Public Library and Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.16: May Sarton, 'Letter to Dorthea Singer', 27 October 1936; Harvard Houghton Library, bMS Am. 1803 (796): Julian Huxley, 'Letter to George Sarton', 17 September 1936. As well as friendship and an interest in history of science, Huxley shared Sarton's New Humanist vision. See, for example, Julian Huxley, *The Humanist Frame* (London, 1961); Julian Huxley, *Essays of a Humanist* (London, 1964).

fiction and history celebrity, H. G. Wells for dinner on Wells' 1937 American tour.[220] Singer, too, was friendly with each of these popularisers, sharing papers with Marvin, maintaining a working correspondence with Wells, and enjoying a friendship with Huxley easily as long and as personal as the one he enjoyed with Sarton.[221]

Yet somehow Sarton and Singer's populist rhetoric and associations did not translate into populist action. At least in the interwar period and aside from occasional reviews and propaganda pieces, Sarton never wrote for the general or even the student public. Singer was only slightly more generous. Of literally hundreds of papers and monographs published by the two between the wars, hardly a one appeared in the popular science or history journals or in popular or student booksellers' catalogues. Contrary to appearances, even Sarton's *Introduction* was never really intended as an 'introduction' — that is, as a work for the uninitiated. For instance, when Sarton did finally publish a popular work in 1952, he recalled a conversation with a former student regarding the *Introduction*:

> Many years ago, soon after the publication of volume 1 of my *Introduction*, I met one of my old students as I was crossing the Yard, and invited him to have a cup of coffee with me in a cafeteria of Harvard Square. After some hesitation, he told me, 'I bought a copy of your *Introduction* and was never so disappointed in my life. I remembered your lectures, which were vivid and colorful, and I hoped to find reflections of them in your big volume, but instead I found nothing but dry statements, which discouraged me.' I tried to explain to him the purpose of my *Introduction*, which was severe and uncompromising; a great part of it was not meant to be read at all but to be consulted ... [222]

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[220] See Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.16: George Sarton, 'Letter to Charles Singer', 11 November 1937. Among Wells' more popular works was his science-centred history of civilization, *The Outline of History*. See H. G. Wells, *The Outline of History: Being a Plain History of Life and Mankind* (2 vols., New York, 1923).

[221] See Singer Correspondence, Wellcome Institute for the History of Science. Also Charles Singer, 'The Dark Ages and the Dawn', in F. S. Marvin (ed.), *Science and Civilization, Unity Series 6* (Oxford, 1923), pp. 112-60; F. S. Marvin, 'Science and the Unity of Mankind', in Charles Singer (ed.), *Studies in the History and Method of Science* (2 vols., Oxford, 1921), ii, 344-58.

[222] George Sarton, *A History of Science* (2 vols., Oxford, 1952-9). Singer published his first general work in 1941. Charles Singer, *A Short History of Science to the Nineteenth Century* (Oxford, 1941).

This severity and lack of compromise was crucial and wholly intentional. Indeed, Sarton believed that by its very nature the history of science could not be 'introductory'. Instead, the history of science should be one's 'supreme humanistic initiation' — 'not ... in any sense introductory, but rather a sort conclusion, or final coordination.'[223] History of science was intended rather for experts.

Institutional records bear this out. *Isis* was advertised exclusively in scholarly journals — 'high grade' advertising, as Secretary Frederick Brasch put it. Of course, to say that *Isis* purchased only 'high grade' advertising is also to say that the journal pursued only 'high grade' readers. The same is true of the Society founded around *Isis*. For individual members, the History of Science Society targeted only those scientists who had recently published on some aspect of science history, either as an introduction to a scientific text or a special lecture. As for institutions, the Society targeted only university, museum and state libraries — particularly those institutions 'giving courses in the history of science'.[224]

Finally, when it came to the more practical business of populism Sarton was utterly unimpressed. For example, describing for Singer a meeting with the touring Wells, a baffled Sarton asked, 'how can a sensible man undertake a lecture tour unless he be obliged to do it by dire poverty ... ?' A more private life seemed to Sarton at once more enjoyable, more constructive and more liberated. He wrote, 'Wells could

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[223] George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), p. 158.

[224] Smithsonian Institution Archives, History of Science Society Records, RU 7474, Box 18, 'Correspondence 1935-40': Frederick E. Brasch, 'Report of the Secretary-Treasurer', 15 December 1936. See Smithsonian Institution Archives, History of Science Society Records, RU 7474, Box 23 for the record of *Isis* advertisements.

indulge himself, write more books quietly in his study ... instead of which he sells himself into slavery. That is absolutely beyond my understanding.'[225]

Indeed, for all his populist flourish, Sarton was always more honestly interested in a purely academic audience. One indication is his refusal to accommodate public shortcomings or even public tastes. In a private letter to Merriam, Sarton explained that, 'To make science or art cheap and vulgar by misstatements, falsifications and the use of slang and "pepper" is to me the unpardonable sin.'[226] This applied especially to *Isis*. Sarton rejected any criticism of *Isis* as 'dull' or 'unprofitable', and refused to 'dumb-down' in any way.[227] Moreover, not only did Sarton record his disdain for popular work, he at times made known his contempt for popular audiences, especially American ones, and often warned of the 'levelling' tendencies of democratic society.[228] He cynically wrote:

> The American reader is a spoiled child who wants to be entertained and does not want to make any effort. He wants to understand everything without any fatigue, and he gets what he wants. For example, he wants to understand the principles of relativity without knowing the A. B. C. of mechanics and mathematics and, as he is willing to pay a high price to his instructors, there are plenty of such instructors. They explain the thing to him by explaining the difficulties away. He believes he has understood, but he has understood nothing. But it does not matter, for half an hour after hearing the brilliant explanation, he has already forgotten every word of it.[229]

Even publicly Sarton let these sentiments be known, although he softened his idiom and offered some rationalization. Sarton insisted that *Isis* did not involve 'any

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[225] Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.16: George Sarton, 'Letter to Charles Singer', 11 November 1937.

[226] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to John C. Merriam', 1 April 1922, p. 4.

[227] Ibid., p. 3.

[228] Ibid., p. 4. See also Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Robert S. Woodward', 23 June 1918; George Sarton, 'Secret History', *Scribner's Magazine*, 67 (1920), 191-2.

[229] Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to John C. Merriam', 1 April 1922, p. 3.

feeling of superiority or pride, anything aristocratic or contemptuous'. Theoretically anyone willing to take the time and effort to rise to its level could participate in *Isis*. Suggesting again the populist necessity of the New Humanism, Sarton wrote in his preface to *Isis* Volume 11, 'our appeal is not directed to any predetermined group of men, but to all men ... The fact that [they] will not appreciate everything which is printed in *Isis* hardly matters, for the essential is the message itself.' Later he insisted:

> Any man, who living a humble life, finds it possible to tear away from the newspapers and magazines and read slowly a good book, or who has enough stamina to resist the cheap seduction of the movies in order to attend a good play or listen to good music, or simply to walk wistfully in his garden ... will instinctively appreciate our effort, even if there be much in *Isis* which does not interest him ... [230]

Nevertheless, the burdens of participation were placed fully and squarely on the shoulders of the public. These were so stringent that they drastically limited the prospective audience for history of science. In fact anyone meeting Sarton's criteria would probably be an academic already.

'This then is the standard of *Isis*: pure science, pure scholarship'.[231] 'Above all', wrote Sarton, the history of science requires 'austerity'. Only austerity, diligence and rigour can satisfy the New Humanist's 'wish to see wholes rather than fragments'. Austerity was simply 'another aspect of unity' — that fundamental unity upon which the New Humanism was founded and toward which it was directed. Sarton wrote, 'The New Humanism is not a new kind of sophistication, but a higher education of the most austere and uncompromising type. Let other people lower their standards, we will keep ours aloft, high above the noisy and vulgar crowds, yet within

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[230] George Sarton, 'Preface to Volume 11', *Isis*, 11 (1928), 11-2.

[231] Ibid., 7.

the reach of every pure heart.' These pure of heart were Sarton's 'most beloved public'.[232]

At least for the time being, this beloved public consisted 'mainly' of 'two young men' Sarton imagined first a 'physicist' — his mind full with experiments, but his heart 'hungry' and eager 'to embrace the unity of science, to understand its genesis and evolution, to appreciate the convergent endeavors of artists, reformers, dreamers and holy men.' For this young man, *Isis* will be his 'literary journal, his romantic friend.' The second young man was a 'scholar', maybe a medievalist, trying seriously to understand intellectual convergences among the Latin, Greek, Arabic and Hebrew cultures of the Mediterranean. This young man would need *Isis* as 'his scientific advisor.' About these Sarton wrote:

> These two men are very different, yet they have an air of resemblance. They have come from opposite points of the intellectual horizon, but at the end of their long journeys, they find themselves surprisingly near. They symbolize very well the composite public of *Isis*: scientists nourishing historical interests and loving to look backward once in a while; scholars who want to know something of that all-embracing and esoteric world of science which is surrounding them more and more closely. Indeed, the New Humanism is a double renaissance: a scientific renaissance for men of letters, a literary and artistic one for men of science.[233]

'Pure science, pure scholarship', reiterated Sarton, 'No compromise is possible here. Such compromise may be necessary and useful somewhere else, but here — in *Isis* — it would be a sort of betrayal.'[234] To sacrifice scientific and scholarly standards, to admit anything less than academic austerity, would be to betray the New Humanism. He wrote:

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[232] Ibid., 11-3.

[233] Ibid., 8-10.

[234] Ibid., 5-14.

> Many subjects dealt with in *Isis* must seem of little importance to those readers who are not sufficiently equipped to understand their connections and implications ... For the same reason hundreds of pages of *Isis* will seem hopelessly dry to many readers. This is not one of our many shortcomings but an unavoidable necessity. Generalizations may be all right on Sundays; they are not in order on working days. We hope to be able to publish sometimes a 'holiday' number, but we do not promise it. We hope to publish popular articles, but most will needs be unpopular. Some people think that they are inspired all the time, but so much inspiration is rather suspicious; it is more probably that they are simply intoxicated or infatuated. One hour of divine inspiration in a life-time of work, one inspired page in a whole volume of *Isis*, that is enough, if we are wise enough to make the most of it.
>
> *Isis* is a very austere journal. In spite — and perhaps because — of which, we expect that all those who love scholarship and truth for its own sake, will help us with all their might and main.[235]

The hoped for reconciliation of science and humanism must begin with the scientist and scholar. The aims of the New Humanism, the requirements of post-war reconstruction, demanded the public be limited to this élite. Perhaps the ultimate triumph of the New Humanism would allow Sarton's populist rhetoric to become a reality. For now, however, his austere young men must form a lonely vanguard. 'To be candid,' wrote Sarton, 'the ideal public of Isis does not yet exist in any tangible size, but it is continually growing, and others — later, much later — will reap what we are sowing. That is all right. The only terrible thing would be if nobody reaped; but no matter how late the husbandmen come, the harvest will be ready.'[236]

It is a measure of the strength of Sarton's commitment to the idea of science history as post-war necessity that he found a way to justify both inclusivity and exclusivity with appeals to the same New Humanism. On the one hand, widespread post-war reconstruction required the widespread diffusion of science history and its New Humanism. On the other hand, however, a lasting reconciliation of science and humanism — the only solid foundation for this New Humanism — required the

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[235] George Sarton, 'Preface to Volume 8', *Isis*, 8 (1926), 10-1.

[236] George Sarton, 'Preface to Volume 11', *Isis*, 11 (1928), 8-10.

austere efforts of austere scientists and scholars. Practically, Sarton favoured the later and catered his publications and institutions exclusively to a small, professional élite.

In the end not all that much can be said about academic history of science's public: in a sense, academic history of science's ideal public was itself, making its public almost indistinguishable from its practitioners.

**The Populism of the Science Museum**

Museum audiences are notoriously difficult to pin down. Occasionally sources allow museum historians to trace definitively the social make-up of an institution's public, but in most cases historians must settle for inferences based on such things as the content of exhibitions and entrance fee revenues. Museums have often kept records of visitor numbers, but not of visitor nature. Only recently have some museums invested in focus groups, visitor surveys and visitor behaviour analyses. These will provide the future museum historian with resources currently unavailable. But for the interwar period problems remain, and the interwar Science Museum is no exception.

Still, there are certain things that can be said about the interwar Science Museum's audience. In fact, there is probably better information for the Science Museum than there exists for any other location for interwar science history. Most significantly, it is obvious that between the wars the Science Museum's audience was vastly enlarged. For instance, excepting the wartime closures, attendance figures from 1913 until the opening of the Eastern Block in 1925 were little changed. For each of these years, visitors to the Western Galleries averaged about 400,000. Yet by the time of the official opening of the Eastern Block in 1928, this number had already

risen to nearly 900,000. By the end of Lyons' tenure as Director in 1933, attendance had topped 1.25 million, where it more or less remained until the outbreak of the Second World War. Throughout this period, daily attendance averaged around 2,000 on weekdays. On Sundays this figure swelled to more than 5,000, and Easter Monday in 1932 saw nearly 44,000 visitors.[237] All in all, these numbers made the Science Museum the most popular of the National Museums in the 1930s, with only the British Museum even coming close.[238]

Fortunately for a discussion about science history's interwar aspirations, even more can be said about the Science Museum's intended public than about its actual public. As in the university, these public intentions were closely tied to notions of practitioner identity. Whereas in the university both practitioners and public were expected to meet a standard of pure science and scholarship, in the Science Museum an ethic of scientific service among practitioners reflected a deeply felt and keenly practised populism.

As mentioned above, most commentators have focused on the growth of the Science Museum's physical plant and on the 'struggle' for space that occupied much of the interwar period. In fact the rhetoric that surrounded this struggle has as much to say about the Science Museum's public intentions as it does about the progress of the building works. This is because the Advisory Council's appeals for increased accommodation were consistently made on behalf of the public. Early on in the period, the building programme was justified by the prospect of increased attendance: 'It is certain that with more ample space for exhibiting the Collections the attendance

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[237] Science Museum Advisory Council, *Reports for the Years 1920-1938*.

[238] See table, Standing Commission on Museums and Galleries, *Second Report* (London, 1938), p. 39.

would be very greatly increased at all times of the year.'[239] Likewise, in times of low attendance, the inadequacy of the galleries was blamed for visitor discouragement:

> The number of visitors admitted to the galleries of the Museum during the year was 429,558, a somewhat smaller number than in 1924. There is no doubt that the inconspicuous character of the temporary entrance ...discourage many from penetrating along the narrow pathway 200 yards in length which leads to the present entrance ... [240]

Yet, even at times of healthy attendance, the populist case for increased accommodation held firm — though it needed to be slightly altered. In milk years it was based instead on visitor overcrowding. As Sir Hugh Bell wrote in December 1929:

> The well-maintained increase in the numbers of visitors shows that a large and growing proportion of the public is keenly interested in the scientific and technical aspects of industry, but this is causing considerable congestion in the galleries ...
>
> This large and rapid increase in the number of visitors, which so far shows no sign of a check, provides in our opinion an additional ground for the provision of another block, since the narrow galleries of the old buildings do little to relieve congestion.[241]

By contrast with Sarton and his university-based colleagues, the populist rhetoric of the Science Museum spilled beyond the Museum's public relations efforts and into its galleries. Above all else, the 1911 Board of Education report made clear that the Science Museum should 'cater for non-specialists', and beginning in 1920 with Lyons' appointment as Director, the targeting of the general public became ever more direct.[242] In a lengthy 1922 memorandum, Lyons outlined a plan for rearranging

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[239] Science Museum Advisory Council, *Report for the Year 1920* (London, 1921), p. 8.

[240] Science Museum Advisory Council, *Report for the Year 1925* (London, 1926), p. 9.

[241] Science Museum Advisory Council, *Report for the Year 1929* (London, 1930), p. 24.

[242] Xerxes Mazda, *The Changing Role of History in the Policy and Collections of the Science Museum: 1857-1973, Science Museum Papers in the History of Science 3* (London, 1996), pp. 14,7; Board of Education, *Report of the Departmental Committee on the Science Museum and the Geological Museum* (London, 1911).

the galleries based on what he perceived to be the general public's requirements.[243] Almost immediately, the Museum's collections, galleries and publications came to reflect the populist turn.

In preparation for meetings to be held in coming months, Lyons' memorandum aimed 'to serve as a basis for discussion'. But Lyons was disappointed to find his staff ultimately unhelpful. Ten years on, in a handwritten letter to Mackintosh attached to the report, Lyons described 'discussions ad nauseam at many meetings with the Higher Officers'. He writes, 'In the end, having got no help from them, for only two others of the useful ones had joined at that date, I gave it up and went ahead on something like the scheme sketched out ...' The extent to which this scheme diverged from earlier museum policy is revealed in its hostile reception among older members of staff who, according to Lyons, 'accepted it under mute protest'. For the next ten years the intention of the galleries was largely down to Lyons.[244]

Throughout his memorandum, Lyons privileged the viewpoint of the 'ordinary visitor' over the 'technical visitor' or 'specialist'. His stated purpose was to 'formulate the principles which are to govern the exhibition of objects and collections in the new buildings so as to show them to best effect, with the greatest convenience to the ordinary visitor, and in the most instructive and attractive manner.' Writing at the height of the Imperial War Museum controversy, Lyons was particularly worried that limited space would obscure the meaning of objects to visitors. Concerned about the damage done to the visitor's convenience and instruction by the crowded and

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[243] Science Museum Archive Z 183/1: Henry G. Lyons, 'Memorandum on the Arrangement of Collections in the Science Museum to Serve as a Basis of Discussion', 17 August 1922.

[244] Science Museum Archive Z 183/1: Henry G. Lyons, 'Letter to E. E. B. Mackintosh', 29 January 1932.

haphazard arrangement of objects, Lyons even decided that much of the collection should be removed from display. Breaking with previous Science Museum policy, Lyons determined that 'the crowding of objects in the existing galleries must not be reproduced in the new buildings where only so much will be placed as can be shown there properly.' For the 'majority of visitors', he wrote, 'these collections already, in many cases, illustrate a branch of technology in greater detail' than was required. Rather, to ensure the satisfaction of visitors and to hold their interest and attention, collections should not be enlarged unnecessarily or displayed in an 'unwieldy and wearisome' manner.[245]

In much the same way Lyons broke with earlier labelling practice. Just as exhibits should pared down for visitors, so always should 'long labels ... be avoided, and where exceptionally lengthy treatment is desirable this should be reserved for the catalogue.'[246] According to Lyons, labels should never exceed 'two-thirds of a page' or a '2 inch card', or '100 to 400 words in length'.[247] As he remarked to the Museums Association's Wembley meeting in 1924:

> These detailed descriptions, or object labels, have been brought to a high standard of development at the Science Museum ... but we feel that some of them are already too long to be useful even to a technical visitor. The aim is now to restrict these labels to 400 words as a maximum, and to print the general description as an introductory paragraph in heavy type, the more detailed and technical account following in ordinary type.[248]

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[245] Science Museum Archive Z 183/1: Henry G. Lyons, 'Memorandum on the Arrangement of Collections in the Science Museum to Serve as a Basis of Discussion', 17 August 1922. Also Science Museum Advisory Council, *Report for the Year 1923* (London, 1924), p. 6.

[246] Science Museum Archive Z 183/1: Henry G. Lyons, 'Memorandum on the Arrangement of Collections in the Science Museum to Serve as a Basis of Discussion', 17 August 1922.

[247] See Science Museum Archive Z 148: Henry G. Lyons, 'Science Museum Memorandum 108', 13 December 1920; Science Museum Archive Z 183/1: Henry G. Lyons, 'Memorandum on the Development of the Science Museum From 1920 to 1933', August 1933, p. 3.

[248] Henry G. Lyons, 'The Aim and Scope of the Science Museum', *Museums Journal*, 24 (1924), 117-8.

Finally these populist concerns helped determine the historical content of the Science Museum's galleries and publications. In fact, it was not until 1911 that the Science Museum formally recognised its historical role, and it wasn't until the interwar period that science history finally entered the galleries and became a day to day concern of the Science Museum.[249] The timing was no accident. Even when it had taken hold, it had not done so by its internal merits. Rather, science history entered the Science Museum as a timely and useful point of popular relevance.[250] Just after the war, for instance, the Science Museum replaced its old *Catalogues* series with a new *Handbooks* series. Whereas the Catalogues had provided exhaustive technical descriptions of collections, the *Handbooks* were 'intended to serve as an introduction to the study of the history and development' of selected branches of science and technology and provided only 'special reference' to particular objects.[251] In his testimony before the Royal Commission on National Museums and Galleries, Lyons explained the new publications regime, justifying the replacement of the *Catalogues* with the more historical *Handbooks* in populist terms:

> ... frankly I am not satisfied with the catalogues. The same type has been in use for many years, and its has been referred to favourable by more than one committee, but it really is too technical and dry, being little more than a reprint of the labels ... We are trying now to get out a new form of catalogue which will give a description of the group in question ... which will make it much more readable and then we shall be able to bring down the

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[249] See Board of Education, *Report of the Departmental Committee on the Science Museum and the Geological Museum* (London, 1911), pp. 4-5; Xerxes Mazda, *The Changing Role of History in the Policy and Collections of the Science Museum: 1857-1973, Science Museum Papers in the History of Science 3* (London, 1996).

[250] Robert Bud, 'History of Science and the Science Museum', *British Journal for the History of Science*, 30 (1997), 47.

[251] For examples see Science Museum, *Catalogue of the Collections in the Science Museum, South Kensington: With Descriptive and Historical Notes and Illustrations, Mathematics* (London, 1920); Alexander Barclay, *Handbook of the Collections Illustrating Industrial Chemistry, Handbooks of the Science Museum* (London, 1929).

> price of the catalogue because we shall be able to sell larger numbers.[252]

Similarly when these *Handbooks* were issued, the Advisory Council assessed their success in terms of their popular appeal:

> The new form in which the Handbooks of Aeronautics (Heavier-than-air Craft) and Industrial Chemistry have been issued is, we consider, a decided improvement on the earlier one which was primarily a catalogue of objects. The historical sections are of definite value, and are likely to appeal to a wide circle of the public.[253]

These populist priorities were carried throughout much of the period. In the letter attached to the report he supplied Mackintosh, Lyons wrote, 'I have just come upon this. You may like to glance through it before throwing it away, which is all it is fit for now.' Yet in notes scribbled in the margin beside this comment, Mackintosh rejected Lyons' suggestion for the paper and betrayed his sympathies with Lyons' populist approach. 'No!' he wrote, 'Keep it, for the fundamental principles will not alter and are necessary as a reminder from time to time.'[254] Indeed, Mackintosh elaborated on these 'fundamental principles' and added his own ideas about the Science Museum's public role in a 1936 'Publicity Guide'. Concerned that 'the immense educative capital contained in the National Museums and Galleries was insufficiently known to the public and was not paying a proper dividend', Mackintosh set out to reinvigorate the Science Museum's public relations efforts. The nature of efforts clearly reflected Mackintosh's prioritisation of the general public. Consider,

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[252] Royal Commission on National Museums and Galleries, *Oral Evidence, Memoranda and Appendices to the Interim Report* (London, 1928), p. 152.

[253] Science Museum Advisory Council, *Report for the Year 1929* (London, 1930), p. 25. See also Alexander Barclay, *Handbook of the Collections Illustrating Industrial Chemistry*, *Handbooks of the Science Museum* (London, 1929); Maurice John Bernard Davy and George Tilghman Richards, *Handbook of the Collections Illustrating Aeronautics*, *Handbooks of the Science Museum* (3 vols., London, 1929-36).

[254] Science Museum Archive Z 183/1: Henry G. Lyons, 'Letter to E. E. B. Mackintosh', 29 January 1932.

for example, Mackintosh's recommendations for the monthly distribution of leaflets. While the greatest number of these, between 2,000 and 2,500, were reserved for sale — price 4d — in the Science Museum itself, the tourist market received the second largest number, with 746 hotels and boarding houses targeted for distribution. Next on the list were schools and education authorities, which received 500 copies. Other bodies received special notice of acquisitions and exhibitions, including 145 press agencies and papers, the BBC and the London Underground. Finally, only a scant remainder were provided to the more technical public — the Museum staff itself, a few journal editors, a handful of private patrons, and 'a small number of miscellaneous Institutes'.[255]

Thus throughout much of the interwar period, and under both Lyons and Mackintosh, the Science Museum prioritised a wide and general public. It might even be guessed that the sheer size of the Museum's attendance meant that these populist aspirations were ultimately satisfied. Certainly, these intentions helped determine the display of the Museum's collections, the layout of its galleries, the historical meanings of its exhibits and publications, and the nature of its public face in advertising. What is more, this populist bent surely coincided with the inclusive image of the Peace Museum and with the Museum Officer's identity as scientific civil servant.

Returning to a comparison with Sarton, it might be argued that in following through on its populist rhetoric the Science Museum more fully lived up to the unifying aims of interwar science history — that Sarton betrayed the ideals of the New Humanism in his disregard for the vast number of humans. Yet Sarton's reasons for this betrayal were all about purity — pure science, pure scholarship — and he was

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[255] Science Museum Archive Z 61: E. E. B. Mackintosh, 'Publicity Guide', April 1936.

not prepared to sully this even to realise his public rhetoric. This was not the case in the Science Museum and its cousins being conceived in the America. Indeed, the museum's populism was not entirely pure, and its efforts in the public interest were not entirely disinterested. What appeared to be slight differences among practitioners — among Sarton's new scientists and the museum's scientific servants — were magnified through the lens of their publics to point toward larger conflicts in the culture of interwar science history.

**Building the Museum to Human Specifications**

Imaginary publics are even more difficult isolate than imaginary practitioners, and yet a considerable amount of information about the publics intended for American science museums can be gleaned from the planning discussions of boosters and board members. In fact these discussions reveal that leaders of the American science museum movement were particularly concerned with their prospective publics, and that these concerns were both pragmatic and profound.

Pragmatically, these concerns were financial. More than their European counterparts, American museum planners were forced into a public posture. That is, unlike European museums, the proposed American museums could count on no promise of government funding. Public participation — especially financial participation — would be vital to their success. Indeed, the financial participation of the public was expected on all levels. Large donations from wealthy industrialists like Rosenwald and Towne could get a movement started, a charter written and perhaps a building built, but they wouldn't suffice for long-term and continued operations. For this the leaders of the American science museum movement turned to

the tried and true methods of older art and natural history museums, which focused heavily on subscriptions and memberships for their financial wellbeing.

The importance of membership is witnessed by the attention given it by the Museums of the Peaceful Arts' George Frederick Kunz, who devoted an entire volume of his massive Presidential Report to the subject. In successive and rigorously documented discussions, Kunz described everything from 'How Museums Try for Subscriptions', 'How Museums Handle Their Publicity' and 'What Museums Do for Children' to the planning of lecture series, the marketing of publications, and the opportunities presented at Christmas for selling gift memberships. In each case, Kunz accompanied his discussion with pamphlets and policy papers from other institutions demonstrating the ways in which existing ventures had answered these questions for themselves. Taken together these lengthy discussions and stacks of ephemera provide a comprehensive overview of how the Museums thought to attract and deal with their prospective publics.[256]

Among the institutions that received special attention in Kunz's report was the Franklin Institute of Philadelphia. On the very first page of his volume on membership, Kunz pasted a document entitled 'Classes of Membership', which he had torn from the pages of its *Journal*.[257] As its title suggests, the document describes the various privileges and purposes of membership of the Franklin Institute, and Kunz hoped to encourage its model in the New York Museums. Aside from 'Honorary and Corresponding Members' — members of the scientific community awarded membership for special achievement — the first classes of membership were clearly aimed at fundraising. 'Endowment Memberships', for example, were reserved for

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[256] Dibner Library MSS 001736 B 1 v. 8: George Frederick Kunz, 'Museums of the Peaceful Arts, Supplement to the President's Report', 12 January 1928.

[257] Ibid., p. 2.

'persons, firms, corporations or associations who shall make an endowment payment of Five Thousand Dollars to the Institute'. 'Resident Life Memberships' and 'Contributing Memberships' were likewise based on significant cash contributions, again with the clear purpose of securing the financial position of the Institute. These first classes of membership were the bread and butter of American museums, and the ways in which to attract and hold them were Kunz's first order of business.

Other classes of membership were directed at other, more profound ends. Less dear, for instance, were the annual passes that Philadelphia residents could purchase for just fifteen dollars. Likewise 'second class stock holders' were entitled to membership for the reasonable sum of twelve dollars. Non-residents, on the other hand, could become members for annual dues of five dollars, and students between the ages of sixteen and twenty-two could secure annual membership for three dollars. Obviously, these modest fees were not intended primarily for fundraising. In the case of these lower classes, Kunz was more concerned with service and alleviating demands on his visitors' pocketbooks.[258] With regard to the information desk, for example, Kunz wrote:

> This is of the utmost importance. Some bright person should always be on duty to make appointments, give information, and to sell postcards, guides and photographs ... A series of leaflets costing five cents each should be provided for each department, and a good general guide, not to cost over ten cents, the latter with a good plan of the buildings. This plan could be framed and marked as to locations ... They are of enormous assistance to visitors. The magazine of the Museum could also be sold at the desk and the price should be only ten percent above the cost of production.[259]

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[258] Dibner Library MSS 001736 B 1 v. 2: George Frederick Kunz, 'Museums of the Peaceful Arts, President's Report', 1 July 1927, pp. 37, 54, 74. See also Dibner Library MSS 001736 B 1 v. 8: George Frederick Kunz, 'Museums of the Peaceful Arts, Supplement to the President's Report', 12 January 1928, pp. 34-7.

[259] Dibner Library MSS 001736 B 1 v. 2: George Frederick Kunz, 'Museums of the Peaceful Arts, President's Report', 1 July 1927, p. 36.

Rather, these lower classes of membership point to the broader societal and political aspirations of the American science museum movement. Around the same time as Kunz presented his internal reports, others in the Museums of Peaceful Arts organization tackled the subject more publicly. In 1928, for instance, the Museums' acting director and former assistant head of the National Bureau of Standards, F. C. Brown, offered his thoughts on exhibit design in the *Scientific Monthly*. Noting the all-too-common experience of 'museum fatigue' among the museum-going public, Brown suggested a series of remedies designed to make the museum experience both more enjoyable and more profitable for visitors. In doing so, Brown spoke pointedly to the needs and nature of the science museum's public and in turn to its broader public purposes.[260]

First and foremost, Brown insisted that museum fatigue was no fault of the visitor. Rather it was the fault of exhibit designers, and to prevent it, Brown argued, it was the duty of those designers to build their exhibits to 'human specifications'. Here Brown stressed not only 'purely physical considerations' such as temperature, humidity, ventilation, housekeeping, coat rooms, seating and dining, he also stressed the visitor's 'intellectual comfort'. Using the Museums of the Peaceful Arts' newly opened midtown 'demonstration gallery' as a case in point, Brown extolled the virtues of the Museums' hands-on exhibits. By his account these had not once received a complaint from a weary visitor. He wrote: 'the visitor in such a museum as we are describing should be fatigued to a minimum extent, because of the variety

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[260] F. C. Brown, 'Building a Museum to Human Specifications', *Scientific Monthly*, 26 (1928), 193-201. Extensive biographical material, along with Brown's personal papers, can be found in the National Museum of American History's Archives Center

of muscles that are brought into play and because throughout he is conscious of his own participation.'[261]

Modelled on those in the Deutsches Museum, the Museums of the Peaceful Arts' hands-on exhibits were clearly aimed at attracting audiences. They were, in Charles Gywnne's words, a self-conscious 'bid for patronage by offering sensations of a pertinent kind'.[262] Indeed Brown's sole criterion for the success of the industrial museum was the size and engagement of its public. He wrote: 'An industrial museum can succeed only in proportion to the visitors it interests.'[263] According to Brown, moreover, this should not be too difficult a task. Barring museum fatigue, Brown argued, the science museum should someday attract 'as great an interest as a prize fight or a football game.'[264] That is, correctly designed and cognisant of the visitor's needs, the science museum should naturally attract a widespread public. Brown wrote: 'The visitor, having arrived at the museum, should find the building without difficulty, and its appearance should make his heart beat faster, much in the same manner as when, in his boyhood days, he arrived near the old swimming hole.'[265]

The reasons behind this natural fit between the science museum and its public lay firmly in the perceived universality of science history. Given the right conditions, the visitor should engage the science museum and its universal subject matter with familiarity and ownership. Brown wrote:

> The industrial museum should be the embodiment not only of the material forces that have characterized the last century, but should show the upward climb from first beginnings to the present day. It

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[261] Ibid., 193-200.

[262] Charles Gwynne, *Museums of the New Age: A Study of World Progress in Industrial Education* (New York, 1927), p. 12.

[263] F. C. Brown, 'Building a Museum to Human Specifications', *Scientific Monthly*, 26 (1928), 201.

[264] Ibid.

[265] Ibid.

> should treat the visitor on the basis of his integrated ancestral experience of hundreds of centuries.[266]

Central to this assertion was Brown's profound respect for the public and his keen acknowledgement of both their place in the story of science history and their importance in achieving the ultimate goals of the science museum movement. In this the more noble reasons for the science museum movement's populism become clear. For the scientific servants of the American science museum, the encyclopaedic and ecumenical history of science and industry presupposed an encyclopaedic and ecumenical public, and demanded that everything possible should be done to exhibit the shared human experience of science history to human specifications. In this way, finally, the unity of science history naturally brought people together, allowing the industrial museum to stand naturally as a Peace Museum.

But although it resonated with the rhetoric of the Peace Museum, there were, to be sure, some deeper motives behind the movement's populism. The American science museum's populism was also tied to firmly held and inflexible notions of community and citizenship. 'The first problem ... of the museum' wrote Brown, 'is to gain and maintain its audiences. This means that the visitor should be interested to such an extent that he will desire to return and that he will tell his friends of the profit he has received ...'[267] Here and elsewhere Brown argued the science museum's interest in community building. More correctly, the American science museum movement was interested in improving and redefining citizenship in the community. In one article Brown quoted from an editorial in *Science*. He wrote:

> We doubt, however, whether much of the science teaching in the schools, either primary or secondary, could be regarded as science for citizenship instead of science for specialists, and we should

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[266] Ibid.

[267] Ibid., 194.

> welcome a movement which would broaden its scope and change its character.[268]

Or as the Founder Engineering Societies of the National Museum of American Industry put it *The Repertory*:

> The need for such museums arises from the complexity of modern industrial civilization, which has become organized on a scale so vast as to reach and influence every human being ... Some knowledge as to the nature and growth of the industries fundamental to our daily life is essential to a full comprehension of our political and social institutions, and of the civilization of today. Museums of engineering and industry can be made an essential means of securing and perpetuating such intelligent understanding.[269]

As this last statement suggests, in the minds of the science museum movement's promoters, good citizenship was grounded in good commerce. The community ties that the industrial museum cared to strengthen were commercial ties. Citizenship in Brown's definition, for example, was clearly tied to economic participation. He wrote:

> It will mean much to the progress in business relations if the banker, the engineer, the educator and the worker can all talk somewhat the same language, and by that I mean, have an inkling of the same understanding of what the language means ... The whole secret of the industrial museum is, after all, one of economy, and rest upon the foundation that operating models and parts of models, sectioned and otherwise, can give understanding for which there is not otherwise means or time.[270]

For Brown the good citizen was one who fit easily into the economic order, and the science museum was intended to make this fit. It might even be said that when Brown referred to 'operating models', he referred not only to museum objects operating in the exhibit hall, but also to their audiences operating in the economy.

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[268] F. C. Brown, 'The Industrial Museum', in Frederic William Wile (ed.), *A Century of Industrial Progress* (Garden City, NY, 1928), p. 567.

[269] John R. Freeman et al., 'An American Museum of Engineering, Objectives', *The Repertory*, July 1927.

[270] F. C. Brown, 'The Industrial Museum as an Aid to Technology: Benefits to be Derived from a Better Understanding by the People as a Whole of the Factors in Our Industrial Development', *The Tech Engineering News*, December 1928.

Redefining citizenship in this way required that the industrial museum attract the broadest possible public, including, but not limited to, the banker, the engineer, the educator and the worker. It also meant attracting young people, especially those on the verge of entering into full citizenship. 'In general, therefore, the museum will be directed to the boy and girl of sixteen, and in doing so it will reach the boys from eight to eighty.'[271]

Indeed all evidence points toward the fact that it was this group of youngsters that Brown targeted at the opening of the Museum of the Peaceful Arts' temporary galleries in midtown Manhattan on 40th Street in 1927. Although these temporary galleries were in the first instance intended to attract the interest and financing of prominent members of industry, nevertheless, of the groups invited to attend the galleries in their first full year of operation, nearly two-thirds were school groups. Of these nearly half were from the secondary schools.[272] Targeting adolescents, the Museums hoped to effect their future lives as citizens. Here the industrial museum set itself up as an educational institution, and it found itself alternately in cooperation and in competition with the schools. Unlike the schools, however, the museum had not according to Brown the benefit and 'moral persuasion of grades, prizes, diplomas, and the like.'[273] Its alternative means of persuasion and the educational ends to which they were turned will be the subject of Chapter 4.

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[271] F. C. Brown, 'The Industrial Museum', in Frederic William Wile (ed.), *A Century of Industrial Progress* (Garden City, NY, 1928), p. 570.

[272] See National Museum of American History Archives Center: F. C. Brown Papers, Box 2, Folder 6: F. C. Brown, 'Director's Report for the Meeting of the Board of Trustees', 2 March 1928; National Museum of American History Archives Center: F. C. Brown Papers, Box 2, Folder 6: F. C. Brown, 'Director's Report for the Year 1929', 1930.

[273] F. C. Brown, 'Building a Museum to Human Specifications', *Scientific Monthly*, 26 (1928), 194.

# Chapter 4: Education

## Teaching History of Science

During the interwar period, Sarton, Singer and their colleagues carefully restricted participation in history of science, both among amateur practitioners and the general public. This attitude extended to education. Though obviously committed to the establishment of science history courses and departments in the universities, both Sarton and Singer were unwilling to admit any but the most advanced students to formal study in the history of science. As Sarton wrote, 'I am not at all hypnotized by my own studies. I believe that the history of science should be studied very deeply, far more so than it has been heretofore, but as in the case of learned languages, I would not try to enforce its study upon too many people.' Singer took a similar line, arguing that 'the history of science as a whole is far too difficult a subject for school teaching, and, indeed, too difficult for any but exceptional students of university rank.'[274]

Nevertheless, this restriction on direct student participation in history of science didn't mean that it had no place in education. Rather, science history should play an important — albeit indirect — role in the school curriculum. That is, rather than stand-alone courses in history of science, history should pervade the science lesson, and science, the history lesson. Science teachers should be schooled in

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[274] George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), p. 135; Charles Singer, 'Scientific Humanism', *The Realist*, 1 (1929), 15. Note: the following discussion mainly concerns attitudes toward education in the schools. Of course, as professional lecturers both Sarton and Singer also held strong opinions on the teaching of science history in the universities. However, these opinions will have been gleaned from earlier sections — in particular Chapter 1 — or will be from following sections. The intent here is rather to compare ideas held by academic historians of science regarding the place of science history in the schools as compared with similar ideas held by practitioners in science history's other contexts.

history, and history teachers schooled in science. While not itself a subject suitable for schoolwork, science history should saturate the interstices of the curriculum, providing something of a glue amongst more appropriate and elementary subjects. Science history would thus work subtly to unify the educational system, paving the way for a New Humanism and with it post-war reconstruction.

If the preceding discussions have seemed unduly focused on the likes of Sarton and Singer, it is only because other university-based historians of science rarely spoke out on the matters discussed above. Content to concentrate on their researches, most university practitioners left the work of discipline building, definition and propaganda to Sarton in America and Singer in Britain. At least one aspect of disciplinary importance, however, received considerable attention from the wider body of academic practitioners. If most practitioners were silent on matters of purpose, identity and audience, they were nevertheless more outspoken when it came to education, though the opinions they expressed very closely matched those of Sarton and Singer.

The subtle centrality of science history in education was widely accepted and promulgated in the years immediately following the Armistice. As Bill Brock points out, this was especially true among school science teachers seeking to counter criticisms by their classics colleagues. Brock describes how, in the wake of the technological horrors of Great War, classics teachers seized the opportunity to recoup the ground they lost to science teachers in the curriculum battles of the previous century. Looking to discredit traditional criticisms of science as dehumanising, science teachers and curriculum designers augmented their experimental

demonstrations and discussions of theory with scientific biography and histories of human discovery.[275]

Building on the work of Brock and others interested in the development of science education in Britain, Anna-Katherine Mayer takes this story further, describing the uses of science's past in interwar education *vis-à-vis* contemporary moral and political negotiations.[276] Many of these will ring familiar. Mayer deftly argues that in trying to distinguish themselves from their German counterparts and to distance themselves from the technological disaster of the war, post-war English educationists contrasted the strong 'moral' aspect of the English educational system with the strict 'efficiency' of the German system. However, this charged dichotomy posed a special problem for advocates of science education — that is, how to teach science without compromising morality for efficiency. With these concerns in mind, it was almost universally agreed that science education must somehow be 'humanised'.

Mayer points specifically to two high-level reports issued in the last days of the First World War, one by the British Association for the Advancement of Science (BAAS) and the other by a governmental committee chaired by J. J. Thomson, both of which 'vetoed specialized or vocational scientific training, lent their support to a general, "humanized" scientific curriculum, and affirmed the dominance of traditional

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[275] B. Brock, 'Past, Present and Future', in M. Shortland and A. Warwick (eds.), *Teaching the History of Science* (Oxford, 1989).

[276] A. K. Mayer, 'Moralizing Science: The Uses of Science's Past in National Education in the 1920s', *British Journal for the History of Science*, 30 (1997), 51-70. For the history of school science in general, Mayer relies especially on the work of Jenkins, Sherratt and the volume edited by MacLeod and Collins. E. W. Jenkins, *From Armstrong to Nuffield: Studies in Twentieth-Century Science Education in England and Wales* (London, 1979); W. J. M. S. Sherratt, 'History of Science in Education: An Investigation into the Role and Use of Historical Ideas and Material in Education with Particular Reference to Science Education in the English Secondary School Since the 19th Century' (University of Leicester Ph.D. Thesis, 1980); Roy MacLeod and Peter Collins (eds.), *The Parliament of Science: The British Association for the Advancement of Science, 1831-1981* (Northwood, 1981).

values of a liberal education.'[277] Importantly, both papers proposed science history as an effective way to meet these aims. The BAAS report, for example, proposed history as 'a solvent to the artificial barriers between literary studies and science which the school timetable usually sets up.'[278] As the post-war English moral and political climate came more and more to despise these barriers — so reminiscent of the German system and the failures of the war — science history became more and more attractive to educators in its perceived or desired ability to dissolve them and to allow science into the mix.[279]

The new educational interest in science history involved proposals both for the introduction of history into the science curriculum and, conversely, for the introduction of science into the history lesson. On the one hand, the new historical interest among science educators in the interwar period was roundly manifest in teacher training courses, in the educational press and in science textbooks. For example, A. E. Heath, senior lecturer in the Department of Education at Liverpool, initiated instruction in the history of science for prospective science teachers in 1921.[280] The first graduate course in history of science was offered in 1924 at University College, London and was envisioned and flexibly scheduled with science teachers in mind.[281] *School Science Review*, a professional journal for science

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[277] A. K. Mayer, 'Moralizing Science: The Uses of Science's Past in National Education in the 1920s', *British Journal for the History of Science*, 30 (1997), 53.

[278] British Association for the Advancement of Science, *Science Teaching in Secondary Schools* (London, 1917), p. 127. See also, Committee Appointed by the Prime Minister to Enquire into the Position of Natural Science in the Education System of Great Britain, *Report* (London, 1918).

[279] A. K. Mayer, 'Moralizing Science: The Uses of Science's Past in National Education in the 1920s', *British Journal for the History of Science*, 30 (1997), especially 51-4.

[280] Ibid., 55. See also A. K. Mayer, 'Fatal Mutilations: Educationism and the British Background to the 1931 International Congress for the History of Science and Technology', *History of Science*, 40 (2002), 445-72.

[281] A. K. Mayer, 'Moralizing Science: The Uses of Science's Past in National Education in the 1920s', *British Journal for the History of Science*, 30 (1997), 51-70. See also W. Smeaton, 'History of Science

teachers founded in 1919, published essays inviting science teachers to take up history in their classrooms.[282] And a series of historical textbooks, entitled *Makers of Science*, was published by, and expressly for use by science teachers.[283]

On the other hand and in a related movement, science history was promoted by a generation of influential history educators. Most notable among these were British Museum Director Frederick Kenyon and Board of Education Inspector F. S. Marvin. Kenyon, for instance, organised a series of conferences to coordinate history and science teaching.[284] Marvin even more ambitiously upheld science history as the essence of a unifying and internationalist history of civilisation in a series of 'Unity History Schools', which were originally intended as professional development courses for schoolteachers.[285] Taken together there emerged in the period — in Mayer's words — a vast programme of 'history of science for all', in which the historical experience of scientific progress, if not the immediate study of history of science, was to pervade the curriculum, stimulating analogous progress in the student's scientific training, in his moral character and in society itself.[286]

Though practising scientists and science teachers did most of this educational work, professional academic historians of science supported their efforts. Indeed, Mayer devotes considerable attention to Charles Singer's involvement in the

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at University College, London, 1919-1947', *British Journal for the History of Science*, 30 (1997), 26. A. K. Mayer, 'Roots of the History of Science in Britain, 1916-50' (University of Cambridge Ph.D. Thesis, 2003), Chapter 2.

[282] For example, E. J. Holmyard, 'The Historical Method in the Teaching of Chemistry', *School Science Review*, 5 (1923-4), 227-33.

[283] Ivor Blashka Hart, *Makers of Science: Mathematics, Physics, Astronomy* (Oxford, 1923); D. M. Turner, *Makers of Science: Electricity & Magnetism* (Oxford, 1927).

[284] Frederick G. Kenyon, *Education, Secondary and University: A Report of Conferences Between the Council for Humanistic Studies and the Conjoint Board of Scientific Societies* (London, 1919).

[285] These meetings' proceedings are published as F. S. Marvin (ed.), *The Unity Series* (9 vols., Oxford, 1915-32).

[286] A. K. Mayer, 'Moralizing Science: The Uses of Science's Past in National Education in the 1920s', *British Journal for the History of Science*, 30 (1997), 54-61.

negotiations she describes.[287] For example, Singer played an important role in the *Makers of Science* series, lending an introduction to each book and his name to their credibility.[288] He even took on Dorothy Turner, one of its teacher-authors, as his long-time research assistant. Similarly, Singer was the driving force behind the establishment of the UCL graduate course and bore much of the teaching load, most of this in the evenings to suit the schedules of his working teacher-students.[289] Finally, Singer was an active participant and supporter of F. S. Marvin's Unity History Schools and contributed several papers to the *Unity Series*.[290]

Nor were these casual commitments. Singer's own educational philosophy was well formed and central to the 'history of science for all' movement. It is perhaps best witnessed in his 1929 article, 'Scientific Humanism', which was itself an elaboration of Singer's 1927 'Introduction' to Turner's number of *Makers of Science*.[291] The title 'Scientific Humanism' should belie the article's familiar aim, though, in this case, Singer's target was more specifically educational. First and foremost, Singer believed that science history should undergird the school history curriculum. Singer saw science history as the basis for a general and, more

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[287] A. K. Mayer, 'Roots of the History of Science in Britain, 1916-50' (University of Cambridge Ph.D. Thesis, 2003).

[288] Charles Singer, 'Introduction', in *Makers of Science: Mathematics, Physics, Astronomy, by Ivor B. Hart* (Oxford, 1923), pp. 6-12; Charles Singer, 'Introduction', in *Makers of Science: Electricity and Magnetism, by D. M. Turner* (Oxford, 1927), ix-xv.

[289] W. Smeaton, 'History of Science at University College, London, 1919-1947', *British Journal for the History of Science*, 30 (1997), 26. See also Singer's lecture notes and UCL papers in Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Papers, PP/CJS B.21-2, C.2.

[290] Not surprisingly, Singer was most closely involved with the Sixth Unity History School, entitled 'Science and Civilization', held at Woodbrooke near Birmingham in August 1922. See Charles Singer, 'The Dark Ages and the Dawn', in F. S. Marvin (ed.), *Science and Civilization, Unity Series 6* (Oxford, 1923), pp. 112-60; Charles Singer, 'Ancient Medicine', in F. S. Marvin (ed.), *Science and Civilization, Unity Series 6* (Oxford, 1923), pp. 43-72. See also Singer's frequent correspondence with Marvin. Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.12.

[291] Charles Singer, 'Scientific Humanism', *The Realist*, 1 (1929), 12-8; Charles Singer, 'Introduction', in *Makers of Science: Electricity and Magnetism, by D. M. Turner* (Oxford, 1927),. ix-xv.

importantly, a unified history of civilization. 'It is the history of mankind as a whole that we need,' wrote Singer, 'the history of civilization, the history of man's thoughts, of man's knowledge, of man's self.'[292] This holistic history would pave the way for the anticipated New Humanism, and the history classroom should be the first line of attack:

> It seems to me that history, in the ordinary sense of the word, that is to say the history of states and of civilisation, is a much more satisfactory medium for introducing the pupil to the conception of science as a factor in the life and thought of our age, a factor shutting us off from all previous ages. Such an attitude would ventilate history, would link the political movements of modern times with the great stirrings of thought and activity in other departments, and would give to history itself a life and variety that can never be conveyed by that endless discussion of campaigns, cabals, economic relations, and Acts of Parliament which form the diet on which our youth passes into its state of intellectual malnutrition.[293]

At the same time, however, and again in keeping with the sentiments of educationists, Singer believed that science history must pervade the entire curriculum. The history classroom was a necessary first step, but was in no way sufficient. Science history must be taught in the science classroom as well. If science history in the history classroom revealed to students the unified history of mankind's civilization, then science history in the science classroom revealed the unity of knowledge that backed it up. Singer wrote:

> From what I have said it will be gathered that I lay far more emphasis on the introduction of science into general history than upon the introduction of history into formal science teaching. Nevertheless we must recognise the important place that historical considerations can take in the formal teaching of science ... To succeed in science it is necessary to receive the tradition of those who have gone before us. Without them there is no effectual working. In science, more perhaps than in any other study, the dead and the living are one. 'We being many, are one body, and

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[292] Charles Singer, 'Introduction', in *Makers of Science: Mathematics, Physics, Astronomy, by Ivor B. Hart* (Oxford, 1923), p. 8.

[293] Charles Singer, 'Scientific Humanism', *The Realist*, 1 (1929), 15-6.

> everyone members one of another.' Science is a tradition and science is one.[294]

Undergirded by science history, the history curriculum could teach the unity of mankind. Undergirded by science history, the science curriculum could teach the correlative unity of knowledge. Thus, for all his insistence that formal courses in the history of science should not be included in the school curriculum, nevertheless Singer in no way rejected the educational importance of science history. Rather — in only an apparent paradox — Singer at once suggested both a looser and more central educational involvement of science history. Looser, in that courses in the history of science should not be added to the curriculum. More central, in that science history should provide the very scaffolding upon which the curriculum should be built, just as it provides the scaffolding for the History of Civilization. He wrote:

> The 'History of Science' should, therefore, find a due but not an undue share in our ideal school 'History of Civilization'. Training in such a subject would, in my opinion, have no less humanizing influence than the study of such subjects as language, history, literature or science itself, studies which would naturally grow out of it. The proper place for the History of Science is as an integral part of the History of Civilization.[295]

In the end Singer believed that science history should provide the barely visible organising principle for all education — for the history of civilization, for a 'scientific humanism'. 'If we are to effect any real change in the general outlook of our citizens upon the world around them,' he wrote, 'we must needs make some far more fundamental change in our system of education than any reshuffling of the curriculum.'[296] 'Works prepared along lines like these help to bring some sort of continuity and unity into the educational scheme,' wrote Singer, 'They point to a time

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[294] Ibid., 16-7.

[295] Charles Singer, 'Introduction', in *Makers of Science: Electricity and Magnetism, by D. M. Turner* (Oxford, 1927), xi.

[296] Charles Singer, 'Scientific Humanism', *The Realist*, 1 (1929), 13.

when the central element in education will be a great outline of history, civics, literature, language, religion, art, science and other departments of knowledge will branch naturally, so as to give the student once again a coherent view, as of old, of the great world into which he has been born and the great heritage into which he has entered.'[297] It was this sweeping New Humanist sensibility, more than any formal knowledge of the history of science, that Singer wished to impart.

Both Brock and Mayer deal strictly with British developments, and unfortunately there have not been any comparable studies of American ones. This may be because there appears to have existed in America no such concerted attention to the role of science history in education as there was in Britain. For instance, while the BAAS sponsored at least four panels on science history education in the period — 1917, 1920, 1923, 1926 — the corresponding American Association for the Advancement of Science did no such thing. Even its journals — both the popular *Scientific Monthly* and the scholarly *Science* — bear little evidence of interest among the American scientific community in science history education.[298] The apparent lack of national interest in the educational role of science history can probably be chalked up to the fact that, unlike Britain, the United States lacked anything even resembling a national educational system. There was — and remains — no national curriculum for students and no national standards for teacher training. The United States Department of Education wasn't even founded until 1980. There could have been nothing like the

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[297] Charles Singer, 'Introduction', in *Makers of Science: Mathematics, Physics, Astronomy, by Ivor B. Hart* (Oxford, 1923), p. 12.

[298] The few articles that appear in these journals concerning the teaching of science history are strictly concerned with university-level studies. See Frederick E. Brasch, 'The Teaching of the History of Science: Its Present Status in Our Universities, Colleges and Technical Schools', *Science*, 42 (1915), 746-60; George Sarton, 'The Teaching of the History of Science', *Scientific Monthly*, 7 (1918), 193-211; Henry Crew, 'The Problem of the History of Science in the College Curriculum', *Scientific Monthly*, 10 (1920), 475-81; Harry Elmer Barnes, 'The Historian and the History of Science', *Scientific Monthly*, 11 (1920), 112-6.

parliamentary committee reports described by Mayer in the United States. There was no one to order them and no one to receive them.

Nevertheless, arguments about the humanising importance of history in science education and of science in history education were not completely absent from the American consciousness. Indeed, the terms employed — 'humanising influences', 'artificial barriers' in the field of knowledge, etc. — are the very same ones used by Sarton to promote the New Humanism. In fact, the subject of education took up a fair chunk of Sarton's 1931 manifesto, *The History of Science and the New Humanism*. Here Sarton proposed a new system of education, with the familiar aim of reconciling rifts in the field of knowledge. He wrote:

> Thus far our education has been almost exclusively literary, the scientific courses, however numerous, remaining so to say on the outside of it. Science teachers are not expected to impart any education but simply to teach their own technicalities. College administrators often speak of scientific and cultural courses, which is a neat way of expressing the same invidious distinction. Is it not clear that as long as science is not meant to educate, it must somehow fail to educate? To break that vicious circle a complete revolution in our system of education will be necessary.[299]

This revolution began, moreover, at the earliest stages of learning, with the most fundamental ingredient of any education — 'one's own language'.[300] Language for Sarton was the point from which a unified education should begin, the most important and always necessary means of communicating both literary and scientific knowledge. Language was the audible and legible expression of the unity of knowledge, a tie to bind the field of knowledge together, which 'instead of being hidden and jeopardized by the stupid dualism of our education, should be emphasized

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[299] George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), p. 121.

[300] Ibid.

in every possible way, by the science masters as well as by others.'[301] Furthermore, these ties could be increased not only by the continual study and mastery of one's own language, but by the mastery of a foreign language, which Sarton believed was the next necessary element of a student's education. That mathematics performed a communicative and connective function similar to that of language seemed to Sarton self-evident, and a thorough course of mathematics should complement the study of languages. Mathematics, moreover, was a universal language, and this vastly expanded its connective utility. As drawing and music were similarly universal, they should be learned as well. Thus the initial foundations of Sarton's new system of education should first and foremost provide the tools for making connections.

Only with these connective abilities firmly in place could students turn to more serious studies without endangering the unity of knowledge. Indeed only at this stage could students be safely introduced to the history of science. It is important to note that nowhere did Sarton's proposals for elementary education directly suggest the teaching of science history. In fact Sarton did not believe that they should. Instead he believed that the history of science should be 'put as far back as possible in the curriculum.'[302] And yet history of science should not exist there as one more lonely speciality. Rather history of science should stand atop the educational hierarchy as a visible inspiration, a lofty beacon for all earlier studies:

> I have hardly spoken of the history of science though it is understood that the history of civilization would be largely focused upon it. The fact is that the history of science, however important is [educationally] far less so than the subjects I have mentioned. I am not hypnotised by my own studies. I believe that the history of science should be studied very deeply, far more so than it has been heretofore, but as in the case of the learned languages, I would not

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[301] Ibid., p. 123. Indeed Singer placed a similar importance on studying the 'Mother Tongue'. See Charles Singer, 'The Mother Tongue', *British Medical Journal*, 1 (1922), 23-4.

[302] George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), pp. 130-1.

> try to enforce its study upon too many people. Those sufficiently attracted to it and qualified to undertake it should be encouraged, and the very fact that people would dedicate themselves to it in earnestness would in the course of time influence the teaching of both science and history considerably. It is probable that a time will come when courses on the history of science will be offered in almost every college, but even if such courses were not offered, a curriculum organised along the pattern which I have outlined would already go a long way toward the fulfilment of the new education.[303]

Neither Singer nor Sarton believed that science history should take up an obvious place in the school curriculum. Rather formal study of the history of science should provide only the final culmination of a student's education, some time in college or beyond. Yet this was not designed to diminish history of science's educational importance. It did not mean that history of science should be taken up casually by graduates. Nor should it be kept in the locked closet of specialists. Rather the entire prior course of study should be aimed at these ultimate researches into science history. History of science would be the highest educational achievement. More importantly, it would be the guiding light for the entire educational process. Singer and Sarton argued at once for a looser and more central involvement of science history in education, one not so concerned with direct teaching of the subject. For both men all education was a road leading to science history. And even if the average student never reached the highest levels of education and the formal study of history of science, nevertheless he would have come far along the road to the New Humanism:

> Such [science] historical courses should be considered, indeed, as a reward: the reward of the traveller who, having reached a stage of his long journey, looks down behind him along the slopes of the mountain upon which he has been climbing. The sun sets; his legs, his whole body, are tired but he thoroughly enjoys the well-deserved rest and the broad prospect which he has won. This is exceedingly sweet and cheering; truly, a great reward ... [304]

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[303] Ibid., p. 135.

[304] George Sarton, 'The Teaching of the History of Science', *Scientific Monthly*, 7 (1918), 208.

## Empire Study

The British Empire Exhibition expected and received nearly 30 million visitors. All of its exhibits were directed at a wide audience, and it is impossible to isolate the British Empire Exhibition's typical science history student. Yet in a general way, the sources provide insight into the overall educational priorities of the Exhibition's organisers.

Children at Wembley were taken on board like never before in the history of great exhibitions. Boys were directed to the Palace of Engineering and the locomotive exhibits, and girls were steered to the philatelic displays and Queen's Doll House.[305] More to the point, the scale and scope of Wembley's amusements were unprecedented, offering an aquarium, a petting zoo, a never-stop railway, a replica of King Tut's tomb and a multitude of 'ingenious devices for swift and eccentric motion'.[306] Still, visitors noticed that the majority of children were found busily toting 'bags, boxes and cases' and 'notebooks for recording their impressions'.[307] This was due to Wembley's wide-ranging and concerted programme of children's education, also unique in the prior history of great expositions.

Wembley's potential for children's education was universally and immediately recognised. A government scheme, whereby students from around the country were provided grants to travel with their teachers to the Exhibition, enabled well over a million school children to visit Wembley in only its first two months of operation. The YMCA provided a canteen for the students, and enormous hostels

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[305] 'Children's Guide to Wembley', *The Times*, 29 July 1924.

[306] *Daily News Souvenir Guide to the British Empire Exhibition. Concise "Where is it" Index and Complete Train, Tram and Bus Guide*, (London, 1924), p. 38.

[307] 'Pageant of Youth: Children's Visits to Wembley', *The Times*, 29 July 1924.

were opened in nearby suburbs to house them.[308] Away from the Exhibition and in the schools themselves, local libraries provided teacher handbooks of Empire history, while the government published a *Weekly Bulletin of Empire Study.*[309] Wembley would be an experiment in what would later be called 'distance learning'.

Twenty-four issues of the *Weekly Bulletin* were published between January and July 1924, intended for teachers of students between eleven and sixteen years of age. Subscriptions were offered at bulk rates and posted free to schools and education authorities. These reached 125,000 teachers, or an estimated three-quarters of all students in the target group.[310] Each issue contained lessons for teachers, along with news from the Exhibition and descriptions of the pavilions. The *Weekly Bulletin* exposed teachers and students to all of the meanings that barraged visitors to Wembley. The historical unity of the British Empire as an inspiration to peace was again the touchstone. Its foundational elements — first, a belief in the power of applied history; and second, the concurrent belief in the history of Empire as the history of human and scientific unity — were both present in the lessons.

The first element, the power of applied history, was explained most clearly by Edward Wood, the President of the Board of Education, in the *Weekly Bulletin's* first issue. That the history of peace might inspire peacemaking seemed self-evident. Wood wrote:

> In this year, when we are to have displayed to us an exhibition of the products and visible resources of the British Empire, it is only natural that our minds should turn to regard the steps which have brought us into so high a position of privilege and responsibility in the world. The story of this evolution, the constitutional

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[308] Ibid.

[309] See Willesden Public Libraries, *Select Catalogue of Books Dealing with the British Empire* (London, 1924); Educational Sub-Committee Inter-Departmental Committee for Government Participation in the British Empire Exhibition, *Weekly Bulletin of Empire Study* (London, 1924).

[310] 'Empire Study: An Epilogue for Teachers', *The Weekly Bulletin of Empire Study*, 24 (1924), 345.

> relationship of the several units of our Society, the economic importance of each, are all subjects of which it is our duty as intelligent citizens to have a reasonable knowledge. It is by that knowledge that our future action will be framed. Without that knowledge we cannot continue to build wisely; we can scarcely hope to maintain what is. But if we have the understanding that comes of knowledge, we may look out with confidence over the present landscape, in which a great part of the world moves with faltering and distracted steps. We can bring to its relief the influence for good which we believe is exercised by the British race, by its spirit of honour, justice and fair dealing, and by the moderation and tolerance which make for stability and peace.[311]

The second element of Wembley's lesson — that the history of the British Empire was a history of unity — was considerably more problematic. A small island nation lording over half the inhabited world hardly seemed the ideal of internationalism. The paradox wasn't lost on contributors to the *Weekly Bulletin*. In a series of articles with titles like 'The British Empire and the League of Nations', educators attempted to reconcile the aims of empire with the aims of international peace. In fact, they argued, there was no paradox:

> If by Empire we mean and must mean Imperialism; if by Imperialism we mean and must mean conquest by force, unwilling subject nations, the exploitation of the conquered by the conquerors, then the idea of a League of Nations cannot be aligned with the idea of the British Empire. But these assumptions, no more than any other, may stand without enquiry ... Between the members of this Commonwealth, war is practically not practicable. The bond that holds them is not force, but sentiment ...
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> There is no need to claim that the British Commonwealth is the same thing as the League of Nations. It is not. But it offers itself as a foreshadowing of the League, more fully and effectively than any other example in history.[312]

Elsewhere the *Weekly Bulletin* explained:

> We contend that as real patriotism is the only safe basis of humanitarianism so there is nothing inconsistent between our subject of Empire Study and a genuine belief in the principles of

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[311] Edward Wood, 'Message from the President of the Board of Education', *The Weekly Bulletin of Empire Study*, 1 (1924), 1.

[312] Robert Jones, 'The British Empire and the League of Nations', *The Weekly Bulletin of Empire Study*, 5 (1924), 42.

> the League of Nations ... True Imperialism is only the larger patriotism, and that enlarged by one diameter is internationalism.[313]

If references to the League of Nations and to the new internationalism in politics were one parry in the defence of Imperial history as the history of unity, then appeals to the war were another. The editors of the *Weekly Bulletin* were very much driven by memories of war and a desire to pass its lessons on to children who otherwise might not remember. The interests of peace and the memory of the fallen demanded that the unity of empire and not its might be taught to students. In the very first lesson, teachers were advised:

> Bring out the lesson that mere bulk [of Empire] is not admirable, but that so many peoples united in loyalty to the idea of a Commonwealth of free peoples, the unity of which is symbolised by one crown and one flag, may be of great benefit to the world if they stand for peace, freedom and justice. Lessons of War have brought this home. Children should feel their membership of this great brotherhood as a solemn trust.[314]

This was stressed again in the last issue of the *Weekly Bulletin* in the 'Epilogue for Teachers'. The editors argued that the memory of war and the struggle for empire must be maintained as much for the peacemakers as for the soldiers:

> The British Empire has been wrought by self-sacrifice. Soldier, sailors, explorers, traders, missionaries, statesmen, administrators, collectors, policemen, railwaymen, engineers, nurses, teachers have all and each contributed. The doctor who was isolated a germ fever, the engineer who has bridged a chasm or created an irrigation scheme, the politician who has devised a constitution or charter, the judge who has upheld British justice — yes, and even the housewife who has maintained the standard of civilisation in the wilderness — these no more but no less than the soldier or

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[313] 'Empire Study: An Epilogue for Teachers', *The Weekly Bulletin of Empire Study*, 24 (1924), 346. In fact, throughout the period, nationalism and internationalism were not considered incompatible. Well-defined nationalisms were sensibly regarded as the necessary building blocks of any international system. George Sarton held strong feelings on the matter and believed that the history of science would best serve the cause of international unity by providing and then integrating good national histories. It was in this connection that he warned of confusing simple-minded 'cosmopolitanism' for true internationalism.

[314] 'Notes for Lessons: Programme I', *The Weekly Bulletin of Empire Study*, 1 (1924), 2.

> sailor who has given his blood — have been the builders of the Empire.[315]

The *Weekly Bulletin* was conceived as an exercise in applied history, in the history of empire applied to the purposes of peace, and as this last statement demonstrates, science history featured prominently. A lesson entitled 'Beginning of Modern History', for example, explained how the invention of the mariner's compass, printing and gunpowder helped stimulate Imperial commerce.[316] Another recalled the Imperial underpinnings of Darwin's voyage on the *Beagle*.[317] Other articles recounted the importance of the steam engine, the telegraph, the aeroplane and other technologies to the extension and maintenance of empire. The practical purpose of these lessons in science history was laid out in a history of tropical medicine entitled 'The Romance of Health and Disease in the Tropics'.

> It is the destiny of the boys and girls of England to-day to take up the burden of Empire to-morrow. They have an obligation to equip themselves to preserve their health and the health of the subject races that will look to them for light and guidance. Let them set out upon the search after truth, not with the anticipation of an irksome duty, but with the spirit of high romance.[318]

Thus science history at Wembley was not an end in itself: It was meant to inspire students to empire service. This imperialist message was sent, moreover, with one nod to the new internationalism of the League of Nations and another to the Great War. That the educational lessons of Wembley were so overtly political might seem disconcerting, but when one considers the powerful presence of politics at Wembley more generally, their presentation in the *Weekly Bulletin* seems mild by comparison.

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[315] 'Empire Study: An Epilogue for Teachers', *The Weekly Bulletin of Empire Study*, 24 (1924), 347.

[316] C. H. K. Marten, 'Beginning of Modern History', *The Weekly Bulletin of Empire Study*, 5 (1924), 42-5.

[317] 'Travellers' Tales: The Voyage of the Beagle', *The Weekly Bulletin of Empire Study*, 9 (1924), 115-6.

[318] S. Lyle Cummings and David Davies, 'The Romance of Health and Disease in the Tropics', *The Weekly Bulletin of Empire Study*, 19 (1924), 276.

In fact throughout the world of interwar science history — in the exhibition, the museum and the university — education provided politics a clandestine point of entry. It was also through education that politics crept into science history's other contexts.

**Reminiscence as a Stimulus to Interest**

It is indicative of the Science Museum's educational focus that the period's most profound change in the galleries was the installation of a 'Children's Gallery'. It is also telling that the ideals of the Peace Museum were most obviously on display there. Instituted personally by Lyons in 1930-31 and designed as a plain introduction to the Museum's broader meanings, the Children's Gallery speaks to the fundamental aspirations of the interwar Science Museum.

The Children's Gallery is often said to have marked a turning point in the history of science museums. It is widely considered a pre-cursor both to today's science centres and to current trends in replacing historical exhibitions with interactive displays of scientific theory. Yet while the Children's Gallery was certainly interactive, it was neither the first of its kind, nor did it by any means turn its back on history.

In many ways the Children's Gallery was inspired from without. Throughout the interwar period, Science Museum staff members were encouraged to travel abroad to discover innovative science and industry museum technique.[319] In practice, this

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[319] See, for instance, Science Museum Archive Z 184: E. E. B. Mackintosh, 'A Museum Officers Work', 1 March 1939, p. 4. 'Visit museums and scientific institutions and large technical libraries at home and abroad, to study museum technique and organisation and collections, and maintain contact with his opposite members of staff.' See also Science Museum Archive Z 148: E. E. B. Mackintosh, 'Science Museum Memorandum 3/38', 13 April 1938.

usually meant visiting Munich's Deutsches Museum, widely considered the pre-eminent science museum in the world.[320] Privileged with a particularly energetic and original director in Oskar von Miller and the substantial industrial and governmental support he attracted, the Deutsches Museum was considered 'the outstanding example' of science museum technique even by London staff.[321]

Among the novelties von Miller installed in Munich were hands-on and moveable demonstrations of scientific and technological principles. Science Museum staff recognized the benefit these moveable set-ups would have in stimulating interest in the galleries but were concerned about their interpretive value. In fact it appears that although they appreciated the potential of the Deutsches Museum's working exhibits, Science Museum staff were in fact dissatisfied with their employment in Munich. Reporting just before the initiation of the Children's Gallery project, W. G. Plummer registered his opinion that:

> ... there are far too many [working exhibits] at Munich. Such apparatus not only requires a great deal of attention, but it is frequently 'out of action' owing to its constant use by visitors ... The directions for operating apparatus are frequently cumbersome ... The visitor becomes so engrossed in carrying out these instructions that he seldom waits afterwards to read the label describing the experiment, and there is always the feeling that one should proceed to the next exhibit at once, 'to see if it will work'. To my mind, it would be a far better plan to set out any apparatus requiring more than one or two buttons for its operation in rooms or places where it can be demonstrated by intelligent Attendants and ... to show a somewhat smaller number of working exhibits which should illustrate phenomena of fundamental importance.[322]

Plummer's concerns about the lack of interpretive and historical material are echoed in an anonymous Science Museum report from the Deutsches Museum:

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[320] Advisory Council Reports record the locations of foreign visits. See Science Museum Advisory Council, *Reports for the Years 1919-1939.*

[321] H. W. Dickinson, 'Presidential Address: Museums and Their Relation to the History of Engineering and Technology', *Newcomen Society Transactions*, 14 (1933-4), 9.

[322] Science Museum Archive Z 193/1: W. G. Plummer, 'Report on Visit to the Deutsches Museum, Munich on 6th December, 1929', 23 January 1930.

> The visitor is rather overwhelmed by the tremendous number of working experiments shown without, in my opinion, sufficient statement of the phenomena they illustrate and their relation to each other and with little indication of their consequences and industrial applications, and I consider that their educational value would be greatly increased by a drastic thinning out.[323]

Science Museum officers did not only visit Munich. Far worse than the Deutsches Museum were the pair of Parisian science museums. On the one hand was the newly founded Palais de la Découverte. Here criticism pointed to the lack of interpretation and historical context: 'They have been able to deal with Physics on a grand scale which we could never hope to emulate here, but there is no systematic treatment of Physics as a whole and there is no historical treatment whatever'. On the other hand, neither were historical displays in themselves necessarily better. The anonymous reporter saved his most severe criticism for Paris's second science museum, the ancient Conservatoire National des Arts et Métiers, whose exhibits he described as 'moribund' and 'of interest only to those visitors with a sufficient historical knowledge of the subject'. 'There are some things wrong with the Deutsches Museum,' he wrote, 'but at the Conservatoire, everything is wrong.'[324]

In the end the Science Museum determined that the most desirable gallery would combine historical objects and working exhibits with rich interpretive resources for the 'exposition of development'.[325] This was just the arrangement that found its way into the Children's Gallery. Far from the purely theoretical hands-on displays of today's science centres, the Children's Gallery interspersed working demonstrations of scientific and industrial principles with artefacts, texts and

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[323] Science Museum Archive Z 210: 'Report on Visits to European Museums', [undated].

[324] Ibid.

[325] Ibid.

abundant dioramas. Fredrick Hartley laid out the exhibition's interpretive and historical intention in the Children's Gallery guide:

> The Children's Gallery is more than a general introduction to the main collection, for although there are a number of exhibits illustrating elementary principles, the Gallery's chief purpose is to show what things *mean*, that is their significance to our daily lives, rather than how they *work*. For this reason the idea of historical development runs through most of the Children's Gallery, as it does in the main Museum Collections.[326]

Just as in the main Museum, 'historical development' was considered in the broadest possible way. For a supposed children's gallery, the chronological and cultural scope of the exhibits was truly audacious. In transportation, for instance, the Gallery aimed to illustrate the 'development of transport by land, sea and air from prehistoric times to the present day'.[327] In communications it presented technologies progressing 'from the primitive beacon to the modern automatic telephone exchange'.[328] W. E. Pretty, the Secretary of the Advisory Council, underlined the extent of the Gallery's reach:

> Time measurement, the making of a pot, a model aeroplane in a wind channel, are also shown in the Gallery ... Illuminated transparencies show astronomers at work; alchemists' and modern pharmaceutists' shops are compared; and the development of the aeroplane is sketched.'[329]

Moreover, and again as in the Main museum, these linkages were considered in more than just their technological aspects. The story of unbroken technical progress served also to unite generations of mankind. Pretty pointed out the link between alchemists and pharmacists. Hartley's guide more explicitly united past with present and future. It read:

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[326] Frederick St A. Hartley, *The Children's Gallery* (London, 1935), p. 3.

[327] Lewis W. Phillips, *Outline Guide to the Exhibits* (London, 1937), p. 5.

[328] Ibid.

[329] Science Museum Archive Z 201: W. E. Pretty, 'The Science Museum Advisory Council', September 1938, p. 10.

> The history of science is closely bound up with the history of mankind like one of the strands of a heavy cable, and a knowledge that leads to a better understanding of the present, and often points the way to the future.[330]

In this way the Science Museum was interested in teaching even children the fundamental tenets of the Peace Museum, about the ways in which science history pointed to a better future. Indeed it is interesting that, when set alongside other Science Museum attendance records, visits by school groups are remarkably well documented. It is clear, for instance, that during the 1920s and 1930s the number of students attending the Museum in organised groups increased more dramatically than general Museum attendance. In 1920, about 8,000 students in school groups were registered, representing less than 2% of total attendance. By 1932 this number had doubled, and by 1936 it had more than doubled again, now comprising more than 3% of visitors to the Museum.

Beginning with the appointment of the Museum's first Guide Lecturer in 1925, there also exist records for the numbers of student groups that received guided gallery tours or special lectures. The figures here follow a similar growth pattern. Approximately 1,000 students received tours or lectures in 1925. By 1935 this number had jumped to more than 9,000. All in all, for the years 1925-1936, student group attendance grew at an average of 19% per year, and student lecture attendance grew at an average of 25% per year, while general attendance grew at the considerably slower rate of only 11% per year on average.[331]

In some cases, more can be said about the students themselves. For instance, for the four years between 1935 and 1938, 45% of student tours and lectures were

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[330] Frederick St A. Hartley, *The Children's Gallery* (London, 1935), p. 3.

[331] Science Museum Advisory Council, *Reports for the Years 1920-1938*.

presented to elementary school groups, 48% to central and secondary school groups, and 7% to technical school groups, with little variation from year to year.[332] In other cases, it is possible to determine the galleries these student groups visited. For instance, during the six years between 1933 and 1938, nearly 90,000 students visited the Children's Gallery as part of organised school groups, a figure representing about 45% of the total number of students in visiting in parties.[333] Finally, in certain instances, the Advisory Council specified the places from which school groups had come — whether like the majority 'from the poorer districts of London', or like the occasional minority 'from such distant places as Liverpool, Plymouth, Bury, Ipswich, Canterbury, Rugby and Leicester'.[334] Taken together, the evidence provides a fairly clear pattern, by which organised student groups, both from London and further afield, were split roughly evenly between primary and secondary school parties, with a scattering of technical schools thrown into the mix.

Throughout the period the Advisory Council seems pleased with the increasing involvement of school groups. Their typical report praised the greater numbers of student tours and lectures as 'making appreciable headway' in assisting schoolteachers or as a 'welcome increase' in the 'educative use of the Museum'.[335] In 1935 the Council singled out the 'marked increase' in group visits to the Children's Gallery 'as satisfactory evidence that the Gallery provides a valuable means of visual

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[332] Science Museum Archive Z 100/5: Science Museum, 'Register of Lectures, Summary', 1935-8.

[333] Science Museum Advisory Council, *Reports for the Years 1920-1938.* It might be assumed that this 45% corresponds roughly to the 45% of students of elementary school age receiving guided tours and lectures.

[334] Science Museum Advisory Council, *Report for the Year 1932* (London, 1933), p. 6; Science Museum Advisory Council, *Report for the Year 1934* (London, 1935), p. 6.

[335] Science Museum Advisory Council, *Report for the Year 1934* (London, 1935), p. 6; Science Museum Advisory Council, *Report for the Year 1935* (London, 1936), p. 6.

education, the advantage of which is being realised and taken.'[336] In 1931 the Council was pleased to learn that 'those who attend the lectures in school parties from secondary schools show a keen interest and a ready appreciation of the lectures on the various technical or scientific collections, and of the illustrations given.'[337] And from time to time the Advisory Council singled out particularly encouraging developments, such as arrangements made in 1930 'whereby parties of students from two of the schools for the blind will be given facilities to assist them to become acquainted with the technical collections'; or negotiations with the London County Council 'to correlate their school curriculum with educational visits to the various Museums'; or the 'several visits by bodies of more advanced workers which require specialized technical information, such as parties from the Military Mechanists from the School of Military Engineering at Chatham.'[338]

At the same time, however, the educational aspirations of the Science Museum were not limited to organised group visits. The Museum was also concerned to educate the self-motivated student. Perhaps unsurprisingly, in terms of ordinary customers it appears that the Science Museum was particularly successful among children. Advisory Council reports made clear that children outside of school groups were among the most frequent visitors to the Science Museum. In their report for 1927-8, for example, the Advisory Council remarked:

> Though the number of school children who visit the Museum in school parties now exceeds 10,000 as already mentioned, this is but a small fraction of those who visit it voluntarily. On two days at the end of October, 1928, which were holidays in the London Schools, the attendances were 7,000 and 6,000 respectively, as compared with a normal attendance of about 1,500, and this increase was due to the large number of children visiting the

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[336] Science Museum Advisory Council, *Report for the Year 1935* (London, 1936), p. 51.

[337] Science Museum Advisory Council, *Report for the Year 1931* (London, 1932), p. 13.

[338] In particular see Science Museum Advisory Council, *Reports for the Years 1927-1935*.

> collections in their holidays.[339]

Other evidence of impressive individual attendance by school-aged children abounds. In a report that 'much impressed' the Advisory Council, Lyons wrote that 'the number of children who visit the collections may be estimated roughly at about 120,000 or 150,000 per annum'.[340] In fact, throughout the period, the attendance figures for April and August — the time of the school holidays — consistently topped the monthly table.[341] It also seems that the Museum's best-selling publication in the period, the *Outline Guide to the Exhibits*, was purchased mostly by or for younger children, as the model aeroplane and kite advertisements that appear in most of its editions attest.[342] The Children's Gallery provides a final illustration, which was so successful as to be doubled in size in only its first year of operation. As Lyons gladly pointed out in his only journal entry pertaining directly his work in the Science Museum:

> Children's Gallery opened on 12 December 1931 is most successful. The Museum attendance 1-11 January: 87,000, and 171,000 during January 1932.[343]

Concern for its many younger visitors undoubtedly helped determine the Science Museum's focus. The previous chapter noted the change from the curatorial *Catalogues* series to the more historical and more interesting *Handbooks* series as indicative of the Science Museum's populism. In fact this is only half correct; the

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[339] Science Museum Advisory Council, *Report for the Years 1927 and 1928* (London, 1929), p. 12.

[340] Science Museum Archive Z 193/1: Henry G. Lyons, 'Science Museum Advisory Council, Director's Report', June 1930; Science Museum Advisory Council, *Report for the Year 1930* (London, 1931).

[341] Science Museum Advisory Council, *Reports for the Years 1920-1938.*

[342] Lewis W. Phillips, *Outline Guide to the Exhibits* (London, 1930). Although the exhibits changed little in this period, the *Outline Guide* enjoyed a new edition in nearly every year prior to the outbreak of the Second World War. In 1936 alone the Science Museum sold as many as 6000 copies. See Science Museum Advisory Council, *Report for the Year 1936* (London, 1937), p. 12.

[343] Science Museum Archive MS 570: Henry G. Lyons, 'Journal of Colonel Sir Henry Lyons', 1905-1943.

change was also made to increase the Museum's educational effectiveness among children — the 'large proportion of young people who do not want but a catalogue that is merely a list of labels.'[344] Lyons was also interested in making Museum publications more affordable to children, and the *Handbooks* series could be produced and sold at a considerable savings.[345] Finally, Lyons' objection to entrance fees was held on similar grounds. Lyons feared that a door charge would deter attendance among school-aged children. As he said in his testimony before the Royal Commission on National Museums and Galleries:

> [Q:] Then I think you stated that it is pretty clear that the imposition of an admission fee would keep out one of your most desirable sets of visitors? [A:] I am certain it would hit the smaller people under 15. [Q:] They come in large numbers? [A:] In considerable numbers from what you might call the poorer part of the community. Very often a brother and sister will come with a couple of quite small children. You will probably see the brother and sister going around and taking an interest in the things, and they bring the two little ones because they are in charge of them for the afternoon. I cannot say that the little ones are much trouble although they do mess the columns by rubbing their hands on them. They will paw and finger everything they can but they do very little harm indeed.[346]

In fact Lyons believed that from an educational standpoint the experience of these youngest visitors was no less important than that of their older brothers and sisters. Answering another question, Lyons argued: 'though they run about and turn handles for amusement, I am quite certain that a great majority of them gain a familiarity with the Museum as a whole and a knowledge of many things in it.'[347] The Advisory Council agreed with Lyons, noting that even though 'some of the children are too

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[344] Royal Commission on National Museums and Galleries, *Oral Evidence, Memoranda and Appendices to the Interim Report* (London, 1928), p. 152.

[345] Ibid.

[346] Ibid., p. 155.

[347] Ibid., p. 152.

young to gain much knowledge from [the exhibits] ... even these are gaining a useful familiarity with the Museum and its collection'.[348]

In some respects, the Science Museum was most interested in these youngest visitors, though not so much as they were, but as they promised to be. The Science Museum was most concerned with guiding these children as they progressed through primary and secondary school, and on to technical school and careers. For instance, the Advisory Council boasted that 'many who now come to study seriously are recognised by members of the Museum staff as having belonged formerly to this category who comes mainly for entertainment.'[349] Elsewhere they wrote that the Children's Gallery 'is undoubtedly serving its purpose by arousing the interest of younger visitors, who afterwards go on to other parts of the Museum'[350] Lyons even once described the 'so-called Children's Gallery' as simply 'the first of a graduated series of introductory collections designed specifically for the general public of all ages ...'[351]

In modern parlance, the interwar Science Museum pursued a programme of lifelong learning or continuing education — entertainment for young children; school programmes for their older brothers and sisters; informed gallery attendants and lecture programmes for when they became technicians. For example, in his testimony before the Royal Commission, Lyons said he was 'pleased to notice of late a very great increase in the number of young men about 18 to 30, who come in small parties, two or three at a time, and usually they go to some particular collection in

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[348] Science Museum Advisory Council, *Report for the Year 1925* (London, 1926), p. 10.

[349] Ibid.

[350] Science Museum Advisory Council, *Report for the Year 1931* (London, 1932), p. 14.

[351] Science Museum Archive Z 183/1: Henry G. Lyons, 'Memorandum on the Development of the Science Museum From 1920 to 1933', August 1933, p. 6.

which they are especially interested.'[352] The Gallery Attendants were similarly happy to report 'that a large proportion of the recent increase in attendance is due to visits by those who are preparing for a technical or an industrial career and by others who are already so engaged; we regard this as satisfactory.'[353] Likewise the Advisory Council applauded the 'large increase ... in the proportion of visitors who have a technical knowledge of some section of the collections and who visit them with a definite purpose.'[354] Finally, the fact that 'the large numbers who now visit the Museum include many who are students preparing for the technical professions or those who are already in employment in them' was held up by the Council as proof that the Museum was 'serving a useful and important purpose.'[355]

The endpoint of this programme of continuing education indicates its ambition: The Science Museum considered itself educationally useful and important insofar as it turned child visitors into technical visitors. In this the Museum perceived itself a training ground for technicians. Indeed even history was subordinated to this idea. As a final case in point, consider the Royal Society's appearances before the Royal Commission. On the one hand in his testimony, F. E. Smith argued that historical series, while important, were educationally subsidiary to the student's understanding of current practice:

> A short time ago I inspected the optical section. There is an admirable collection of antique optical instruments, and certain modern instruments, but you do not gain much optical knowledge.

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[352] Royal Commission on National Museums and Galleries, *Oral Evidence, Memoranda and Appendices to the Interim Report* (London, 1928), p. 152.

[353] Science Museum Advisory Council, *Report for the Year 1930* (London, 1931).

[354] Science Museum Advisory Council, *Report for the Years 1927 and 1928* (London, 1929), p. 10.

[355] Science Museum Advisory Council, *Report for the Year 1929* (London, 1930), p. 9.

> You cannot do so by merely seeing a microscope which was used by a certain investigator.[356]

Rather, he said, 'in my opinion the Science Museum should show historical apparatus and modern apparatus, but historical apparatus should not be shown unless lessons can be learned from it.' Smith strongly registered his belief in the educational value of the Museum, and even his belief in the value of historical collections, but only insofar as they were directed at teaching current science and technology. The final exchange of his interview made the point:

> [Q:] You think that more can be done for the Science Museum in the educational direction? [A:] Yes. [Q:] And rather by sacrificing the past? [A:] Sacrificing the antiques. [Q:] And developing the new and the present? [A:] I think so.[357]

On the other hand, in the brief the Royal Society recommended a more vigorous programme of special exhibitions to better demonstrate the linkages between the Museum's historical collections and current scientific and industrial practice. Modelled on the Royal Society's Exhibition of Pure Science at Wembley, these special exhibitions would represent 'a periodical epitome of scientific progress'.[358] In their final report, the Royal Commission relayed these suggestions to the Science Museum, advocating temporary displays of recent scientific and industrial developments on behalf of those students and professionals 'who are seriously interested in the collections, who are taking notes and who are inquiring of the technical attendants'.[359]

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[356] Royal Commission on National Museums and Galleries, *Oral Evidence, Memoranda and Appendices to the Interim Report* (London, 1928), pp. 157-61.

[357] Ibid.

[358] Royal Commission on National Museums and Galleries, *Interim Report* (London, 1928), p. 53.

[359] Royal Commission on National Museums and Galleries, *Final Report, Part II* (London, 1930), p. 48.

This suggestion was ultimately taken up in the mid-1930s, when the Science Museum extended its on-again-off-again temporary exhibition programme. For the first time the Science Museum invited various industrial associations to suggest and stage their own exhibitions at the Museum. The first of these was staged by the plastics industry in 1933 and was considered a tremendous success.[360] Others followed in quick succession, and the whole decade of the 1930s is marked by these industrial exhibitions. In keeping with the Royal Society and Royal Commission's recommendations, these exhibitions were intended to be primarily for technical education. For instance, in his 'Special Exhibitions' manual, Mackintosh wrote that 'their object is to be educative and helpful to the serious student and research worker, and to provide a valuable and visual instrument to the rising generation.'[361] History was featured, but was subordinate to technical teaching. As Mackintosh had it, these industrial exhibitions should cover at least a small historical section: 'Reminiscence,' he wrote, 'is a good physiological stimulus to interest ...'[362]

Thus while the Science Museum may have shared Sarton's unifying historical vision, it surely did not share his humanistic educational philosophy. The interwar Science Museum pursued a programme of education aimed at scientific and technical training. In this it targeted both children and technicians, with the aim of turning the former into the later. This focus on technical education did not diminish the importance of science history in the Museum, but it did help determine the kind of history on offer — only such history that pointed to current practice was eligible for educational application. Though it was suffused with history, the educational mission of the Science Museum was directed first and foremost towards contemporary

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[360] Science Museum Advisory Council, *Report for the Year 1933* (London, 1934).

[361] Science Museum Archive Z 108/4: E. E. B. Mackintosh, 'Special Exhibitions', March 1939, p. 1.

[362] Ibid., p. 10.

problems. This first became manifest in the establishment of a programme of special exhibitions which were designed to aid in technical education and — as the next chapter will suggest — to meet other, very practical purposes.

# Chapter 5: Industry

## Pure Science, Pure Scholarship II

Despite the convergence of interest in science history during the interwar period — in the university, the museum and the great exposition — this interest was far from uniform. Although these different contexts and their practitioners shared the common ground of positivism and the experience of war, nevertheless their focuses, practices, associations and publics differed greatly as each sought out the best way to meet its post-war purposes. Indeed, as the 1920s ended and the 1930s began, the differences started piling up.

One area of outstanding difference was in attitudes toward material culture. Naturally practitioners in science museums and great expositions took a greater interest in material culture than did their counterparts in the academy, but this difference in interest cannot simply be attributed to relative proximity or distance to scientific and industrial objects. Rather, attitudes toward material culture among different groups of practitioners must be understood in the context of contemporary negotiations about the role and importance of science history. These negotiations involved weighty questions, for instance about the nature of pure versus applied science, about appropriate participation in science history, the integrity of historical narrative and ultimately about the role of science history in the post-war work of reconstruction.

It is telling that, despite the widespread success of science history during the interwar period, propagandists for academic history of science paid strikingly little attention to developments in other contexts, especially in the museum. Professional

journals such as *Isis* and *Archeion* hardly recognised the startling expansion of science history in museums. Scarce notice was given to the grand re-opening of the Deutsches Museum, and neither journal even mentioned the openings of the Museo in Florence, the Science Museum in London or the Chicago Museum of Science and Industry, each of these the pre-eminent museum of science in its respective country. This academic neglect is perhaps most obvious in George Sarton's propagandic output. Although before the armistice Sarton had repeatedly identified the museum as a potential location for a proposed 'Institute for the History of Science', during the interwar period Sarton seemed disinterested in museums. In 1938 he re-affirmed his call for an Institute, but ignored the museum in favour of the library or university.[363] Similarly Sarton's 1936 introductory handbook, *The Study of the History of Science* did not even list the increasing number of science museums among the institutional resources available to students.[364] Occasionally Sarton's remarks betray an outright disdain for museums. In a note on Porter and Mitman's efforts to found a National Museum of Engineering and Industry, Sarton scolded them, writing, 'Only the fruits interest them, they will have nothing to do with the seeds. This is, I repeat, a very narrow, a very ungrateful and very disturbing attitude.'[365] And in a short piece entitled 'How to Celebrate the Memory of Great Men', Sarton rejected the museum as worthy of this purpose, describing it as 'but half alive anyhow'.[366]

It might be objected that the 1931 International Congress of the History of Science met at the Science Museum in London in association with the Newcomen

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[363] George Sarton, 'An Institute for the History of Science and Civilization', *Science*, 45 (1917), 284-6; George Sarton, 'An Institute for the History of Science and Civilization', *Science*, 46 (1918), 399-402; George Sarton, 'An Institute for the History of Science and Civilization', *Isis*, 28 (1938), 7-17.

[364] George Sarton, *The Study of the History of Science* (Cambridge, MA, 1936), p. 70.

[365] George Sarton, 'National Museum of Engineering, Washington, DC', *Isis*, 6 (1924), 542.

[366] George Sarton, 'How to Celebrate the Memory of Great Men', *Isis*, 15 (1931), 339-40.

Society. In fact throughout the period the only mention of the Science Museum in the academic literature was made to announce it as the location for the Congress, and a closer look reveals that while the Museum provided a convenient *physical* meeting place for academic historians, it did not provide their *intellectual* meeting place.[367] Just one session at the Congress contained papers in the history of technology, the subject to which the Newcomen Society was explicitly directed. Significantly this session was entitled 'The Interdependence of Pure and Applied Science'.[368] Ronald Kline has shown that during this period, older notions of *technology* as synonymous with *applied science* began to be replaced by a new anthropological model whereby *technology* 'referred to both the objects of material culture and the methodology for procuring them'.[369] Simultaneously, the phrase *pure and applied science* came increasingly to be replaced by the phrase *science and technology*, a new usage that expurgated material and practical activity from 'the implication of impurity'.[370] Thus, the choice of the term *applied science* instead of *technology* is significant on two counts. First, it helped to exclude material culture from the discussions: while technology was seen as incorporating material culture, the term *applied science* was

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[367] Robert Bud, 'History of Science and the Science Museum', *British Journal for the History of Science*, 30 (1997), 46; Robert Bud, 'Research at the Science Museum', in *Clio in Museum Garb: The National Museum of American History, the Science Museum and the History of Technology, Science Museum Papers in the History of Technology 4* (London, 1997), pp. 47-53. Similarly, it should be said that Sarton and his colleagues were not in all instances unsympathetic toward the museum. For example, in one of his only other significant mentions of museums, Sarton acknowledges the importance of new establishments in Washington and Oxford and even suggests that Gunther's collegiate collecting efforts might be reproduced at Harvard. Still, in keeping with Sarton's more general neglect of museums, these happenings are treated in appendix to Isis and as peripheral to its main concerns. See George Sarton, 'National Museum of Engineering, Washington, DC', *Isis*, 6 (1924), 539-42; George Sarton, 'Oxford Museum of the History of Science', *Isis*, 6 (1924), 542-3; George Sarton, 'The Harvard Museum of the History of Science', *Isis*, 6 (1924), 543.

[368] See the conference programme 'The Second International Congress of the History of Science', *Archeion*, 13 (1931), 74-6. See also conference proceedings International Congress of the History of Science, 'Proceedings of the Second International Congress of the History of Science', *Archeion*, 14 (1932).

[369] Ronald Kline, 'Construing "Technology" as "Applied Science" in the United States, 1880-1945', *Isis*, 86 (1995), 217.

[370] Ibid., 218.

more ambiguous on this count. Secondly, by using the older phrase *pure and applied science* instead of *science and technology*, the Congress organisers more clearly invoked the hierarchy that subordinated material culture and its production. In fact, despite the presence of the Newcomen and the Science Museum setting, not one of the conference papers dealt directly with instrumental, material cultural or museological concerns.

This was a not uncommon situation. Historians of science often mobilised the flexibility of these terms — pure science, applied science, technology, etc. — to exclude material culture from their discussions. For instance, in disparaging the intentions of the National Museum of Engineering and Industry, Sarton was keen to distinguish between technological 'fruits' and scientific 'seeds'.[371] Likewise, Singer was able to order the 'effects' of scientific advance into two classes — 'indirect and direct' — corresponding very closely to Sarton's 'fruit' and 'seeds'. On the one hand, the more 'widespread and obvious' indirect effects of science — i.e. technologies — should fall to the general historian for consideration. On the other hand, the 'deeper if less evident direct effects of science' — i.e. those that bear upon 'life and mind' — should remain the privileged 'province of the special historian of science.'[372] Indeed, only in the leisure of retirement did Singer turn any attention to these 'indirect effects', with the publication in 1954 of the landmark *A History of Technology* under his editorship.[373]

Even when it wasn't invoked explicitly, the rules of the *pure science-applied science-technology* hierarchy continued to operate to subordinate problematic objects.

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[371] George Sarton, 'National Museum of Engineering, Washington, DC', *Isis*, 6 (1924), 542.

[372] Charles Singer, 'Scientific Humanism', *The Realist*, 1 (1929), 14-5.

[373] Charles Singer, Trevor Williams and Richard Raper (eds.), *A History of Technology* (8 vols., Oxford, 1954). See also Melvin Kranzberg, 'Charles Singer and 'A History of Technology'', *Technology and Culture*, 1 (1959-60), 299-302.

This was most obvious in the case of scientific instruments, where material culture necessarily impinged on discussions of pure science. Yet while scientific instruments may have in places met the criteria for classification as pure science, even so these same criteria allowed scientific instruments to be passed over as somehow 'less pure' than other members of the class. In discussing instruments Sarton at times seemed ready to admit that science is 'not created only by our minds, but to a far larger extent than is usually supposed, by our hands'. Immediately, however, he corrected himself: 'Or more exactly,' he wrote, 'much of our thinking was inspired by the purely technical or manual part of our labor.'[374] According to Sarton, instruments may impinge on scientific thought, but only as inspirations of transitional and subordinate importance. Likewise, while instruments and other 'paraphernalia' may be useful for teaching purposes, they are not in and of themselves worthy of study, and 'cheap models' and 'copies' should do just fine.[375]

Here it seems that attitudes toward material culture and ideas about the relative value of pure versus applied science were associated with ideas about appropriate participation in science history. It has already been shown, for instance, that according to Singer's classification of effects, only the direct effects of science on the human mind should properly concern the professional historian of science. Yet Singer's categories served not only to exclude material culture from the purview of the specialist historian of science, but also to exclude non-specialists from participating in history of science. While the indirect material effects of science may have been suitable for large audiences, the intellectual sophistication required to study

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[374] George Sarton, *The History of Science and the New Humanism* (New York, 1931), p. 28.

[375] George Sarton, 'The Teaching of the History of Science', *Scientific Monthly*, 7 (1918), 198-202; George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), pp. 150-1.

direct effects on mind restricted the history of science to senior scholars. It was in this connection that Singer argued that history of science was 'too difficult a subject for school teaching, and indeed, too difficult for any but exceptional students of university rank.'[376] Sarton similarly believed that the complexity of history of science excluded the masses from participating. Remember that Sarton argued that the history of science should indeed be 'studied very deeply', but only those 'sufficiently attracted to it and qualified to undertake it should be encouraged.'[377] More to the point he argued that instruction in the history of science be 'put as far back as possible in the curriculum' and participation limited to those students sufficiently trained in scientific principles and 'sufficiently familiar with the scientific spirit'.[378]

In light of these hierarchies, it is not surprising that museum-based and material cultural research was marginalized by the mainstream of professional history of science. For instance, for most of his career the museum-based Oxford historian, Robert T. Gunther struggled for recognition as a serious historian of science and was never fully accepted by the academic establishment.[379] While his fourteen volumes on

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[376] Charles Singer, 'Scientific Humanism', *The Realist*, 1 (1929), 15.

[377] George Sarton, *The History of Science and the New Humanism* (New York, 1931), p. 135.

[378] Ibid., p. 130. Throughout this section the use of the term 'participation' is deliberately vague to reflect historical ambiguities. Singer and Sarton's targeting of (advanced) students as history of science's relevant audience makes it difficult to speak in usual terms of 'practitioners' and 'publics'. Their focus on students conflates these common categories of participation, since the students considered are those members of the public on their way to becoming practitioners. Significantly, the targeting of students in itself limits participation in history of science — restricting the relevant public to students means restricting it to future practitioners. In this the very notion of a 'public' dissolves, leaving only potential peers. Despite his occasional populist flourishes, these meanings served Sarton's disciplinary aims particularly well. Sarton's efforts to secure and sustain the discipline required new blood. While Sarton wrote often and at length on the propriety and importance of university history of science teaching and published at least three college student primers, it was not until the last decade of his life that Sarton attempted anything resembling a popular work. He writes of *Isis*: 'The main papers are generally not meant to be read...but to be studied. The aim of *Isis* is not by any means to entertain idle readers but...to organize the history of science as an independent and full-fledged discipline ...' George Sarton, 'The New Humanism', *Isis*, 6 (1924), 36.

[379] See J. A. Bennett, 'Museums and the Establishment of the History of Science at Oxford and Cambridge', *British Journal for the History of Science*, 30 (1997), 29-46; A. V. Simcock, 'A Dodo in

*Early Science in Oxford* were widely praised, his more museological, object-centred works were demeaned.[380] A lengthy review by Alexander Pogo — a respected historian of astronomy and George Sarton's office-mate and assistant — described Gunther's massive *Astrolabes of the World* in the most unfavourable terms: 'To conclude: a hastily compiled and rather carelessly proof-read catalogue *de luxe*. *Caveat lector.*'[381]

Never mind that Gunther's study intended to be a 'catalogue de luxe'. Nevertheless, most of Pogo's criticisms stemmed from his unhappiness with the catalogue format. It was not so much Gunther's work that was attacked, but the *kind* of work Gunther was doing. Just as Sarton subordinated scientific instruments to scientific theory as objects of historical inquiry, Pogo subordinated the work of cataloguing to the work of historical narrative. Sarton argued that if instruments were important, it was only as inspirations to intellect. Pogo made a related claim about the relationship between the catalogue and the narrative. Refusing to dignify Gunther's work as real history, Pogo argued that 'the corpus and the catalogue are but source material; their publication does not constitute a history of the astrolabe; their analysis and integratio by a scientist and scholar ... must follow ... '[382] He wrote further that the catalogue was merely 'a necessary preliminary step' in the writing of this history, a history whose ultimate goal would be to demonstrate the astrolabe's importance 'in the preservation, during the Middle Ages of Greek astronomical

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the Ark', in A. V. Simcock (ed.), *Robert T. Gunther and the Old Ashmolean* (Oxford, 1985), pp. 65-8, 79-83. Gunther will re-emerge in later discussions.

[380] R. T. Gunther, *Early Science in Oxford* (15 vols., Oxford, 1923-67). For its reception, see George Sarton, 'Robert T. Gunther, *Early Science in Oxford,* Volumes 1-2', *Isis*, 6 (1924), 449-53.

[381] Alexander Pogo, 'Robert T. Gunther, *Astrolabes of the World*', *Isis*, 20 (1933), 316; R. T. Gunther, *Astrolabes of the World* (2 vols., Oxford, 1932).

[382] Alexander Pogo, 'Robert T. Gunther, *Astrolabes of the World*', *Isis*, 20 (1933), 311.

knowledge.'[383] Here the integratio for which Pogo argued would subsume both the work of cataloguing and the astrolabe itself in a positivist narrative of intellectual progress. In this way the form and specificity of material culture studies were uneasily accommodated by the positivist narrative ideals of professional historians.[384]

In a recent paper, Silvia de Renzi examines the relationship between collectors and dealers and the academy in the growth of science history in just this period.[385] Contesting received wisdom that attributes early twentieth century interest in science antiquities to the concurrent advance of academic history of science, de Renzi argues instead that collectors and dealers should be shown more attention as active influences in discipline building. Here de Renzi traces the intricate ties and mutual influences that existed between these groups in constructing academic history of science. By contrast, the preceding discussion has emphasized the divisions that existed between the contexts in which material culture figured prominently and the largely library-based context of the academy. Yet while both influences and divisions can be traced, neither the influence model nor the division model really do justice to the complexity of the relationship between the contexts of interwar science history. Rather than viewing the relationship as reactionary or causal, it may be better to view it as modal; that is, to see science history in the academy, the museum and the antiquities marketplace as diverse though related responses to common needs. One

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[383] Ibid.

[384] A related example can be found in the *Isis* review of Gunther's one-volume *Early Science in Cambridge*, which by contrast with the Oxford volumes was prepared primarily as a catalogue to accompany a scientific instruments exhibition: 'Dr. Gunther's book ... is properly to be regarded as miscellany, rather than as an historical account or analytic examination of Cambridge science, — it is nonetheless valuable for all that.' See M. F. Ashley-Montagu, 'R. T. Gunther, *Early Science in Cambridge*', *Isis*, 28 (1938), 134; R. T. Gunther, *Early Science in Cambridge* (Oxford, 1937). For Gunther's uneasy relationship with positivism see A. V. Simcock, 'A Dodo in the Ark', in A. V. Simcock (ed.), *Robert T. Gunther and the Old Ashmolean* (Oxford, 1985), p. 66.

[385] Silvia de Renzi, 'Between the Market and the Academy: Robert S. Whipple (1871-1953) as a Collector of Books and Science', in R. Myers and M. Harris (eds.), *Medicine, Mortality and the Book Trade* (Folkestone, 1998), pp. 87-108.

way to do this is to view the variety of interwar science history in light of pervasive hopes for post-war reconstruction.

Here differing attitudes toward material culture — and the negotiations over pure versus applied science, publics and positivist narrative integrity that they informed — may be seen as differing ideas about the post-war work of science history. For instance, earlier chapters have shown how material culture was seen in the museum as an effective means of education and enlightenment by introducing a wide public to the concepts and practices of science and industry. Displayed most often in positive and progressive series, the material culture of science was seen as important for both national and international betterment.[386] On the one hand, by assisting industrial education, the museum would contribute to the progress of national manufactures. On the other hand, displayed most often in progressive series, the material culture of science was seen as a spur for international peace, demonstrating to the public the positive achievements of industry and the more 'peaceful arts' of humankind

Of course, academic history of science shared in this notion of the re-constructive and pacifist potential of science history — consider Sarton and Singer's New Humanism. Yet regardless of these sympathies, for academics the introduction of material culture to the historical field and its wider implications diminished history of science's potential as a force for peace. For instance, the divisions between pure science, applied science and technology — of which material culture was largely constructive — become particularly important when considered in the context of science history's aspirations for post-war reconstruction. They allowed Sarton, for example, to exonerate science of the technological crimes committed in the war and

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[386] George Basalla, 'Museums and Technological Utopianism', *Curator*, 29 (1974), 105-18.

thereby remain a force for peace. Praising peaceful, 'disinterested' scientific research, Sarton wrote:

> These words may sound very strange to the disillusioned people of our time, many of whom blame science for their troubles, and the more so because their expectations had been more foolish. The technical progress of the last century has been so stupendous that they imagined that its continuance at the same speed or faster still would soon introduce a golden age. Well, that was a great mistake, for technicians can improve instruments only — they cannot change human nature. The foolish hopes of yesterday and the present disillusionment simply prove that these people have not understood the function of science.[387]

Or more candidly in a letter to May, Sarton lamented his failure to obtain a driver's licence, writing:

> My failure has many causes, one of which is that I don't like machines of any kind. I don't like to think of them or about them. As a historian of science I find myself in a paradoxical situation, for I hate this machine age — which is the result of science — and yet I love science. Scientists are not by any means innocent of the present chaos, though it is clear that they have no control over the applications of science, whether those be merciful or criminal.[388]

Similarly the limitations on participation that Sarton and Singer based in these hierarchies of pure and applied science also spoke to ideas about science history's post-war reconstructive role. By contrast with the museum, history of science in the academy would not promote peace by virtue of its mass appeal. Rather, history of science was something that contributed quietly and gradually to peace. Remember, for instance, Sarton's 'secret history'. Sarton placed his own work among those isolated, 'imperishable contributions to the whole of humanity', whose gradual accumulation represented the gradual progress of peace.[389] Rather than a mass movement, history of science best served the cause of peace by slow and steady individual scholarship. For instance, in the aftermath of the Second World War, when

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[387] George Sarton, *The History of Science and the Problems of Today* (Washington, 1936).

[388] New York Public Library Berg Collection: George Sarton, 'Letter to May Sarton', 25 June 1939.

[389] George Sarton, 'The New Humanism', *Isis*, 6 (1924), 16-7.

Julian Huxley asked Sarton to join the newly formed UNESCO history of science project, he replied regretfully that although he was 'deeply interested in that project and anxious to show [his] good will,' nevertheless he 'persist[ed] in believing that the best creative work is done by individuals working alone.' He continued, 'I am not taking refuge in any "ivory tower", for I am always conscious of my social obligations, but I cannot fulfil those except in solitude.'[390] Similarly in the interwar period, Sarton wrote that individual research and publication were the only means of 'unifying good will' and effecting a lasting peace. 'It is a very slow way,' wrote Sarton, 'but all considered, the only one.'[391]

This gradualism was in turn related to another gradualism, that of the positivist historical narrative. Just as histories of science were among the imperishable contributions of mankind, so too were the discoveries of scientists and the story of their positive accumulation a story of increasing peace. 'The history of science is the history of mankind's unity, of its sublime purpose, of its gradual redemption.'[392] In order for histories of science to promote this ideal, a narrative of slow and steady progress had to remain intact and clearly intelligible. The idiosyncrasies and specificities of individual objects were subversive of these ends and therefore unsuitable for inclusion in the work of academic historians.

For advocates of the Peace Museum, material objects of science and industry stood as evidence of the peaceful potential of mankind and their public display as productive of this peace. For academic historians, material culture — along with the narrative problems, modes of participation and hierarchies of pure and applied science

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[390] Harvard Houghton Library, bMS Am. 1803.1 (311): George Sarton, 'Letter to Julian Huxley', 17 May 1946.

[391] George Sarton, 'Unification of Goodwill', *Isis*, 27 (1937), 211-5.

[392] George Sarton, *Introduction to the History of Science*, *Carnegie Institution of Washington Publication 376* (3 vols., Baltimore, MD, 1927-32), i, 32.

that it involved — seemed at odds with the reconstructive role of history of science. Thus, attitudes toward material culture underline the complexity of interwar science history. On the one hand, they can be seen as lines of division between the various contexts of science history. On the other hand, differing attitudes toward material culture betray sympathies between these contexts when considered amidst the elaborate negotiations about the role of science history in interwar politics.

**Special Exhibitions at South Kensington**

In fact, the tension that Sarton perceived *between* his own vision of science history and the material cultural science history of the museum also existed *within* the museum, and the interwar Science Museum was uncertain about the role industrial art should play in its portrayals of science history. Tensions between science and industry, and in the relationship between pure and applied science, were acutely felt in the Science Museum and worsen as the interwar period wore on.

As both public and patron, industry held a special place in the interwar history of the Science Museum. Of course, industry played a fundamental role in the entire history of the Science Museum, beginning with its origins in nineteenth century industrial exhibitions. Yet between the wars industry appeared ever more important in the Museum. Just as new provision for technical and industrial education was provided in this period, the Museum sought to make itself 'of more practical use to those actually engaged in industry as distinct from students.'[393]

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[393] Royal Commission on National Museums and Galleries, *Final Report, Part II* (London, 1930), p. 47. The suggestion as phrased this way was submitted by the Federation of British Industries and was taken up by the Royal Commission on National Museums and Galleries and by the Science Museum Advisory Council. The Federation of British Industries would play a significant role in increasing the influence of industry in the Science Museum, receiving a seat on the Advisory Council and submitting

Concern over industry's role in the Science Museum came to a head in the late 1920s. Increasingly, representatives of industry were asking, 'What does the Science Museum do for Industry?' The Science Museum did not have a good answer — more than once Lyons responded that he had 'no clear idea of what would be of value to them' — and this became an increasing source of tension and embarrassment.

Case in point are the investigations of the Royal Commission on National Museums and Galleries.[394] Specifically, the Royal Commission was interested in the Science Museum's provisions — or lack thereof — for industrial meetings. Although suggested by the 1911 Departmental Report, funding for conference facilities was not included in the building of the Eastern Block, and at the time of the Royal Commission's hearings, there stood only a half-finished 200-seat lecture hall. Without funding, its completion was uncertain, and this emerged as a great concern among the Royal Commission's interviewees. The testimony of the Royal Society's Mr Smith was representative. When asked if he considered 'a Lecture Hall a requisite adjunct' to the Museum's facilities, Mr Smith responded: 'That is so. If the Museum is going to perform its proper functions — and I do think that assistance to industry is one of its functions.' When asked whether a shared facility for the three South Kensington museums would meet these needs, Smith thought not, saying that the needs of industry required a dedicated facility, in which apparatus could be demonstrated and easily moved about. In fact, Smith had in mind a facility far grander than the one under construction. First, he argued for an enlarged lecture theatre, in which 'meetings of 500 or 600 people where lectures on fairly popular subjects would be given'. Second, he recommended the installation of a separate

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nominations for several others. See, for instance, Science Museum Archive Z 200/1: Sub-Committee on the Representation of Industrial Concerns on the Advisory Council, 'Report', 1931.

[394] PRO ED 79/30: Henry G. Lyons, 'Letter to J. S. M. Ward', 19 November 1928. PRO ED 79/30: Henry G. Lyons, 'Letter to Sir R. T. Glazebrook', 2 November 1928.

facility, along the lines of the one already under construction, in which meetings of industrial and scientific societies might be held: 'I had in mind the more advanced type of discussions where the number present would be comparatively small ... a Conference Room to hold 200 people would suffice.'[395]

Similarly, the Royal Commission was worried about the constitution of the Advisory Council and its industrial representation. The issue emerged in discussions about the lack of coordination between the South Kensington museums. In this connection, the Royal Commission forwarded not only the idea of a joint lecture hall, but also of a joint governing body for the three South Kensington museums. For much the same reason as he rejected the idea of a joint lecture hall, however, Mr Smith rejected the idea of a joint Council:

> This matter was discussed by the Royal Society Committee. The view I think which was quite generally expressed and approved was that they could not conceive of any super body managing all three Museums ... One cannot imagine a body of men who are competent to look after the Science Museum and equally competent to look after the Natural History Museum. Two councils are needed and a third for the Victoria and Albert Museum.

Rather, according to Smith, men of industrial sensibilities must constitute an independent Science Museum Advisory Council. He said:

> I had in mind ... that the Council of the Science Museum might have on it certain representatives of the larger technical Societies of London, say the Civil Engineers who might nominate a representative, and the Mechanical Engineers. If those people took their duties seriously, it would to a considerable extent ensure that the Museum was fairly up-to-date with regard to engineering and civil engineering and other branches. [396]

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[395] Royal Commission on National Museums and Galleries, *Oral Evidence, Memoranda and Appendices to the Interim Report* (London, 1928), pp. 157-61.

[396] Ibid.

Smith's recommendations received favour among the members of the Royal Commission and ensured that much of Lyons' own testimony would be occupied with questions about the constitution of the Advisory Council. Here Lyons repeated that the Science Museum's usefulness to industry was unclear. 'The problem is one of perception', Lyons said, 'I rather feel that a great many people in industry still look upon the Museum as one that is primarily an educational one only and which stops short of being a Museum of Industry.' According to Lyons, the solution to this problem was to better coordinate the Science Museum's contacts with industry, and as a practical matter to reconstitute the Advisory Council:

> There is an Advisory Council and they give us advise about anything we like to ask them, but it seems to me that if there were some body which represented groups of industry or groups of technical institutions more directly then probably we might be more effectively kept up to the mark than we are now.[397]

In its final report, the Royal Commission took these suggestions to heart, making two recommendations regarding the constitution of the Advisory Council. First it suggested that the Council should be enlarged 'making it more fully representative of scientific and technical institutions and industrial groups.' Second, it argued that its terms of reference should be amended 'so as to assign to the Advisory Council a more active part in the management and development of the Museum'.[398]

These recommendations were made in 1930, and by 1931 the Advisory Council could already report that their number had been enlarged from 12 to 32. Nearly all the new members represented industrial concerns. Similarly by 1931 the Advisory Council reported that their terms of reference were under revision, to

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[397] Ibid., pp. 150-7.

[398] Royal Commission on National Museums and Galleries, *Final Report, Part II* (London, 1930), p. 45.

guarantee greater representation of industry.[399] Other evidence also points to the increasing influence of industry at the Science Museum in the immediate aftermath of the Royal Commission's hearings. On the one hand, the Science Museum took great pains to attract industrial conferences to its now-finished lecture hall. In the two years following the Royal Commission's report, records show that more than 20 conferences were held by outside bodies at the Museum, nearly all of which were organised by industrial associations.[400] On the other hand, the Advisory Council began recording the details of Museum officers' visits to industrial firms, turned increasingly to comparisons with international industrial expositions — describing the Museum as 'a continuous exhibition' — and came more and more to favour its longer title, the 'National Museum of Science and Industry'.[401]

Finally the Science Museum stepped up its programme of special exhibitions. Introduced in the previous chapter, the Science Museum's new programme of special exhibitions was intended first and foremost to promote technical and industrial education — to provide industry with competent labour. In his manual for special exhibitions, for instance, Mackintosh described the aim of these exhibitions primarily in terms of their benefit to industry. 'In the case of an industrial exhibition,' wrote Mackintosh, '[the Science Museum] exposes and advertises the latest advances in the industry concerned, and at the same time gives interest and incentive to other

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[399] Science Museum Advisory Council, *Report for the Year 1931* (London, 1932), pp. 3-5. See also Science Museum Archive Z 200/1: Sub-Committee on the Representation of Industrial Concerns on the Advisory Council, 'Report', 1931; Science Museum Archive Z 200/1: Science Museum Advisory Council, 'Terms of Reference, Draft', 1931.

[400] Science Museum Archive Z 183/1: Henry G. Lyons, 'Memorandum on the Development of the Science Museum From 1920 to 1933', August 1933., Table I, Use of the Science Museum by Outside Bodies.

[401] See, for instance, Science Museum Advisory Council, *Report for the Year 1930* (London, 1931), p. 13; Science Museum Advisory Council, *Report for the Year 1931* (London, 1932), p. 9; Science Museum Advisory Council, *Report for the Year 1932* (London, 1933), p. 5.

industries.'[402] While this was not an entirely new role for the Science Museum, what was new was the way in which it was performed and the control the Science Museum ceded to industry.

The first of the post-Royal Commission special exhibitions opened in April 1933. Organised almost independently by industrial concerns, the 'Plastics Materials Industry' exhibition was roundly considered a tremendous success. The Advisory Council was impressed by the exhibition's strong attendance and by sales of its companion bibliography, reporting that 'the benefit accruing was undoubtedly realised by members of other industries who visited the Museum, with the expected result that enquires as to facilities for similar exhibitions have been received from other industrialists.' Moreover the Advisory Council was happy to report that in addition to benefits to the plastics industry, the exhibition also helped 'widen the sphere of influence of the Museum' and noted the subsequent arrangement of copycat exhibitions in the United States and Australia.[403]

A sequel was opened the following year, this time by the Rubber Industry. Apparently it met with even greater success, hosting over 300,000 visitors in its short run. It is clear that the Museum was surrendering more and more control to industry. This time the industry provided its own salaried guide lecturers and wrote its own handbook, which was published and sold by the Museum.[404] In addition 'facilities were provided for a series of visits by associations and institutions, at which the Rubber Growers and Rubber Research Associations were "at home" to their

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[402] Science Museum Archive Z 108/4: E. E. B. Mackintosh, 'Special Exhibitions', March 1939.

[403] Science Museum Advisory Council, *Report for the Year 1933* (London, 1934).

[404] Science Museum Advisory Council, *Report for the Year 1934* (London, 1935), pp. 8-9; Science Museum, *Rubber Exhibition (November 1934-April 1935): A Brief Account of the History of Rubber from its Source to the Finished Product and a Descriptive Catalogue of the Exhibits, Compiled by the Rubber Growers' Association* (London, 1934).

guests.'[405] When it finally closed six months after opening, the exhibition was removed 'in toto' by the Rubber Growers' Association and transferred for audiences in Manchester and Edinburgh. In many ways the Science Museum had become a billboard and clearinghouse for industry.

A final example reinforces the point. After the Rubber Growers had left the building, another group took their place. This time it was the Anti-Noise League, and their exhibition was nothing less than a concerted and direct appeal to the public on behalf of industry and government. Organised under the auspices of the Ministry of Health, the Office of Works, the Admiralty, the National Physical Laboratory, the General Post Office, the B. B. C., the Industrial Health Research Board and the Royal Institute of British Architects, 'as well as a number of [unnamed] industrial research laboratories and firms', the *Noise Abatement* exhibition was an exercise in industrial propaganda and government apology if there ever was one. Here again the organising committee provided its own tour guides, publications, and exhibits to demonstrate how industry provided the public with better, quieter buildings and better, quieter machines. According to Advisory Council, 'the aims of the exhibition were to illustrate to the public the scientific means now available for the reduction of unnecessary noise and also to stimulate co-operation between those who understand the causes of noise and those who suffer from its effects.'[406] Not especially subtle in its delivery, the exhibition included images of hospital wards and school classrooms before and after soundproofing. The live demonstration of silenced and un-silenced pneumatic drills must have been particularly persuasive of the benefits of modern industry. Of course, it might be said that without industry there wouldn't have been

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[405] Science Museum Advisory Council, *Report for the Year 1935* (London, 1936), p. 9.

[406] Ibid., p. 10.

the pneumatic drill to silence in the first place, yet throughout the exhibition, industry was portrayed as providing only solutions. If problems remained, they were not the fault of industry, but of those who refused industry's benefit. Here's the pitch:

> At last we are noise-conscious. This is not only a slogan: it describes the reaction of normal and intelligent people against something that is hurting them and their children — against something that was increasing its power to hurt them ... It has been the business of the Anti-Noise League to activate those concerned in the design and manufacture of noisy machines towards better manners as well as more efficient science. We have been careful to do this tactfully and by requests rather than by any form of pressure. Manufactures are almost one hundred per cent. amenable to good sense and to the good of the community ... We have done what we can: we have marshalled experts and we have got the manufacturers on your side, but we cannot *make* you enjoy greater quiet, smooth nerves, decent sleep, and better general health. You can have these things, and have them abundantly, if you will carry on with the next step — in your own and your children's interest.[407]

While the Science Museum surely benefited from the increased presence of industry in its affairs, nevertheless these special exhibitions marked a hard turn for the Science Museum and one that put it in an awkward position. On the one hand, exhibiting industries provided the science museum with increased attendance, new exhibits, and even sound-proofing for its lecture hall.[408] On the other hand, as a public institution, the Science Museum had to be wary of the appearance of impropriety. As industry played an ever greater role in staging exhibitions — in everything from financing to gallery design and staffing — concerns mounted that the Science Museum might take on 'the semblance of a Trade Show' or even become 'an ordinary trade exhibition.'[409] Increasingly the Science Museum even depended on

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[407] Anti-Noise League, *Noise Abatement Exhibition* (London, 1935).

[408] Science Museum Advisory Council, *Report for the Year 1935* (London, 1936), p. 11. The Advisory Council reported that 'as an integral part of the [noise reduction] exhibition and after a technical test of the acoustics of the lecture theatre, four firms kindly undertook to treat certain panels on the ceiling and back wall with sound-absorbing material.

[409] Science Museum Archive Z 108/4: E. E. B. Mackintosh, 'Special Exhibitions', March 1939. Science Museum Archive Z 186: Henry G. Lyons, 'Museum Policy', 11 November 1932, p. 2.

industry for direct financial support.[410] In many ways it also depended on industry for its stall in the changing cultural marketplace of the late 1930s.

## Misfits: Social Engineering in the Industrial Museum

It is no accident that the museums planned for America were defined from the outset as industrial museums. In fact, backers of these museums came almost exclusively from the boardrooms of corporate America. Among them were some of the most recognized names in American industry, including Julius Rosenwald, Thomas Edison, Lucius Eastman, Henry Ford and Walter Chrysler.[411] Not surprisingly, these men came to the American science museum movement with their corporate interests at heart.

In Chapter Two it was shown how the example of Oskar von Miller provided a model of practitioner identity that emphasized the engineer as public servant, and indeed the people most directly involved in the day to day planning and operation of the American industrial museum conformed quite nicely to this model. Richards, Brown, Porter and Mitman, for example, were all trained as engineers and like von Miller moved freely between private sector positions in industry and public sector positions in government and charitable organisations.

Scientific servants did not, however, control the destiny of the movement they spearheaded. As in Europe these men were overseen by another layer of

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[410] Science Museum Archive Z 108/4: E. E. B. Mackintosh, 'Special Exhibitions', March 1939, p. 9.

[411] Other influential industrialists who signed up to the science museum movement included Westinghouse President E .M. Herr, Commonwealth Edison President Samuel Insull, General Electric President Gerard Swope, Erie Railroad President Frederick Underwood and J. P. Morgan President Thomas Lamont, and many others. See, for example, Porter's 'Charter Membership of 100', Smithsonian Institution Archives RU 297, Box 8, 'National Museum of Engineering & Industry, Correspondence, 1922-5, 1927-8': H. F. J. Porter, 'Letter to the Organizing Committee', 12 April 1924; Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'National Museum of Engineering and Industry, To Be Under the Direction of the Smithsonian Institution, Washington, D.C.' 1924.

administration, in the form of advisory councils, organizing committees and boards of directors. Unlike in Europe, however, where museums received substantial government financial support and where members of government played prominent roles in advisory councils and in matters of museum policy and direction, in America the councils and committees were made up entirely of corporate big-wigs. It is no coincidence that these same big-wigs were expected to put up all the money.[412]

By this arrangement, science history in the American museum would be constructed by professional engineers at the behest and with the material support of industrial powerbrokers. This arrangement also ensured that this history would be celebratory of American industry and business. Porter's plan even called for a 'National Hall of Achievement for Engineers, Inventors, and Industrialists' and a 'Founders' Room' to celebrate in bronze 'those whose contributions in time, money or effort will have made possible the establishment of such a museum.'[413]

And yet the American industrial museum intended to do more than celebrate. Rather, supporters of the American industrial museum believed it would be productive of real-world economic ends. On the one hand, they believed the American industrial museum would be more than a vessel of public edification. Instead it would be a 'spur to invention'.[414] This was applied history in its most real sense — history to hardware — and plans for American industrial museums at one

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[412] Indeed the extent to which the industrial museum in American was conceived apart from government can be gleaned from a question put to Porter during testimony before the Senate Education Committee. Discussing the industrial museums of Europe, Senator Copeland asked of the museum in Nuremburg, 'Is that an industrial museum or a government institution?' Note there is no conception that it might be both. United States Senate Committee on Education and Labor, *Hearings on S. 454, A Bill to Establish a Commission To Be Known as a Commission on a National Museum of Engineering and Industry* (Washington, 1930), p. 7.

[413] Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'A Great National Museum for Industrial America', 1924. See also 'The Hall of Fame for American Inventors', *The New York Tribune*, 2 September 1923; 'Mall is Selected for Museum Site', *The Washington Star*, 11 January 1925.

[414] Smithsonian Institution Archives RU 297, Box 8, 'Correspondence': 'Plan Industrial Museum to Spur Young Inventors', [undated].

point even recommended the building of industrial research laboratories to complement the exhibits.[415] On the other hand, there was another, subtler if no less important application to which history in the industrial museum was turned. That is, promoters of the American industrial museum saw it as productive of broader social and macroeconomic ends. In particular, promoters argued that the museum might directly prevent problems of unemployment, social dislocation and even drudgery by educating workers of their proper place within the labour force.[416]

From the outset, American industrial museums were conceived primarily in terms of education, as opposed to, say, research or preservation. This may seem unremarkable for would be public institutions, and indeed a similar educational focus has been demonstrated for the interwar Science Museum and the British Empire Exhibition. Yet to some extent education is more visible in the American industrial museum than in these other contexts, or at least the larger aims to which education was turned are more visible in the American industrial museum.

As with so much else, the American museum movement's educational ideas were formed in Munich. Charles Gywnne, for example, singled out the Deutsches Museum's educational efforts for their energy and extent, pointing both to the Museum's organized educational programming and to its more general accommodation for women and other 'casuals'.[417] Charles Richards offered similar

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[415] Smithsonian Institution Archives RU 192, Box 253, Folder 3: Carl Weaver Mitman, 'A Suggestion as to the Activities Open to the Division of Mineral and Mechanical Technology and Their Development into a Department of Engineering', October 1922.

[416] Much of what follows in this section is supported by Russell Douglass Jones' recent excellent dissertation, especially his discussions of attitudes toward labour, industrial research and social responsibility in Chapters 3, 5 and 6. See Russell Douglass Jones, 'Engineering History: The Foundation of Industrial Museums in the United States' (Case Western Reserve University Ph.D. Dissertation, 2001).

[417] Charles Gwynne, *Museums of the New Age: A Study of World Progress in Industrial Education* (New York, 1927), pp. 12-5.

praise, discussing at length the Museum's lecturers, publications, planetarium, vocational courses and programme of school visits — these last made mandatory under Bavarian law. More fundamentally, Richards praised the Deutsches Museum for the extent to which education defined the institution, recommending the Museum for its 'purely educational aim' and for the way in which 'its organization, collections, and methods of display have all been so developed as to forward this educational purpose'.[418]

Despite this high praise, however, leaders of the American science museum movement were not entirely satisfied with the Deutsches Museum's educational model. Richards, for example, argued:

> [The Deutsches Museum] is so large that even superficial inspection of its contents requires six or eight extended visits. Furthermore, some of its departmental collections are becoming too highly complex and specialized for the appreciation of the layman. In some groups the amount of material of a closely related character is out of proportion to the ideas represented or at least to the ideas capable of being grasped by the average visitor. It would appear as if the highly specialized staff working with intense enthusiasm over a period of years has approached the danger line in accumulating material. In other words they have reached the point where the significant is in danger of being overwhelmed by quantity and complexity and the psychology of the visitor with his limited powers of observation and absorption lost sight of.[419]

Here Richards worried that the Deutsches Museum's 'over-weight' of educational exhibits had served to weaken the their ultimate educational effect. While he admired particular policies and the general rule by which the Deutsches Museum privileged education, nevertheless Richards was concerned that the number and diversity of the Deutsches Museum's exhibits had obscured the lessons they were designed to teach. It was on this score of overweight that Richards strayed from the Deutsches

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[418] C. R. Richards, *The Industrial Museum* (New York, 1925), p. 32.

[419] Ibid., p. 53.

Museum's model in making recommendations for the American industrial museum's educational programme.

Rather than bombarding the visitor with varied and complex messages, Richards favoured a sparser, more easily assimilated model. More specifically, Richards set forth a model whereby 'a constant emphasis' on the museum's overriding aim would serve naturally to prevent problems of overweight. Here exhibit designers would take 'the greatest care ... in selecting only material of the highest significance, in rigidly holding down the collections to the objects that tell an important story, and in eliminating all others.' Just as the museum's other functions of collection, preservation, research and exhibition would be subordinated to the primary educational function, so too would education be subordinated to a higher purpose — that is, to those 'important stories' and, more importantly, to the lessons and morals they held.[420]

One way to uncover the higher purposes of the American museum movement is therefore to look to the students intended for these lessons. As in other contexts of interwar science history and in other science museums, education in the American industrial museum was intended for both children and adults. Yet in the American case children's education was in fact often subordinated to adult education. Promoters of the American industrial museum were always more concerned with workers than with students. Indeed even in those instances when they were concerned with students, they were most often interested in them as future workers.

Take, for instance, Charles Gywnne who's *Museums of the New Age* was made up predominantly with proofs of the industrial museum's educational value, but

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[420] Ibid., pp. 52-3.

who finally assessed this value in terms of benefits to current and future workers. In Gywnne's words, education in the industrial museum should be first and foremost dedicated to 'the interest and the integrity of labor'.[421] He wrote:

> The worker must be shown the relationship of his industry to him as well as his relationship to that of industry; he must be given perspective necessary to realize the interdependence of that industry and other industries in the national prosperity; he must be strengthened to meet the demands of still greater specialization to come — and because his place must be taken tomorrow by the boy of today, that boy must be given guidance and choice now.[422]

Or take Porter, who recommended the Deutsches, the Technisches, and other European museums on the basis of their effectiveness in producing industrial labour:

> The great museums of applied science form today an essential link in the vocational education of the rising generations of Europe. They present in concrete and graphic form the dramatic stories of industrial progress; their priceless exhibits vitalize the text-book instruction of schools and colleges for countless young men and women destined to take their places in the industrial world.[423]

Or F. C. Brown, who in a series of articles described the educational fitness of industrial museums to women, managers, construction engineers and other divisions of the industrial labour force, and who quoted MIT President Samuel Stratton in saying,

> Museums are an exceedingly important factor in our educational system. The Industrial Museums of Europe, especially that at Munich, are examples as to the value of this particular type of museum which is so rapidly finding favor in the country. In a few years one will be found in each of the large centers of population. The public finds such collections interesting and instructive. They are the inspiration of youth fitted by nature for work in the fields of science, engineering or industry.[424]

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[421] Charles Gwynne, *Museums of the New Age: A Study of World Progress in Industrial Education* (New York, 1927), p. 15.

[422] Ibid., p. 9.

[423] Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'National Museum of Engineering and Industry, To Be Under the Direction of the Smithsonian Institution, Washington, D.C.' 1924, p. 5.

[424] F. C. Brown, 'The Industrial Museum as an Aid to Technology: Benefits to be Derived from a Better Understanding by the People as a Whole of the Factors in Our Industrial Development', *The Tech Engineering News*, December 1928. See also F. C. Brown, 'The Museum Can Help Business: Study of

It is important to read these statements carefully. In each case the visitor was conceived of solely as worker. Likewise, the emphasis in each case was laid less upon the visitor himself, but rather upon his 'place in the industrial world'. That is, the emphasis was less on improving visitors through education than on educating them of their appropriate station within the labour market. Education in the industrial museum was not intended to enable visitors to choose freely among the various industries and job descriptions, but rather to enable them to choose *correctly*. Porter clearly described this intention in a 1925 radio address:

> At present our boys and girls have no place where the various processes utilized by the industries are exhibited and demonstrated so that they may intelligently select a vocation for which their tastes and capabilities would qualify them and so, many of them drift in to their life work haphazard only to find that they are misfits. This is actually a mis-fit situation. The many who miss are the unfortunates whom we are apt to consider failures. The few who fit are the successes of the day whom we are apt to consider geniuses. As a result there is today in this country a large element of underpaid or unemployed die to the fact that they do not know what they are fitted for and there is no place for them to go to find out. Vast sums of money have to be expended annually to alleviate the discomfort and misery which are thus brought about, too late to be obviated. Instead of preventing this situation we actually allow it to develop and they try to cure it when it is hopeless. Evidently a campaign of education is necessary to inform the people generally regarding the real value to themselves of a Museum of Industry.[425]

Here Porter pointed to the social and economic problems caused by 'misfit' workers as one justification for the industrial museum. Here too rested the higher

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Industrial Growth Inspires New Ideas', *Nation's Business*, May 1928; F. C. Brown, 'The Use of the Industrial Museum as Seen by the Construction Engineer', *The Stone & Webster Journal*, March 1929; 'Women Fascinated By Mechanical Exhibits', *The New York World*, 28 July 1929.

[425] Smithsonian Institution Archives RU 192, Box 253, Folder 4: H. F. J. Porter, 'A Great National Museum of Engineering and Industry, Radio Broadcast from Municipal Station WNYC', 10 March 1925. Elsewhere Porter wrote, 'It is pretty generally conceded nowadays that although occasional success in life is attained by men who have not enjoyed the advantages of education, such cases are exceptional. The better people can be prepared to meet life's problems the more certain will be their prospects of achievement. The earlier our youth can be informed regarding the various industries and their processes the better they can select the one for which their proclivities are suited and in which they will be most successful, for it is in the satisfaction with which a man works that he will devote his time and thought most willingly and profit accordingly.' See 'Our Project', *The Repertory*, October 1927.

purpose toward which education in the American industrial museum was turned. Behind the educational rhetoric of the American science museum movement was always a keen vision of a good, natural and sustainable industrial order. Education in the industrial museum helped to sustain this order by helping people to find their proper place in industry. Ultimately promoters of the American industrial museum were most concerned with teaching workers to work unproblematically in the industrial society they built and led.[426]

Perhaps then George Sarton was right to be wary of industrial museums. In fact, the American industrial museum was always, and perhaps unsurprisingly, more concerned with maintaining industrial peace than with inspiring the grander sort of international and humanistic peace Sarton propounded. As Richards argued, the industrial museum's 'paramount purpose' was educational, and what it sought to teach was 'the industrial basis of our present-day life'.[427] It did so with both eyes trained on maintaining that basis, and in this way the educational mission of the American industrial museum also pointed toward some of its economic and political underpinnings. Leaders of the American science museum movement were less interested in the creation of a new and better world than in the maintenance of the industrial and economic status quo. While it is incorrect to see this as malicious — surely from their public pronouncements, leaders of the movement believed they were helping — nevertheless, they were ultimately and personally interested in maintaining industry's and their own standing in social order. Their celebration of the history of science and technology was intended as a source of hope and a site of salvage, just

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[426] Russell Douglass Jones, 'Engineering History: The Foundation of Industrial Museums in the United States' (Case Western Reserve University Ph.D. Dissertation, 2001), Chapter 3.

[427] C. R. Richards, *The Industrial Museum* (New York, 1925), p. 2.

not necessarily a new or changed one. Theirs was a peace based not on change, but rather on order.

In this the American industrial museum was ultimately a very conservative institution. That is, it was conceived as an attempt to solve industrial America's problems through the existing and internal mechanisms of American industry, presenting solutions based on strengthening the status quo — for instance by finding workers their proper station within that existing order. This mission became more important as the interwar period wore on, especially with the onset of the Great Depression. While in earlier years promoters of the American industrial museum could appear to be driven by the idealistic belief that the museum would solve the problems of industrial society through the power of science history, in later years the Great Depression brought on a new urgency to solving these problems and indeed the emergence of a new one. This was a renewed fear of government interference in industrial affairs, and promoters began more and more to construe the industrial museum as a way to solve the problems of industrial society and depression without government involvement.[428]

Finally, then, the American museum's programme of industrial education points to some of the movement's internal skeletons and external conflicts with other arenas of interwar science history. Even more than the Science Museum, the American museum proposed a practical programme of industrial education that stood in stark contrast to the humanistic educational ideals of 'pure science, pure scholarship' proposed by George Sarton and his colleagues. While this difference seems obvious and reasonable, it is not unimportant. In fact, differing educational

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[428] Russell Douglass Jones, 'Engineering History: The Foundation of Industrial Museums in the United States' (Case Western Reserve University Ph.D. Dissertation, 2001), Chapters 5-6.

agendas and attitudes toward industry were reflective of differing visions for science history, and these differences became more pronounced in the later years of the interwar period. A changing economic and political climate accentuated divisions within the culture of interwar science history and revealed fault lines in the sturdy cultural bedrock it alleged to provide.

# Chapter 6: Politics

## The Rise and Fall of Internationalism

Considering their general disregard of the public and their outright hostility toward political history, it stands to reason that academic historians of science would not be terribly interested in contemporary political matters. Sarton, for example, despised the history of politics, diplomacy and military engagements as little more than 'local scenery' and proclaimed on behalf of his fellow historians of science, 'From our point of view peoples and nations, even as men, are not to be judged by the power or the wealth they have attained, nor by the amount of perishable goods which they produce, but only by their imperishably contributions to the whole of humanity.'[429] Singer held a similar view, believing that mankind's highest achievement lay in his ability to transcend the depressing circularity of politics and warfare through purposeful scientific advance. He wrote:

> The scenes of [political] history fade one into the other and again they suffer kaleidoscopic change. Forces, the nature of which is obscure to us, weld myriads of men into great empires. Empires clash and are rent into the tribal fragments that are customary among savages. Tribes combine again into ever new kinds of aggregates. Passions are directed now to higher now to lower aims, and not seldom upon objects that seem to us childish. Reason and unreason contend. Order gives place to disorder to be reordered again. The creation of the great civilizations vanish in the tumult of wars and from the confusion some thing shapes itself that is different from what was before ... Yet through all these changes there is something that persists. Continuity is not wholly broken for the spirit of man has remained essentially the same and something more than a memory has come to us from those shattered hopes, those broken hearts, those triumphs that have ended in defeat, which have marked the transition of each age into the next ... It is the capacity to adapt his life to his history that distinguishes man

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[429] George Sarton, 'The New Humanism', *Isis*, 6 (1924), 16-7. See also, George Sarton, 'Secret History', *Scribner's Magazine*, 67 (1920), 187-92; George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), especially Chapter 4.

> and especially civilized man. This capacity is the flower that comes to fruit as Science.[430]

Despite this rhetoric, interwar academic historians of science in fact were extremely interested in politics, and their vociferous condemnation of political history betrays not apathy, but rather an active engagement with politics. Had academic historians of science ignored political history altogether, it might more easily be argued that they were disinterred in politics. Instead, the fact that academics like Sarton and Singer worked so diligently to set themselves up as competitors to traditional modes of political history demonstrates their interest in entering the political fray. That is, historians of science were not content to allow what they viewed as inferior kinds of historical discourse to dominate political debate.

Central to this debate in the early interwar period was the idea of internationalism. Especially in the years immediately following the armistice, there was a hope and even a belief that organised internationalism could halt the cycle of war, and historians of science hoped to ride this wave of internationalist sentiment. Arguing that the unified history of science might form the basis for international unity, historians of science looked to place themselves at the centre of interwar politics.

The worldwide internationalist sentiment of the interwar period saw its greatest triumph — and ultimately its greatest failure — in the foundation of the League of Nations. Like much of the rest of the world, Sarton rejoiced at the foundation of the League, writing his wife in 1919:

> I have just been reading the text of the League of Nations covenant which President Wilson disclosed yesterday at the Paris conference. So my faith that the war would least irresistibly to it is

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[430] Charles Singer, 'One Increasing Purpose: The Spirit of Science in History', *The Times Literary Supplement*, 18 July 1936.

> justified ...! It is a great privilege to be living at a time like this: the world has suddenly made a gigantic step forwards: it has become far smaller and far greater.[431]

Earlier that year, Sarton wrote a similarly hopeful letter to the editor of the *New York Evening Post*, saying:

> ... I am myself as international-minded as it is possible to be. I have been a staunch supporter of the League of Nations (of the genuine and generous kind) at a time when it was considered by many wise men as a good subject of jokes. Now that this 'Utopia' is slowly becoming a reality, I see clearly that its fulfilment will open a period of such intense international relations in every field that to the people of the next century the pre-war period will seem to be, in comparison, utterly provincial. The war will probably play in the internationalization of the world the same part that your Civil War played in the unification of this country.[432]

At the same time, however, Sarton believed that the League of Nations was merely a step in the right direction. Though its establishment was reason for hope, Sarton correctly ascertained that its future was by no means guaranteed. More precisely, Sarton believed that the establishment of the League was a case of putting the cart before the horse. He wrote:

> Unity cannot be accomplished artificially ... Our clumsy organizers, superorganizers and other busybodies, obsessed by material and external unification, do not even begin to realize how far such unification is from the genuine and inherent unity of knowledge, which is at once the goal and the torment of our minds.
>
> Unity can not be created from the outside but only from the inside. If it does not exist in the souls of men, it does not exist anywhere.[433]

Though Sarton applauded political efforts at peace and internationalisation, he nonetheless believed these efforts to be of only secondary importance to mankind's essential purpose — his 'secret history' of purposeful scientific advance. Any purely

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[431] New York Public Library Berg Collection: George Sarton, 'Letter to Eleanor Mabel Sarton', 22 November 1919.

[432] George Sarton, 'Letter to the Editor', *The Evening Post*, 22 February 1919.

[433] George Sarton, 'Preface to Volume 9', *Isis*, 9 (1927), 229.

political unity would be little more than an 'external unity', imposed from without and therefore uncertain. Indeed it was for this reason that Sarton rejected interwar efforts to establish an international language, efforts which were championed by his friend and colleague Aldo Mieli in his journal *Archeion.*[434]

By contrast, the correlative unities of knowledge and mankind — made known and instilled in 'the souls of men' only through the study and advance of the history of science — were for Sarton 'organic, internal' unities and the necessary basis of any lasting international peace. Here Sarton joined F. S. Marvin in insisting that the League of Nations should promote history of science as 'the basis of unity' among its members.[435] 'Those who would understand the advance of internationalism and further it,' wrote Sarton, 'must needs study the history of science; there is, in my opinion, no better way of giving their activity the philosophical foundation which it lacks but too often. The sublime recital of man's intellectual progress throughout the ages, would fire their enthusiasm, stimulate their devotion, increase the convergence and the efficiency of their endeavors.'[436]

The practicalities of just how these internal unities of science history might effect the more external unities desired by statesmen were dealt with by Sarton in an article entitled 'Two Fundamental Problems'.[437] Written at the height of the international economic crisis of the early 1930s, it was here that Sarton's socialism, as described by his daughter and others, most clearly converged with his conception of

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[434] George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), pp. 125-8. Mieli published much of *Archeion* in 'Interlingua'; see, for example, Mieli's comments in *Archeion*, 8 (1927), 485-95.

[435] F. S. Marvin, 'Science and the Unity of Mankind', in Charles Singer (ed.), *Studies in the History and Method of Science* (2 vols., Oxford, 1921), ii, 357.

[436] George Sarton, 'The New Humanism', *Isis*, 6 (1924), 28.

[437] George Sarton, 'Two Fundamental Problems', *Isis*, 24 (1936), 308-9.

and hopes for science history.[438] Here Sarton argued that the main obstacle to international peace, that is to external unity, were the problems of labour in capitalist society. Of this first fundamental problem Sarton wrote:

> The greatest problem which the statesmen of our time have to solve is the humanization of industry and labor. They must find means of protecting the lives and souls of men against the merciless development of industrial, commercial and financial methods, or rather those methods must be radically transformed in order to realize (or begin the realization of) a human economy as opposed to a purely material economy.[439]

Moreover, these problems were truly international problems and required international solutions:

> The greatest treasures of any country are men, not goods. The problem is easier to state than to solve; its solution cannot be worked out completely on a national basis, for international difficulties are involved. Just as soon as our statesmen can be brought to see that the happiness of individual men, and their creative activities in the field of art and science are the main concern, and that on that basis the efforts of each nation are to the benefit of all others, just as soon as they see that, and no sooner, will it be possible to establish international peace on a sound footing.[440]

Standing alongside this fundamental obstacle to external unity was Sarton's second fundamental problem — the familiar problem of internal unity or the 'the humanization of science', to be solved, of course, through the study of science history. These two fundamental problems were for Sarton 'correlative' and here was where the internal unities of science history might help to effect the external unities of

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[438] Although published in 1936, 'Two Fundamental Problems' was penned while Sarton was in Portugal for the Third International Congress in 1934. For Sarton's socialism, see May Sarton, *I Knew a Phoenix: Sketches for an Autobiography* (London, 1959); May Sarton, 'An Informal Portrait of George Sarton', *Texas Quarterly*, Autumn 1962; May Sarton, 'Looking Back at My Father', in Carolyn Anthony (ed.), *Family Portraits: Remembrances by Twenty Distinguished Writers* (New York, 1989), pp. 200-1; Arnold Thackray and Robert K. Merton, 'On Discipline Building: The Paradoxes of George Sarton', *Isis*, 63 (1972), 288-9; Robert Fox, 'Sartonian Values in a Changing World: The Case of Isis', in Marco Beretta, Claudio Pogliano and Pietro Redondi (eds.), *Journals and History of Science* (Florence, 1998), pp. 109-19.

[439] George Sarton, 'Two Fundamental Problems', *Isis*, 24 (1936), 308-9.

[440] Ibid.

labour and, in turn, of international relations. Sarton explained that the humanization of science would in due course humanize both industry and labour. He wrote:

> It is noteworthy that *these two problems are correlative*; they have been entailed by the same causes, and there are so many interrelations between them, that the solution of the one cannot fail to help in solving the other. It is necessary to readapt the body politic and the minds of individual men to the new conditions which the development of science and of scientific method has created. The second problem is more particularly our own and let us devote ourselves to it humbly and patiently.[441]

The effectiveness of science history in advancing internationalism was thus proportional to its effectiveness in humanising labour and science through the study of science history.

Sarton own contribution in behalf of these two correlative problems was, of course, his 'Revue Internationale', *Isis*. In fact, Sarton went out of his way to maintain the international character of *Isis*, especially after he had moved the journal and himself to the far shores of America during the war. Early on *Isis* promised to report 'only on those [meetings] which are genuinely international, *not* those from which representatives of German, Austrian and Russian science are systematically excluded.'[442] Furthermore, Sarton worked diligently to promote international subscriptions, repeatedly lowering subscription rates for European subscribers whose currency had been 'debased' by the war and the pernicious reparations of Versailles. In particular, Sarton offered help to German colleagues, promising never to discriminate between victor and vanquished when it came to editorial matters.[443] Finally, long after he had settled in the United States, Sarton stubbornly maintained

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[441] Ibid. See also George Sarton, *The History of Science and the Problems of Today* (Washington, 1936).

[442] George Sarton, 'The International Organization of Science', *Isis*, 3 (1921), 420-1.

[443] George Sarton, 'Collaboration with Germany and Other Countries Whose Currency is Debased', *Isis*, 6 (1924), 44-5.

his contract with the Belgian printers of *Isis*, St Catherine's Press, in an effort to send some of his relatively good fortune their way.[444] In all cases, the vast shortfalls in revenue incurred by these assistance schemes were covered by Sarton himself.

Finally, aside from the administrative internationalism of *Isis*, Sarton strove to keep its content international as well. Consider the events that provoked Sarton's 1919 letter to the *New York Evening Post*. Early on in the period, Sarton sought to restrict *Isis* to one language, English. This prompted published criticisms among a few scientists that Sarton's rejection of French, German, Italian and other papers amounted to a tacit rejection of internationalism. It was in response to these claims that an outraged Sarton wrote:

> The writer of your editorial seems to have been under the impression that I had decided upon this change as a war measure, as a kind of reprisal against Germany, and he rather inconsiderately denounces it as an attempt to injure the internationalization of science ... [On the contrary] It is precisely to increase the international of *Isis* that I decided to restrict its publication to one language instead of four. There are, of course, far more people able to read comfortably any one of these four languages that the four of them. I found out that the polyglottism of *Isis* was a serious and unnecessary obstacle to its circulation and consequently to the diffusion of the history of science and of the ideal of the New Humanism.

As for his choice of English, moreover, the francophone Sarton explained that this 'great personal sacrifice' was also made for international reasons, as English was the world's most widely spoken language. Finally, Sarton believed that the 'younger civilizations of the world' — The United States, Canada, Australia, New Zealand and South Africa — were best placed to effect the necessary changes. He wrote:

> I believe that as far as the diffusion of common sense in politics and the spirit of fair play are concerned these young nations are the hope of the world. They are, on the whole, less trammelled by precedent and prejudice, and more capable of working out radical

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[444] Not until the outbreak of the Second World War did Sarton decide it was time to finally give up on his Belgian printers, who once again stood at the frontlines. See George Sarton, 'The End of the Belgian Isis', *Isis*, 33 (1941), 41-54.

> ideas in a conservative way. I trust that the ideal of the New Humanism — that is, the reconciliation of science and art, truth and beauty — will find a more appreciative audience among them. That is why, in the middle of my life, I choose to speak English.[445]

By this point it should be no surprise that Singer shared Sarton's internationalism. Unlike Sarton, however, Singer's internationalism was tied in the first place to his conception of Judaism, and only then to his ideas and work in the history of science. Indeed, it was Singer's early awareness of the plight of European Jews led him to a firmly internationalist stance.[446] Having visited with his father — a prominent English Rabbi — the Jewish refugee camps of the late nineteenth century Hapsburg and Romonov pogroms, Singer was from an early age intimately familiar with problems of race, ethnicity, religion and national division. Like his father, this experience led him to reject Zionism and, unlike his father, Orthodox Judaism, both of which he viewed as only compounding existing divisions, creating an 'unnecessary and harmful separation between man and man'.[447] Instead, Singer took an active role in working out a place for Jews within the mainstream of national culture through his work with the Liberal Jewish Synagogue and in fostering internationalism through his work in the history of science.

Though grounded in religion, Singer's internationalism was most evident in his insistence on the international character of the discipline he was working to found. Here the normally soft-spoken Singer was most outspoken. For instance, in his 1936 review of Sarton's *Introduction*, Singer wrote:

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[445] George Sarton, 'Letter to the Editor', *The Evening Post*, 22 February 1919. Despite his protestations, Sarton still found it difficult to reject his many colleagues writing in foreign languages. Throughout the period, and although he bemoaned the extra editorial work it meant, Sarton grudgingly accepted articles in five languages — English, French, Italian, German and, as if to emphasize his international aspirations, Latin. See George Sarton, 'Preface to Volume 8', *Isis*, 8 (1926), 7-11.

[446] Geoffrey Cantor, 'Charles Singer and the Early Years of the BSHS', *British Journal for the History of Science*, 30 (1997), 5-23.

[447] Charles Singer, 'What Judaism Means to Me', *Liberal Jewish Monthly*, 8 (1938), 73.

> The history of science is a vital issue of modern scholarship. It is science, and it is science alone, that can set forth that which is universal in mankind. In our world we see men divided in the ways of thought, into groups that are either national or universal ... Against such disruption the disinterested employment of reason is in the end the only effective weapon. Only through science can man know his world. Only by the aid of science can man truly know either his fellows or himself. Should science cease to be international we may know of a surety that end of our civilization is at hand. It would be the Hippocratic sign of impending death.[448]

Singer showed similar gusto in defending the international credentials of Sarton's *Isis* and History of Science Society, of which he was a founding member and future president. In a letter to Oxford's stubborn — and bigoted — R. T. Gunther, for instance, Singer wrote:

> Doubtless you are right not to join the History of Science Society. Nevertheless, I feel that you are under some misapprehensions concerning the situation. May I attempt to remove them ...? The History of Science Society is <u>not</u> an American venture. Sarton is <u>not</u> an American. *Isis* is <u>not</u> printed in America ... [449]

Finally Singer's interest in organising history of science on an international basis is revealed in his early work in founding the Comité International d'Histoire des Sciences and in his efforts as President of the 1931 International Congress in London.

As events in Europe unfolded, however, neither Singer nor Sarton's internationalism was easily maintained. In the immediate wake of the Great War, for example, both Singer and Sarton had worked diligently to prevent the exclusion of German scholars from international meetings.[450] Yet just as political internationalism failed along with the League of Nations, so too did history of science's disciplinary

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[448] Charles Singer, 'One Increasing Purpose: The Spirit of Science in History', *The Times Literary Supplement*, 18 July 1936.

[449] Museum of the History of Science, Old Ashmolean Letters, 1930: Charles Singer, 'Letter to Robert T. Gunther', 16 March 1930. Singer's emphasis.

[450] Geoffrey Cantor, 'Charles Singer and the Early Years of the BSHS', *British Journal for the History of Science*, 30 (1997), 5-23; Christoph J. Scriba, 'The Beginnings of the International Congresses of the History of Science', in Fritz Kraft and Christoph J. Scriba (eds.), *XVIIIth International Congress of the History of Science, 1989: Final Report* (Stuttgart, 1993), p. 7.

internationalism falter as the period wore on. Case in point is the foundering of the International Congress movement in the 1930s. The first two International Congresses, held in Paris in 1929 and in London in 1931, had by most accounts been quite successful. Certainly both saw ample international attendance. In particular, the 1931 meeting famously hosted the international debut of Soviet history of science.[451] A third Congress was planned for Berlin in 1934 under the presidency of Karl Sudhoff, the now elderly founder of German history of science. Hopes were high for a repeat performance. In the months leading up to the Congress, however, Hitler came to power and purged the German universities. Outraged, Singer and Sarton — joined by Hélène Metzger, Henry Sigerist, Frederick Kenyon and others — decided to boycott the Congress unless it was moved from Berlin.[452] Indeed, Sudhoff had himself became an obstacle as he had recently joined the Nazi party. The future of the Congress and of organised international history of science were briefly but uncomfortably in question.

In the end, Sarton, Singer and their allies won out, and the Congress was moved to Portugal, but the internationalist ideal had been damaged.[453] So too, in fact, was the notion that science history might somehow promote post-war reconstruction.

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[451] International Congress of the History of Science, 'Proceedings of the Second International Congress of the History of Science', *Archeion*, 14 (1932); International Congress of the History of Science, *Science at the Cross Roads: Papers Presented to the International Congress of the History of Science, Held in London from June 29th to July 3rd, 1931 by the Delegates of the U.S.S.R.*, 2nd edn (London, 1971). See also A. K. Mayer, 'Fatal Mutilations: Educationism and the British Background to the 1931 International Congress for the History of Science and Technology', *History of Science*, 40 (2002), 445-72.

[452] Helene Metzger was ultimately a victim of the Nazi Holocaust, dying in Auschwitz in 1943, something which touched and disheartened both Sarton and Singer greatly. See George Sarton, 'Helene Metzger', *Isis*, 36 (1946), 133; Charles Singer, 'Mme. H. Metzger-Bruhl', *Nature*, 157 (1946), 472.

[453] Christoph J. Scriba, 'The Beginnings of the International Congresses of the History of Science', in Fritz Kraft and Christoph J. Scriba (eds.), *XVIIIth International Congress of the History of Science, 1989: Final Report* (Stuttgart, 1993), p. 10. See also Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS A.60: Charles Singer, 'Letter to Aldo Mieli', 11 June 1933.; *Archeion*, 15 (1933), 249; George Sarton, 'Lustitanian Memories', *Isis*, 22 (1935), 440-55.

Portentous events were quickly mounting, and while Sarton and Singer did not turn completely away from the peaceful promise of the history of science, their attentions were certainly drawn elsewhere. Increasingly, science history's other locations were also turning to new concerns.

**Changes at the Fair**

Originally intended for 1915, the British Empire Exhibition took its inspiration from the success of the 1908 Franco-British Exhibition at White City. Believing that the British Empire alone afforded sufficient scope for a large exposition, Lord Strathcona — the motive force behind White City — called a meeting in early 1913, at which plans were set in motion. Almost immediately stymied by war, the idea was nevertheless quickly taken up again in 1919 under the active presidency of the Prince of Wales. Yet the war affected more than the exposition's timetable. In 1913 it was suggested that the exposition highlight the seemingly indefatigable manufacturing and military strength of the Empire. By the time of the Exhibition's opening in April 1924, this message has been subtly but significantly altered. The change was from a position of security to one of insecurity — both nationally and internationally.

National politics had drastically changed in the years before Wembley. The 1918 election returned Lloyd George to Downing Street, but growing unhappiness with the economic consequences of Versailles on the left, and bitterness over the 1921 settlement that created the Irish Free State on the right, toppled his shaky coalition in 1922. The fall of Lloyd George marked the end of Liberal government in Britain, but left an unsteady balance of political power in its wake. In 1923 the Conservative

Stanley Baldwin became Prime Minister, only to be defeated less than a year later when Britain's first Labour government took office under Ramsay Macdonald. However, Labour's victory in January 1924 was itself followed by defeat in November and by the return of Baldwin and the Conservatives to government, where they remained through the turbulent years of financial crisis and labour unrest until 1929. Thus it happened that Wembley was built under a Conservative government, opened and closed in 1924 under Labour, then reopened under the Conservatives in 1925.

In fact changes at Westminster made little difference to the planning and operation of Wembley, which were carried out primarily by the Exhibition's independent Executive Council, by industrial groups and by the dominions and colonies themselves. Yet the changes in Britain's political climate reflected in these Parliamentary upheavals were profoundly important for Wembley, and they permeated all aspects of the Exhibition.

First and foremost, the Exhibition and its industrial supporters had to separate themselves from the stigma and very recent memory of industrial warfare. Alan Morton has recently described how Fellows of the Royal Society attempted to isolate and free something called 'pure science' from popular associations with technology and industry in their exhibits at the British Empire Exhibition. Morton persuasively argues that the Exhibition of Pure Science helped consolidate a professional identity and establish a social status for university-based research scientists among the tax-paying public that increasingly supplied their funding. He also suggests that the delineation of 'pure' science at Wembley served to distance the Fellows and their

work from the destructive technologies of modern warfare, so present in the popular memory.[454]

Certainly this was their intention. But whether or not the message got through is another story altogether. Indeed, it seems that if the idea was to downplay the industrial applications and military benefits of pure science, Wembley's organisers seem not to have heard. When describing the Exhibition of Pure Science, the official Wembley literature justified the display by appealing to the practical application of pure science. The handbook for the Pavilion of HM Government, for example, rationalised 'the truth is, before we can make use of the resources of Nature, we must know all about them,' while Wembley's *Official Guide* claimed, 'We do not often realise that relationship [between science and modern life], we are not quick to grasp the extent of our debt to the scientist, how his efforts and discoveries minister to our daily needs.'[455]

Similarly the overall placement of the exhibits seemed to emphasise, rather than minimise the industrial and military service of pure science. The Royal Society's exhibits were placed right alongside displays of military and medical technology, and the exhibition of pure chemistry formed a kind of hub from which the exhibits of the various chemical industries radiated outward. Most threatening to the illusion of purity was the placement of the explosives exhibits. First, a small section on the wartime progress of explosives was included in the exhibition of pure chemistry itself. Secondly and in violation of Wembley's general rule that only

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[454] Alan Q. Morton, 'The Electron Made Public: The Exhibition of Pure Science in the British Empire Exhibition, 1924-5', in Bernard Finn, Robert Bud and Helmuth Trischler (eds.), *Exposing Electronics, Artefacts: Studies in the History of Science and Technology* (Amsterdam, 2000).

[455] G. C. Lawrence, *British Empire Exhibition, 1925: Official Guide* (London, 1925), pp. 36-7. British Empire Exhibition, *Guide to the Exhibits in the Pavilion of His Majesty's Government* (London, 1924), p. 61.

representative associations be allocated exhibition space, Nobel Industries was given an entire bay of over 4,000 square feet, just outside the main Chemical Hall.[456] This arrangement seems to have influenced the *Times'* impressions of the chemical exhibits. Missing the point about purity, the paper described the exhibition of pure chemistry this way:

> In the scientific branch of the Chemical Hall are a large number of exhibits showing the progress in explosives research and manufacture, many of the exhibits being lent by the Board of Trade, the Imperial War Museum, the Science Museum, the Research Department, Woolwich and Nobel's Explosives, Ltd.[457]

The impression of purity was not only compromised from without. As Morton points out, pure scientists themselves recognised and promoted the practical and even military potential of their work, albeit in their own way. In this connection, Morton shows how J. J. Thomson held up the x-ray as an example of a practical outcome of pure scientific research.[458] Similarly, in its description of the Exhibition of Pure Science, the government pavilion's *Guide* pointed to Faraday and the dynamo.[459] A final example of this creeping practicality was the prevalence of government engineers on the Royal Society's organising committee. Indeed, one military engineer — Woolwich's Robert Robertson — was at once involved in planning the Exhibition of Pure Science, the exhibition of pure chemistry and the military explosives exhibits.[460]

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[456] Lawrence Weaver, *Exhibitions and the Arts of Display* (London, 1925), p. 65.

[457] 'Wide Range in Chemicals, Series of Bright Colours, A Glance at the 18th Century', *The Times*, 23 April 1924.

[458] Alan Q. Morton, 'The Electron Made Public: The Exhibition of Pure Science in the British Empire Exhibition, 1924-5', in Bernard Finn, Robert Bud and Helmuth Trischler (eds.), *Exposing Electronics, Artefacts: Studies in the History of Science and Technology* (Amsterdam, 2000).

[459] British Empire Exhibition, *Guide to the Exhibits in the Pavilion of His Majesty's Government* (London, 1924), p. 62.

[460] A look at the roster of the Royal Society's Exhibition of Pure Science organising committee reveals a heavy slant toward applied scientists. In fact, with a few exceptions — William Bragg is the most

Thus whatever their intentions, Wembley's exhibitors of pure science did not achieve a firm separation of pure and applied science. Similarly, notions of purity were not confined to self-conscious exhibits of pure science. Just as the taint of application extended to, and indeed was managed by, the exhibitors of pure science, the exhibitors of industry shifted the boundaries of pure and applied science according to their own purposes. In both cases these boundaries were subject to interpretation and finesse.

Needless to say, industry was not wholeheartedly interested in associating itself with the war. Rather, industry at Wembley looked only to associate itself with those aspects of military technology that had proved either most benign or most likely to bring about future peace. Case in point is the Nobel exhibit. Nobel tried to distance itself the destructive applications of their product at every turn. Its pamphlet set out first and foremost to dispel the 'popular fallacy that the explosives industry is dependant on War for its prosperity' — its first page was headed, 'Nobel Industries Limited: Its Influence in Commerce, Reconstruction Work, the Effect on Everyday Life.' Accordingly most of its displays focused on Nobel's non-military products — the pamphlet's cover lists nails, lamps and bicycles most prominently.[461] Even where shells and cartridges were displayed in the gallery, they were arranged in benign geometric patterns and framed. Wembley's Director-General of Exhibits, Lawrence

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notable — the committee is made up almost entirely of applied scientists and government engineers like Robertson, for example, Napier Shaw, head of the Meteorological Office, Richard Glazebrook, formerly of the National Physical Laboratory, and F. E. Smith, the same military engineer whose testimony helped institute the programme of special industrial exhibitions at the Science Museum in the 1930s. See Royal Society of London, *Handbook to the Exhibition of Pure Science* (London, 1924); Royal Society of London, *Phases of Modern Science: Published in Connexion With the Science Exhibit Arranged by a Committee of the Royal Society in the Pavilion of His Majesty's Government at the British Empire Exhibition, 1925*, 2nd edn (London, 1925). See also Smith's testimony before the Royal Commission on Museums, Royal Commission on National Museums and Galleries, *Oral Evidence, Memoranda and Appendices to the Interim Report* (London, 1928), pp. 157-61.

[461] Nobel Industries Limited, *Nobel Industries Limited: A Record of Their Exhibits at the British Empire Exhibition* (London, 1924).

Weaver, praised this technique as making a lifeless subject matter more engaging — though it is not very difficult to image other ways of making an explosives exhibition more animated.[462] Nowhere were pictures of the products at work. At Wembley, even the explosives industry had the look of purity and was cleansed of the taint of war.

The reopening of Wembley in 1925 saw stirring and significant changes.[463] The government played an increasing role in the Exhibition and more specifically in the portrayal of science history. The Palace of Engineering was dismantled, refurbished and re-opened by the government as the Palace of Housing and Transport. The Ministry of Health's exhibits were vastly expanded. Wembley seemed a more political place in 1925, or at least the politics of science history were more obviously on display.

Politics most forcefully collided with science history in Wembley's new Palace of Housing and Transport. In fact, the Palace of Housing and Transport was constructed in self-conscious relation to its predecessor, the Palace of Engineering. The relationship between the two was laid out in the Exhibition's *Official Guide* for 1925:

> Last year the Palace of Engineering told us of ripe achievement in a field that the English-speaking world has gone far to make its own. This year we consider not so much our achievements as our needs. These, in brief, are:—
>
> Better HOUSING, and more of it, and
>
> Better TRANSPORT, and more of it.
>
> It is a recognition of this salient truth that has turned the Palace of Engineering of 1924 into the Palace of Housing and Transport of 1925.[464]

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[462] Lawrence Weaver, *Exhibitions and the Arts of Display* (London, 1925), pp. 63-5.

[463] 'Second Year of the British Empire Exhibition', *The Times*, 23 May 1925.

[464] G. C. Lawrence, *British Empire Exhibition, 1925: Official Guide* (London, 1925), p. 46. See also 'Housing and Transport', *The Times*, 23 May 1925.

Where the Palace of Engineering celebrated the achievements of the past, the Palace of Housing and Transport would consider their application to present needs. History was not banished from the exhibits, it was put to good use. The relationship between the Palace of Engineering of 1924 and the Palace of Housing and Transport of 1925 provides a prime example, not just of the widespread interest in science history, but of the belief in its utility.

Significantly, science history was utilised to address the issues that now dominated the changed British political scene, that seemed to threaten peace and prosperity — housing, transport and, above all, labour. Away from the other ministries in the Pavilion of HM Government, the Ministry of Labour established its exhibition headquarters in the Palace of Housing and Industry. The nearby transport exhibits were organised around the 'Railway Centenary' and highlighted improved working conditions on the railroads, the docks and the motorcar assembly line. For instance, the combined port authorities highlighted improvements on the docks — their 'signs of substantial and intelligent progress arrest[ing] attention on every hand.'[465] The housing exhibits were arranged by the Ministry of Health and demonstrated a similar progress in building materials, lighting and heating that promised 'ample and comfortable accommodation at a moderate price' to the labouring classes.[466]

Organised or sponsored almost entirely by government agencies, the Palace of Housing and Transport communicated the message that the combined effects of scientific and industrial progress and government effort had improved and would

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[465] G. C. Lawrence, *British Empire Exhibition, 1925: Official Guide* (London, 1925), p. 49.

[466] Ibid., pp. 46-7.

continue to improve the situation of the workingman. Through a progressive history of science and industry, government appealed to an increasingly powerful labour movement for support and tried to diffuse the growing tension that would ultimately lead to the following year's General Strike.[467] The *Official Guide* summarized the Palace's pacifying intent, reporting:

> The keynote ... of the Palace of Housing and Transport is activity. Wherever it is possible, machinery is seen at work. The labour by which the Empire thrives is seen, under ideal conditions to be sure, but he must be unimaginative indeed who cannot recognise in every revolving wheel a means to an end, and that end the maintenance in peace and prosperity of the British Empire.[468]

Here the government appealed not only to labour's inheritance of a progressive science history, but also to their patriotism. The British Empire Exhibition was, of course, a great patriotic undertaking. Nationalism was everywhere at Wembley, and science history was not left untouched. Alan Morton has shown that the biographical arrangement of the Exhibition of Pure Science not only helped secure the reputation and identity of British research scientists, but also served to rid their science history of German contributions.[469] Other examples abounded in the great displays of British initiative in the Palaces of Industry, Engineering and Housing and Transport. In general, however, the unifying rhetoric of interwar science history spoke to internationalism, and so it was at Wembley. Since the war, 'internationalism' — as embodied by the League of Nations — had been the buzzword of British foreign policy. It was no less present at Wembley, but the

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[467] Robert Rydell makes a similar point about the intentions of interwar American exhibitions. See Robert W. Rydell, *World of Fairs: the Century-of-Progress Expositions* (Chicago, 1993).

[468] Ibid., p. 50.

[469] Alan Q. Morton, 'The Electron Made Public: The Exhibition of Pure Science in the British Empire Exhibition, 1924-5', in Bernard Finn, Robert Bud and Helmuth Trischler (eds.), *Exposing Electronics, Artefacts: Studies in the History of Science and Technology* (Amsterdam, 2000).

League was not its model. Though the League maintained a pavilion at Wembley, the Empire served as the epitome of internationalism.

Earlier expositions had been uncritical in their acceptance of empire and its benefits. The war's unprecedented scale and persistent post-war political, economic, social and diplomatic instabilities undermined the notion imperial omnipotence. As such, Robert Rydell has effectively argued that Britain and Europe's interwar expositions were fundamentally 'designed to renew domestic support for national imperial politics' in the wake of the Great War. This meant appealing to the new internationalism. To this end, exposition authorities helped construct what Rydell has called the *coloniale moderne* sensibility — 'a conjuncture of modernistic architectural styles and representations of Imperial policies that stressed the benefits of colonialism to colonizer and colonized alike — developed from the desire to decant the old wine of imperialism in new bottles bearing the modernistic designs of the interwar years.'[470] Perhaps predictably, the new designs of *coloniale moderne* were French, and the new imperial politics, British. The new architectural style — Art Deco — emerged in Paris at the1925 Exposition Internationale des Arts et Industriels Decoratifs. The new political stance emerged at Wembley.

As Rydell suggests, the new message stressed imperial unity and synergy in favour of imperial dominance. Science history took on a new relevance in this dialogue. Rather than a history of conquest and political and military domination, Wembley's History of Empire was the history of coloniser and colonised working together to benefit scientific and material progress. Colonies provided raw materials and specimens for scientific and industrial research, while the mother country returned modern knowledge, medicines and conveniences. Far from a history of

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[470] Robert W. Rydell, *World of Fairs: the Century-of-Progress Expositions* (Chicago, 1993), pp. 61-2.

warfare, shown in the light of science history, the history of Empire was the history of co-operative, international and peaceful scientific advancement. For both colonials and the home population, the prominence of science history at the British Empire Exhibition provided proof of past Imperial benefit and hopes of renewed stability and peace. These ideas were most obviously born out by the combined Ministry of Health exhibits for 1924 and 1925.

It is useful to begin with the expanded health exhibits of 1925, of which the foremost hall was largely historical. There, in three tableaux, modern, medieval and primitive medical technologies were illustrated. A fully equipped research laboratory and operating theatre represented modern medicine — 'the last word in antiseptic surgery.'[471] A sixteenth century alchemist's chamber — complete with its 'tangle of retorts, vials, alembics, and cucurbites fashioned in sinister-looking green glass, and with strange animals and fishes depending from the blackened roof' — stood for medievalism.[472] Primitive medicine, in contrast, was not displayed historically. Or, rather, it was not displayed historically, *per se*. Instead, primitivism was represented by 'the fantastically painted medicine-man of West Africa, who is seen practising his art by means of incantations, offerings, and rude remedies.'[473] Here the exhibit clearly equated the early stages of British or Western development with the current stage of development among colonial peoples. It is the same equation that appeared throughout the Exhibition in domestic displays that described ancient Western homemaking practices in terms of those of the colonial present. The eugenic

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[471] G. C. Lawrence, *British Empire Exhibition, 1925: Official Guide* (London, 1925), pp. 34-5. See also Ministry of Health, *Guide to the Ministry of Health Exhibits* (London, 1925); British Empire Exhibition, *Guide to the Pavilion of His Majesty's Government* (London, 1925), pp. 39-41.

[472] 'Health of the Empire, Fight Against Disease, Medical Science and Eugenics', *The Times*, 23 May 1925.

[473] Ibid. See also 'Health Exhibits at Wembley: Historical Tableaux', *The Times*, 3 April 1925.

undertones of these histories were clear — 'behind' suggested 'below' — and they were closely tied to Wembley's particular brand of internationalism.

The tropical medicine exhibit of 1924 best illustrated these relationships. It read like a blueprint for colonial betterment. In it was chronicled the ongoing Imperial contribution to the prevention and elimination of malaria, plague, leprosy and other diseases in the tropical dependencies.[474] By contrast, these same diseases were displayed a year later to have 'practically ceased in the United Kingdom'.[475] The contrast made clear a vision of empire and internationalism in which the more advanced home country lent the fruit of its historical experience and achievements to its underdeveloped colonies, and in return received their bounty and obedience. With these resources, the home country gained even more experience, and the cycle continued in harmony:

> A Nation which boasts an Empire incurs a great responsibility; for the principle of Empire is mutual benefit and common service. 'There is,' said Ruskin, 'no wealth but life. That country is the richest which nourishes the greatest number of healthy and happy human beings.' Included in the Dominions, Crown Colonies and Protectorates of the British Empire, and especially in the Colonies and Protectorates, are many districts in which climatic conditions foster disease, thus hampering progress and limiting productivity.[476]

Empire then was an international order grounded in science history, on the differential development of colonizer and colonized — the colonizer could benefit his colonies because his history had already provided their problems with solutions. These problems having been solved, the healthy colonies could then provide materials

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[474] See British Empire Exhibition, *Guide to the Exhibits in the Pavilion of His Majesty's Government* (London, 1924); Tropical Health Committee, *Tropical Health: The Campaign Against Tropical Disease in Both Human and Plant Life* (London, 1924).

[475] Ministry of Health, *Guide to the Ministry of Health Exhibits* (London, 1925), pp. 8-13.

[476] British Empire Exhibition, *Guide to the Exhibits in the Pavilion of His Majesty's Government* (London, 1924), p. 75.

to sustain the colonizer's historical progress. In this way, while the British Empire and its science history were undoubtedly sources of national pride for the British, they were equally sources of international benefit for the colonies. Thus just as science history in the Palace of Housing and Transport promised an alleviation of industrial strains at home, science history in the Ministry of Health exhibits promised life-sustaining benefits abroad. Seen another way, Wembley's appeal to science's proven past worked to diffuse obvious tensions both between industry and labour and between empire and internationalism. Regardless of phrasing, science history was believed a ready foundation for both national and international peace and prosperity.

Neither belief survived the decade between Wembley and its sequel. The Glasgow British Empire Exhibition of 1938 was a very different affair. Just as Chicago's 'Century of Progress' exposition of 1933-4 was replaced by New York's 'World of Tomorrow' exposition of 1939-40, the historically grounded and hopeful Wembley was replaced by the daydreams and nightmares of Glasgow. Rather than the celebrated, progressive and trusted past, the science exhibits at Glasgow called forth an imaginary future. The most obvious change was in architecture — the grand neo-classical designs of Wembley were replaced by futuristic Palaces of Engineering and Industry at Glasgow. Science was no longer displayed as something that linked generations in a history of progressive achievement; instead it was something that separated a promised future from a foreboding present. Similarly, science history seemed something no longer able to sustain national tranquillity or internationalism. On the one hand, the fierce antagonism between government and organised labour in the late-1920s and 1930s made the notion of a government sponsored celebration of worker's progress untenable. At Glasgow, Labour leaders on the City Council opposed the exhibition's commitment to Empire and the Labour Party issued its own

anti-handbook.[477] On the other hand, the spirit of unity and internationalism seems to have expired. With the interwar emergence of strictly nationalist parties in Britain, even the home nations celebrated their science separately at Glasgow. Scots, Irish, and Ulstermen, along with Catholics and women, all maintained their own pavilions. Finally, whereas Wembley strove for purity, science at Glasgow was clearly tied to war. Enormous murals on the Palace of Engineering's façade depicted war ships and aeroplanes in battle. The services this time were provided with their own grand pavilion, which conspicuously featured an exhibit on rearmament. Whereas Wembley responded to a recent past, Glasgow signalled things to come. Its militaristic undertones and futuristic designs evoked by turns the fear of war and a longing for the future.

**Science and the Army**

If special exhibitions highlight the new importance of industry and technical education in the 1930s Science Museum, then they also demonstrate the extent to which this industrial turn was tied to the changing political climate of the time. More precisely, by promoting national industrial strength and imperial power abroad, special exhibitions helped firm up the Science Museum's position as an important national institution. They also seriously changed the tone of the Science Museum's brand of science history.

On the one hand, certain special exhibitions were purely industrial affairs. Take, for example, the 1933 *Plastics* exhibition, which attracted about 500,000 visitors at the height of a renewed economic crisis. Organised by the plastics industry

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[477] See Independent Labour Party, *Come and See the Empire by the All Red Route* (Glasgow, 1938).

itself, the exhibition promoted the idea that the extension of technology by British industry would shore up consumer confidence and national strength. Throughout the exhibition ran themes of consumer comfort and industrial prosperity. Then at the cutting edge of technology, plastic was portrayed as a panacea for domestic hardship. The main body of the exhibition featured an almost grotesque array — 'an infinite variety', as the Advisory Council had it — of moulded plastic consumer goods. Everything was plastic: telephones, fire alarms, motor parts, furniture, pots and pans. There was even a specially designed plastic room, in which the walls, floor, doors and everything inside was made of the wonder stuff. Most impressive were the working hydraulic presses, which before visitors' eyes turned raw chemical powders into souvenir plastic ashtrays. These same plastic ashtrays were presented to delegates of the World Economic Conference — meeting coincidentally in South Kensington — as gifts and symbols of the British plastics industry.[478]

In fact, this technique of on-site production of consumer goods became a mainstay of the Science Museum's programme of industrial exhibitions of the late 1930s. So did the increasing involvement of political figures and groups such as the World Economic Conference as guests and proprietors. The best examples of the latter must be the *Smoke* and *Noise Abatement* exhibitions of 1935-6. In these strange exercises in industrial and government propaganda, industrial leaders and government ministers together organised a series of lectures covering such 'important aspects of noise and its mitigation' as 'Law and Noise', 'Housing and Noise', 'Education and the Noise Problem' and 'Health and Noise'.[479] Across the board, these and other

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[478] Science Museum Advisory Council, *Report for the Year 1933* (London, 1934), pp. 9-11.

[479] Science Museum Advisory Council, *Report for the Year 1935* (London, 1936), pp. 10-1; Anti-Noise League, *Noise Abatement Exhibition* (London, 1935).

strategies worked together to demonstrate the consumer good of nationally coordinated industrial efforts.

Although the new industrial exhibitions at times attracted large crowds, unlike other Science Museum programmes, they were not primarily intended for the general public. When first deciding to make the Museum's facilities available to industrial firms, the Advisory Council explained the audience and object of the proposed exhibitions:

> ... it has been suggested to the Council that it might be well worth while to afford facilities to an industry, or group in an industry, for showing informatively its products to other industries, and arranging their display so as to give such industries the information which they would require in order to judge of their utility rather than aim at attracting a general public. The Council are of the opinion that if this can be successfully achieved it may be of great practical value and might be of special service to the minor industries which are being encouraged in many parts of the country.[480]

Obviously the new arrangement was intended to benefit industry. But it was not to be simply for industry's sake. The national interest was involved as well. As the Advisory Council wrote in 1937:

> The wealth of this country is directly attributable to the discoveries of science and the national industries, and public opinion in these material times expects that this aspect of knowledge and endeavour should be displayed and housed with the same amplitude and dignity which has been wisely devoted to our arts and humanities.[481]

The following year, the Secretary of the Advisory Council, went one-step further, warning that 'The Buildings Tragedy' and its limiting effect on the special exhibitions programme was damaging the nation. Rather than on populist or educational grounds, the case for increased accommodation was based on nationalist politics:

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[480] Science Museum Advisory Council, *Report for the Year 1932* (London, 1933), p. 5.

[481] Science Museum Advisory Council, *Report for the Year 1937* (London, 1938), p. 4.

> There can be no shadow of a doubt that these special exhibitions have provided a wonderful stimulus to trade. Only lack of space has prevented a very considerable extension among these lines. Quite apart therefore from the enormously increased educational value that more adequate buildings would possess — a value which is difficult to assess in pounds, shillings and pence, but which cannot fail in the long run to increase the nation's wealth — the national income would be directly and immediately enlarged by many thousands of pounds.[482]

On the other hand, another group of special exhibitions were more like celebrations of imperial power, or rather of empire in cooperation with and harmonised by science and industry. Each of three exhibitions — the *North of Ireland Linen* exhibition, the *Rubber* exhibition and the *Empire's Airway* exhibition — juxtaposed images of colonial labour and production with displays of metropolitan science and consumption. For instance, the *Rubber* exhibition was organised by the Rubber Growers' Association, together with the Research Association of British Rubber Manufacturers, the Rubber Institute of Malaya and the London Advisory Committee for Rubber Research, and was opened by the Secretary of State for the Colonies, Sir Philip Cunliffe Lister. The Exhibition was divided roughly into two sections. The first recreated the Asian rubber plantation, and included a diorama, films and photographs of planting and harvesting. It also included a set of exotic live rubber trees sent specially from Malaysia. The second depicted the science of rubber manufacture and the commercial uses of rubber in the home, the hospital and in consumer goods like toys and automobiles. The message was one of science and empire, colonized and colonizer, working easily together for the common good, and

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[482] Science Museum Archive Z 201: W. E. Pretty, 'The Science Museum Advisory Council', September 1938, p. 12. See also Science Museum Advisory Council, *Report for the Year 1938* (London, 1939), p. 4.

came complete with films of smiling plantation labourers, leafy-green rubber trees and rubber mats made efficiently on-site and given free to exhibition goers.[483]

The *Empire's Airway* exhibition sent a similar message. Staged by Imperial Airways and visited by over 100,000 in its run of less than two months, the exhibition displayed the benefits of the imperial air network — an efficient postal service, a sophisticated meteorological service, and a bustling tourist trade. Along side these were maps and charts laying out the omnipresence of the empire's air routes and the swiftness and control with which they were operated. Dioramas of imperial airports in Johannesburg, Shargah and Karachi were also included, showing uniformed natives working easily with or for metropolitan pilots, industrious businessmen and happy travellers.[484]

As at Wembley, these special exhibitions employed a *coloniale moderne* sensibility that tied economic stability and social progress to the concomitant extension of empire and science. Rydell has described the period's expositions as promulgating a vision that made science, industry and 'the modernistic dream worlds of mass consumption on view at fairs unthinkable apart from the maintenance and extension of empire.'[485] The description could just as easily be applied to the Science Museum and its own set of imperialist dream worlds.

Certainly both groups of special exhibitions represent a change in tone for the Science Museum. Gone is the broad populism of the immediate post-war years. Gone are the correlative ideas of the unity of knowledge and the unity of mankind.

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[483] Science Museum, *Rubber Exhibition (November 1934-April 1935): A Brief Account of the History of Rubber from its Source to the Finished Product and a Descriptive Catalogue of the Exhibits, Compiled by the Rubber Growers' Association* (London, 1934); Science Museum Advisory Council, *Report for the Year 1934* (London, 1935), pp. 8-9.

[484] Science Museum Advisory Council, *Report for the Year 1935* (London, 1936), pp. 12-3.

[485] Robert W. Rydell, *World of Fairs: the Century-of-Progress Expositions* (Chicago, 1993), p. 62.

The internationalism and interculturalism of the earlier period had been replaced by the promotion of national industrial strength and the display of imperial hegemony. Having contrasted itself with the Imperial War Museum in the early-1920s, by the mid-1930s the Science Museum had taken up their imperial banner.

A memorandum regarding the future of the Science Museum's ship model collection may seem an unlikely place to look for the change. Yet the ship model collection was a source of particular concern for the Science Museum of the late 1930s, and the settling of its future signalled a turning point for the Museum. Seemingly to the surprise of the Science Museum — or at least to Lyons' surprise — the ship model collection emerged as a central issue for the Royal Commission on National Museums and Galleries.

When the Commission asked Lyons about the Science Museum's interest in the ship model collection, Lyons argued that it was necessary to 'show the history, the development of the wood ship passing into the iron and the steel ship.' When asked whether he thought the Science Museum's collection of ship models might overlap with those of the proposed maritime museum at Greenwich, Lyons answered curtly, 'I have no idea, except what I have seen in the papers, of what the ideas of those who are interested in Greenwich are.' Significantly his questioner, Sir Lionel Earle, had a ready answer, describing the proposed museum's intention in more patriotic terms. He said: 'It is chiefly to save the collections from going to America and other parts.'[486]

Yet at the time of his testimony, Lyons was not overly protective of the collection. He conceded:

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[486] Royal Commission on National Museums and Galleries, *Oral Evidence, Memoranda and Appendices to the Interim Report* (London, 1928), p. 156.

> It seems to me, if Greenwich is going to illustrate the history of the Navy, which is a different thing from ship construction, there will certainly be a considerable number of objects which I should not wish to take into the Science Museum, because I could not consider that they came within our scope.[487]

Moreover Lyons' emphasis on the collection's technical purpose was maintained by the Science Museum after his retirement and throughout the 1930s, although his generosity was not. That the ship model collection was a source of patriotism and a symbol of national status for their chosen keeper would become clearer in the coming years. A decade after Lyons' testimony, and nearly twenty years after its dispute with the Imperial War Museum, the Science Museum found itself in another dispute with another museum, this time with the newly formed National Maritime Museum in Greenwich.

The Maritime Museum was established by Parliament in 1934, although renovations to Queen's House delayed the installation of collections for some years. Yet from the very founding of the new museum, the Science Museum's attention to its nautical collection markedly increased. Special exhibitions highlighting *Native Boats*, *The R.M.S. Queen Mary*, *British Fishing Boats*, *Chinese Junks* and *The Centenary of Transatlantic Steam Navigation* all took place in the years between 1934 and 1939. Similarly, additions to the collection received new attention in the 'Acquisitions' section of Advisory Council reports. And as the Maritime Museum began to demand the transfer of the collection, the Advisory Council became increasingly pre-occupied with the ship models situation.[488]

Late in 1937 the issue came to a head. In early November a letter was posted to the Chairman of the Standing Committee on Museums and Galleries asking for

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[487] F. E. Smith, the Royal Society's witness, says much the same. See Ibid., p. 161.

[488] Science Museum Archive Z 200/2: Science Museum Advisory Council, 'Notes for New Members', 1943, p. 1.

help in dealing the controversy.[489] As both President of the Board of Education — therefore the Science Museum's ultimate boss — and Chairman of the Board of Trustees of the Maritime Museum, Lord Stanhope rightly discerned a conflict of interest. A few days earlier Stanhope had received a letter from Sir James Caird. In his letter, Caird recorded his unhappiness over the ship model collection's being housed in the Science Museum. He argued that the proud national collection had been repeatedly debased by the Science Museum's policy of displaying it alongside objects on loan from private and industrial concerns. He requested that, as Chairman of the Maritime Museum's Board, Stanhope contact the Standing Commission to arrange for immediate action. He also provided an incentive:

> It might perhaps be pleaded that our buildings at Greenwich are already filled. This argument would only carry weight if it Eastern Leg of the National Maritime Museum buildings are left in its present incomplete condition. I should like therefore to take this opportunity of saying that I am prepared to put the cost of putting the Eastern Leg into the same condition was the remainder of the buildings as soon as the Office of Works are ready with their plans and estimates. Yours Sincerely, James Caird, Trustee and Liberal Benefactor of the National Maritime Museum.[490]

In the weeks following Stanhope's involving of the Standing Commission, the Science Museum was asked to submit a memorandum laying out their position. Dated December 1937, the paper set out the Science Museum's long-held view of the ship model collection as primarily of scientific and historical value:

> The aim of the Collections is to illustrate the history, development and purpose of the ship as a structure and as a machine ... The ship model collections of the Science Museum are therefore more concerned with the technical than with the purely romantic ...

The paper went on to discount the notion of any 'serious overlapping or competition' with the Maritime Museum, reminding the Standing Commission that 'it is normally

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[489] Science Museum Archive Z 193: Lord Stanhope, 'Letter to Sir Evan Charteris', 11 November 1937.

[490] Science Museum Archive Z 193: James Caird, 'Letter to Lord Stanhope', 9 November 1937.

assumed that the newcomer makes itself conversant with the scope of the established museums.' It regretted that the Maritime Museum went directly to the Standing Commission without consulting its fellows at the Science Museum first. And it rejected outright the notion that the admission of private objects into the Science Museum's galleries had somehow compromised the Museum's standing as a national institution. The paper concluded with a reiteration of the value of the Science Museum and its motives in keeping the ship model collection:

> It will be seen, therefore that the activities of the Science Museum and the Maritime Museum will be progressively divergent as time goes by; the one basing its collections on technical achievements and touching closely on the life of the people by its encouragement of vocational study; the other recording 'the history of our national maritime adventure'.[491]

In fact this is probably the last statement of the Science Museum's hopeful interwar vision. Only a few months later the Standing Commission judged in favour of the Maritime Museum, sending most of the ship model collections there. The Commission's decision appeared in their report for 1938, and began with a clarification of the Museums' respective spheres of concern. With regard to the Science Museum, the Commission acknowledged the universalism and internationalism of the Science Museum's mission, reporting:

> The Science Museum seeks by its general collections, which cover an immensely wide field of scientific endeavour, to aid in the study of technical development and to illustrate the applications of science to industry. In the sphere of ship models it displays an historical conspectus, including a representation of craft from the earliest time to the present day. This display is not restricted to developments in this country only but is international in character.

With regard to the Maritime Museum, however, the Commission privileged the essentially national character of its mandate, recognising that, unlike the Science

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[491] Science Museum Archive Z 193: Science Museum, 'Memorandum on the Water Transport Collection at the Science Museum, with Particular Reference to Ship Models', December 1937.

Museum, the Maritime Museum could better illustrate the work of 'each type of ship in relation to its work both in peace and in war, in fostering commerce and in trade defence.'[492]

In the end, therefore, it was really a choice — as the Science Museum had held all along — between a history of progressive and peaceful technical achievement on the one hand, and a romantic history of national military superiority on the other. In the immediate run up to the Second World War, the Standing Commission chose the latter — as ultimately did the Science Museum. In fact by the time of the Commission's decision, the Science Museum had already started to turn away from the ideals of the Peace Museum.

This turning away was most apparent in the staging of an exhibition entitled *Science in the Army*. Organised in cooperation with the War Office and the Army, *Science in the Army* set out to illustrate 'the working partnership of the British Army with Science and the technical training and research now essential in a modern army.'[493] Opened in 1938 by the Secretary of War, the exhibition followed along the same administrative lines as earlier industrial special exhibitions, with the War Office supplying most of the exhibits and producing the accompanying printed material. After a brief historical overview of military technology — from spear to Spitfire — the exhibition was more or less a recruitment exercise, following the career of a new recruit as touched upon by technology: 'how a raw recruit is turned into the up-to-date soldier'.[494]

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[492] Standing Commission on Museums and Galleries, *Second Report* (London, 1938), pp. 30-1.

[493] Science Museum Advisory Council, *Report for the Year 1938* (London, 1939), p. 10.

[494] Anthony Armstrong, *Science in the Army* (London, 1938).

Absent was any notion of human or historical unity. The exhibition stressed the unique superiority of British military science. Historical references were included only to communicate the essential difference of modern warfare, the weakness of old and the strength of the new. Absent as well was the earlier notion that the history of science is the history of peace. The exhibition's handbook concludes with King Solomon's proverb — 'A man of knowledge increaseth strength'.[495]

Even in the early years of the 1930s there had endured an ideal of the Peace Museum — universal, progressive and hopeful — and Advisory Council member Sir Richard Glazebrook could still proclaim its aims:

> The Museum was to be devoted to the development of Natural Science and Technics, a living History of the Spirit of research and discovery of every age and of all countries, an Institution in which the influence of Scientific Research on Technics should be fully shown, a Hall of Fame for those whose thoughts and deeds have left their impress on the culture of their age; a source to stimulate the memories of men of Science by the teaching of History, a fount of fruitful ideas for those who study Science in its relation to Technics, an example and a spur for all.[496]

Yet with the increasing influence of industry and the new attention to national and imperial politics in the late 1930s, the hope that peace might be grounded in science history faded, Finally, as the political and cultural climate of the turned away from post-war reconstruction and towards a new round of pre-war preparation — from the productive international collection of the Science Museum to the nationalist military collection of the Maritime Museum — the Science Museum took up the cause of *Science in the Army.*

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[495] Ibid.

[496] Royal Commission on National Museums and Galleries, *Oral Evidence, Memoranda and Appendices to the Final Report* (London, 1929).. See also, Science Museum Advisory Council, *Report for the Year 1930* (London, 1931), p. 39.

## Museums That Might Have Been

Ultimately the American science museum movement could not reconcile its rhetoric with its reality. The lofty vision of the Museums of the Peaceful Arts simply was not compatible with the more basic industrial interests it served. The arguments around the industrial museum in turn seem forced and awkward, and they did so to contemporaries. Compare, for example, two arguments that appeared together in a promotional pamphlet for the Museum of the Peaceful Arts. On the one hand Dexter Kimball, Dean of Cornell University, proclaimed:

> Never in the history of mankind has it been made so clearly evident, as in recent days, that the hope of civilization lies in unselfish co-operation and there should be little place for the selfish man or selfish organization in our political, industrial and social fabric.

On the other hand, Calvin Rice, President of the American Society of Engineers, argued:

> Ours is a great industrial nation and we want to make it continually prosperous. We have had several of the world's leaders tell us that if we will establish a museum of this nature it will go a long way toward inspiring the capacity for invention which is essential to our industrial progress ... If the generation which follows us is to be endowed with a comparable capacity for production, we must exhibit to them the developments in our industrial processes, and this may best be accomplished through the medium of an up-to-the-minute live industrial museum.

On the one hand, Kimball's internationalist arguments were those of the Peace Museum. On the other hand, Rice's were those of maintaining national production and the underlying industrial order that made it possible.[497] In the tumultuous

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[497] Dibner Library MSS 001736 B 1 v. 1: Museums of the Peaceful Arts, 'The New York Industrial Museum, Museums of the Peaceful Arts', 1929. Other instances of this tension about. See, for example, the April 1928 edition of *The Repertory*, which placed Charles Richard's question 'Shall we leave other nations to grow wise through the study of our achievements and ourselves neglect their meaning and their inspiration?' side by side with a statement by Columbia University's George Counts that read, 'There must be developed in the ordinary citizen of every nation a feeling of genuine kinship with the whole of mankind. The old antipathies, antagonism and prejudices, the product of ages of isolation, conflict, and rivalry, must give way to understanding and good will.'

political atmosphere of 1930s, it became increasingly difficult to reconcile these statements, as their incompatibility became increasingly and painfully apparent. Nor, as it turns out, could these sentiments succeed alone. Increasing uncertainty and alarm in Europe had bred an increasing isolationism at home that stood at odds with the once tenable message of the Peace Museum, and in the midst of a deepening and seemingly endless depression, the industrial museum seemed too little too late. Finally, its attempts to maintain the industrial, social and political order of previous decades seemed laughable or even sinister.

And yet in the later years of the 1920s and the early years of the 1930s, the science museum movement saw some significant, if temporary, success. In 1928 a popular temporary exhibition hall was arranged in mid-town Manhattan by the Museums of the Peaceful Arts' first Director, F. C. Brown. This was followed in 1936 by a gala opening of 'permanent' galleries in Rockefeller Center, now under a new name — The New York Museum of Science and Industry — and a new Director — none other than *The Industrial Museum*'s Charles R. Richards himself.[498] In Chicago, the Rosenwald Industrial Museum, renamed the Chicago Museum of Science and Industry, opened in 1933 in conjunction with that city's great 'Century of Progress' exhibition, and together the two celebrated the triumphs of science history.[499] In Washington too, Porter's efforts made some headway. His plan received widespread support from nearly all quarters of society, including national and international museum professionals, the general public, educationists, industrialists, labour groups and politicians. His 'Charter Membership of 100'

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[498] See Russell Douglass Jones, 'Engineering History: The Foundation of Industrial Museums in the United States' (Case Western Reserve University Ph.D. Dissertation, 2001), p. 231. for a description of the Museum's opening ceremonies, attended by William Bragg, Amelia Earhart and Albert Einstein among others.

[499] See Jay Pridmore, *Inventive genius: The History of the Museum of Science and Industry, Chicago* (Chicago, 1996), pp. 49-62.

included some of the Nation's most prominent and influential citizens, and he maintained the backing of important professional and cultural institutions such as the Founder Engineering Societies and the American Association of Museums.[500] He even won himself some Congressional attention beginning in the late-1920s.[501]

The apparent success is deceiving. Despite the best efforts of people like Brown and Richards, the 'monumental' Museums of the Peaceful Arts overlooking the Hudson River were never built. Even the pared down installation of the New York Museum of Science and Industry barely survived the Second World War. Likewise in Chicago, where the Museum of Science and Industry still stands, the romantic belief in science history that drove its foundation was sacrificed to a colder vision of current industrial processes. Emblematic of this shift was a change in the Museum's directorship in which Waldemar Kaempffert, who had been chosen based on his resemblance to Oskar Von Miller, was replaced by Lenox Lohr — military engineer, mastermind of the Century of Progress exposition, and author of the slogan 'Science finds, Industry Applies, Man Conforms'. Indeed, even Porter's energetic efforts never received more than rhetorical support from his admittedly impressive constituencies.

Most significantly and despite his published claims to the contrary, Porter's proposals never found any firm support in the one place that mattered most — the Smithsonian Institution itself. Somewhere along the line, through all his energetic

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[500] Smithsonian Institution Archives RU 297, Box 8, 'National Museum of Engineering & Industry, Correspondence, 1922-5, 1927-8': H. F. J. Porter, 'Letter to the Organizing Committee', 12 April 1924; Smithsonian Institution Archives RU 192, Box 253, Folder 4: 'National Museum of Engineering and Industry, To Be Under the Direction of the Smithsonian Institution, Washington, D.C.' 1924.

[501] United States Senate Committee on Education and Labor, *Hearings on S. 454, A Bill to Establish a Commission To Be Known as a Commission on a National Museum of Engineering and Industry* (Washington, 1930). See also the various legislation regarding the Commission, including, S. 5848, 70th Congress (1929); H. R. J Res. 426, 70th Congress (1929); H. R. J. Res. 65, 70th Congress (1929); S. 454, 71st Congress (1931) (enacted); S. 1200, 72nd Congress (1931); S. 2642, 72nd Congress (1932); H. R. J. Res. 166, 72nd Congress (1932).

promotion efforts on behalf of Smithsonian's National Museum of Engineering and Industry, Porter evidently forgot to get the go-ahead. Ironically, moreover, it is in Porter's greatest achievement — the establishment by Congress of a commission to study his proposal — that this greatest of his failures becomes most and most painfully apparent.

During his testimony before the Senate Education Committee in 1930, Porter recounted the steps by which he had started his lobbying on behalf of a National Museum of Engineering and Industry. He recalled Mitman's 1920 appeal, his own positive response to this appeal, and his incorporation of the National Museum of Engineering. He also recalled the more general arguments he had made so many times before in favour of the science museum movement.[502]

Certain aspects of Porter's testimony were not so straightforward. He first ran into trouble when asked about his relationship to other institutions of the science museum movement. Here Porter had difficulty convincing the Committee members that the promoters of museums in New York, Chicago and Philadelphia were really so enthusiastic about the National Museum idea. He was especially unconvincing in arguing that his institution was agreed to become the 'parent' of 'children' in New York, Chicago and elsewhere.[503] Pressed again, Porter insisted, 'I wish to emphasize again that so far as I know, there is absolutely nobody who has anything to say against this project.'[504]

This was not entirely true, and Senator Copeland's response suggests he may have known as much. Perhaps now convinced of Porter's wider support, Senator

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[502] Ibid., pp. 2-7.

[503] Ibid., pp. 4-5.

[504] Ibid., p. 10.

Copeland still wondered about his ties in Washington, asking 'I would like to ask in that connection what the attitude of the Smithsonian Institution is?' The question was not unexpected, though Porter could only sheepishly respond: 'They will answer that.'[505]

Porter was probably wise not to answer. Despite his stationery, his architectural plans and his boasts of partnerships, in fact Porter's relationship with the Smithsonian Institution had been growing colder ever since the Regents voiced their general support for the idea of an engineering museum in October 1924. As early as the autumn of 1925, for instance, Mitman was forced to write the first of several letters to Porter warning him not to overreach his mandate. Declining an invitation to come to New York to speak on behalf of Porter's movement, Mitman wrote:

> You ask me to do something here to show the Institution's interest in your movement. If you were here and could realize the different irons which the Smithsonian has in the fire — and in fires that are a great deal more reality than yours — you would probably appreciate better the attitude which the Institution takes ... The Smithsonian has not the money to run back and forth or help in other material ways ... Possibly were the executive regime of the Institution of another calibre you might be able to deal with them in your way but under the existing regime you can not do it so you might as well not try directly or indirectly for your methods simply provoke rather than interest them.[506]

Porter seems not to have taken the message. In following years, the Secretary's office started increasingly to receive letters from various organizations and individuals wondering about Porter's connection to the Institution. Answers to these letters grew increasingly short. Ultimately, the Secretary's office told its confused correspondents 'I beg to say that the National Museum of Engineering and Industry has, at the present time, no definite connection with the United States

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[505] Ibid.

[506] Smithsonian Institution Archives RU 297, Box 8, 'National Museum of Engineering & Industry, Correspondence, 1922-5, 1927-8': Carl Weaver Mitman, 'Letter to H. F. J. Porter', 30 September 1925.

National Museum.'[507] Internally, Porter's correspondence now received ridicule. In the margins of one of Porter's letters Mitman wrote, 'Isn't there some way that we can tell Porter to mind his own business?' The Secretary's office simply replied, 'He is apparently hard of hearing.'[508]

In testimony later that same morning, Senator Copeland's Committee pressed Porter again. This time it was Senator Walcott. He asked:

> Have you, for instance, got back of you here the support of the National Council of Research or the National Academy of Sciences? Are they interested? How about the President of the United States and the City Planning Commission? And the Smithsonian Institution, of course? Have you got these people advocating the appointment of a commission? That seems to me to be the whole purpose of this hearing — to get their active cooperation; because, for instance, if they were to oppose it, if those people that I have just mentioned or the officers of those associations would oppose it, it would not get very far.[509]

Porter now hedged again, arguing that it was more difficult to secure the support of institutions than of individuals, though of course he had tried. Institutions, Porter claimed, had boards of directors, memberships and other obstacles to making formal endorsements. Unconvinced, Walcott responded gruffly, saying 'But I think

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[507] Smithsonian Institution Archives RU 192, Box 253, Folder 5: Alexander Wetmore, 'Letter to E. F. DuBrul', 14 January 1928. Among others see also Smithsonian Institution Archives RU 192, Box 253, Folder 5: E. F. DuBrul, 'Letter to William De C. Ravenel', 27 December 1927; Smithsonian Institution Archives RU 192, Box 253, Folder 5: Edwin E. Slosson, 'Letter to Charles Abbot', 14 August 1929; Smithsonian Institution Archives RU 192, Box 253, Folder 5: Alexander Wetmore, 'Memorandum', 6 September 1929; Smithsonian Institution Archives RU 192, Box 253, Folder 5: Senator Reed Smoot, 'Letter to Charles Abbot', 3 March 1928; Smithsonian Institution Archives RU 192, Box 253, Folder 5: Charles Abbot, 'Letter to Senator Smoot', 6 March 1928.

[508] Smithsonian Institution Archives RU 297, Box 8, 'National Museum of Engineering & Industry, Correspondence, 1922-5, 1927-8': Carl Weaver Mitman, 'Handwritten Note to Alexander Wetmore', 16 June 1928; Smithsonian Institution Archives RU 297, Box 8, 'National Museum of Engineering & Industry, Correspondence, 1922-5, 1927-8': Alexander Wetmore, 'Handwritten Note to Carl Mitman', 16 June 1928. For an internal accounting of the Smithsonian Institution's relationship with Porter see Smithsonian Institution Archives RU 192, Box 253, Folder 6: Carl Weaver Mitman, 'Brief Statement of the History of the Movement to Establish a National Museum of Engineering and Industry', 1932. For Porter's account see 'The Proposed National Museum of Engineering and Industry', *The Repertory*, December 1928.

[509] United States Senate Committee on Education and Labor, *Hearings on S. 454, A Bill to Establish a Commission To Be Known as a Commission on a National Museum of Engineering and Industry* (Washington, 1930), p. 16.

you ought to do it … It would to my mind speak for the scientifical and physical side of it if you could get, for instance, Doctor Abbot and Doctor Wetmore to speak in favor of the propositions.' Here Walcott referred to the Charles Abbot and Alexander Wetmore — respectively Secretary and Assistant Secretary of the Smithsonian Institution — at which point Copeland interjected, 'We must have a representative here from the Smithsonian Institution.' 'Yes' Porter responded, 'Mr Mitman of that Institution is here.'

'Suppose we hear from him now,' said Copeland.[510]

In fact Mitman was in a bad spot. Despite his frustrations, he had always sympathised with Porter's aims, and nearly ten years' correspondence must have sown some seeds of collegial loyalty. Moreover, it could very well be argued that Mitman himself had triggered the whole sorted mess with his first remarks in the 1920 annual report. Now he was forced finally to confront Porter with the unhappy and unalterable truth. 'Frankly,' he began,

> … we didn't know anything about this commission being formed until we got copies of the bill; and I believe that we have been studying museum possibilities and museum developments in the city of Washington — it is a part of our work — and that we have covered the study pretty thoroughly. Furthermore, at this time, Doctor Abbot informs me that the board of regents has some other project before Congress; and that they would not care to jeopardize that project by moving very heavily toward this one.[511]

Ultimately and over the objections of the Smithsonian administration, a Commission on a National Museum of Engineering and Industry was established by Act of Congress. Mitman was sent to Europe, but by the time he left it was clear the trip and the commission would come of nothing. As Thomas Ewing, one of Porter's associates, prophetically suggested in his testimony to Senator Copeland's

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[510] Ibid.

[511] Ibid.

Committee, 'it is very difficult to keep alive the interest of a group of people who have no reason but a public interest for working on the matter at all if nothing is being actually accomplished.'[512] Senator Walcott had also been right: without active support at the Smithsonian, Porter's plan was destined not to get very far.

Porter died on January 25, 1933. By that point the Smithsonian administration and Regents had already moved well beyond his plan. As Mitman had suggested in his testimony, they were actively pursuing the establishment of a National Museum of American Art to stand beside the National Museum of Natural History. A site was selected just across the Mall from where Porter's National Museum of Engineering and Industry would have stood.

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[512] Ibid., p. 9.

# Epilogue: *Quousque Tandem*

By the middle of the 1930s, events in Europe had begun to slowly wear away at both Sarton and Singer's formerly unbending optimism.

Singer, for one, became simultaneously less interested in science history and more and more occupied with the plight of the German Jews. As he explained to Henry Sigerist in 1940, 'From the beginning of 1933 'till the end of 1939, work was almost impossible for me. My mind was too occupied with the situation and with the fate of my colleagues.'[513] Indeed, his correspondence from the period between the Portugal Congress and the end of the Second World War is dominated by letters concerning his work with the Jewish Refugee Council.[514] Certainly his publication record shows this. Though the fact that Singer published few history papers in this period is telling, more telling are the many papers he published in defence of Nazi victims.[515] In 1936, for instance, he contributed an anonymous piece to *Nature*, entitled 'Heidelberg, Spinoza and Academic Freedom', which marked his contribution to the ultimately successful campaign to quash British participation in the University of Heidelberg's 550th anniversary celebrations on account of its recent purges.[516] A second piece for *Nature* warned of the increasing militarism in German

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[513] Genevieve Miller, 'Charles and Dorothea Singer's Aid to Nazi Victims', *Koroth*, 8 (1985), 217; Geoffrey Cantor, 'Charles Singer and the Early Years of the BSHS', *British Journal for the History of Science*, 30 (1997), 10.

[514] Wellcome Institute for the History of Medicine, Contemporary Medical Archives Centre, Singer Correspondence, PP/CJS, especially, A.73-A.76.

[515] See E. Ashworth Underwood, 'Bibliography of the Publications of Charles Singer', in E. Ashworth Underwood (ed.), *Science, Medicine and History* (2 vols., Oxford, 1953), ii, 555-81.

[516] Charles Singer, 'Heidelberg, Spinoza and Academic Freedom', *Nature*, 137 (1936), 303-4. See also Charles Singer, 'University Ideals', *Time and Tide*, 26 October 1935.

scientific circles.[517] Singer's only monograph of the years immediately preceding the Second World War, similarly dealt with the approaching Holocaust — in 1937, Singer published *The Christian Approach to the Jews*, a short book sought to dispel common misconceptions about the history of the Jewish Diaspora in Europe and set straight the scientific and historical errors propagated by anti-Semites.[518] Indeed, this political digression lasted throughout the war. Finally, in 1943, Singer published a none-too-optimistic tract condemning the lack of effort by the international community on the Jews' behalf, suggestively entitled, *The Christian Failure*.[519] It now seemed obvious that history of science was too vague and distant a solution to the problems of international peace. After being evacuated from University College, London in 1939, Singer retired to his cottage in Cornwall, and once and for all from formal work in the history of science.

Similarly, Sarton's prefaces to *Isis* began to take a decidedly gloomier tone. For instance, in his preface to the twenty-eighth volume of *Isis* in 1937, Sarton recalled a story from the *Arabian Nights*, which described the maniacal behaviour of a people dominated by the cult of their Leader's personality. Sarton went on to draw some none too subtle comparisons between Sinbad's savages and certain modern civilizations, both enslaved and reduced 'from the condition of disciplined but free individuals to that of mere cells of a larger and fiendish creature, the State personified by its Leader.' A committed positivist, Sarton was incredibly disheartened by the apparent lack of moral progress in the years between the Islamic Middle Ages of the *Arabian Nights* and his own day. Astonished by current events, Sarton ended his preface not with his usual hopeful call to arms, but incredulously, asking, 'Is mankind

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[517] Charles Singer, 'Inauguration of the German State Council for Research', *Nature*, 141 (1938), 655-6.

[518] Charles Singer, *The Christian Approach to Jews* (London, 1937).

[519] Charles Singer, *The Christian Failure* (London, 1943).

unable to profit from past errors or must it repeat them on a larger and bloodier scale?'[520] Elsewhere in 1937 his fears resurfaced: 'Is man turning around in hopeless circles, like the circles of Hell?' he asked, 'Is our life nothing but delusion and vanity, *vanitas vanitatum*? Is the light which we see a false light worse than darkness?'[521] Finally in 1939, with war in Europe imminent, Sarton could only quote a plaintive Cicero for the title of his *Isis* preface. 'Quousque Tandem?' he wrote: *How much longer?*[522]

Soon after, the publication of *Isis* was moved from Belgium and again briefly suspended because of war in Europe.[523] What had begun with the optimism of 'War and Civilization', ended with the despair of 'Quousque Tandem?' Whereas after the Great War the Carnegie Institution could embrace the idealism of a young Belgian refugee, the coming of a second war would cause the Institution's powerful new president, Vannevar Bush to tell an 'ill' and 'silent' Sarton, 'As far as I can see, Sarton, your work is irrelevant.'[524]

Of course, neither Sarton nor Singer was easily kept down. After the war, both men renewed their international commitments, most visibly in their efforts to include history of science in the organisational structure of UNESCO. Even as early as 1941, Sarton could muster 'A Defense of the History of Science'.[525] Singer, too,

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[520] George Sarton, 'A Story from the Arabian Nights', *Isis*, 28 (1938), 321-9.

[521] George Sarton, *The History of Science and the New Humanism*, 2nd edn (Cambridge, MA, 1937), preface.

[522] George Sarton, 'Quousque Tandem', *Isis*, 31 (1939), 6-7.

[523] George Sarton, 'The Publication of Isis', *Science*, 92 (1940), 59-60; George Sarton, 'The End of the Belgian Isis', *Isis*, 33 (1941), 41-54.

[524] May Sarton, 'Looking Back at My Father', in Carolyn Anthony (ed.), *Family Portraits: Remembrances by Twenty Distinguished Writers* (New York, 1989), pp. 193-4. See also Carnegie Institution of Washington, George Sarton Papers: George Sarton, 'Letter to Vannevar Bush', 17 January 1939 and later Sarton-Bush correspondence at the Carnegie Institution, Washington.

[525] George Sarton, 'Defense of the History of Science', *Isis*, 34 (1943), 465-6.

was able to return to the ideals of the New Humanism, which he proclaimed in his foundation address before the new British Society for the History of Science.[526] Indeed some measure of their former hopes returned with war's end to both Sarton and Singer, and both returned to ideals of the New Humanism. Alas, this time nobody was listening.

[526] Charles Singer, 'The Role of the History of Science', *Bulletin of the British Society for the History of Science*, 1 (1949), 16-8.

# Conclusion

If this thesis has succeeded, it will have done two things. First, it will have shown that science history in the interwar period was a varied and diverse field of cultural interest. Second it will have shown that this interest was deep seated, that it spoke to important cultural currents, and that the memory of war was one of the most important. Finally, it at least will have shown that the first element — the diversity of interwar science history — can be more clearly conceptualized in terms of the second element — the memory of war. That is, the strong thread of post-war memory is a useful one to follow across a many patterned carpet of interwar science history.

The diversity of interwar interest in science history and the pervasiveness of post-war memory also means, however, that this thesis has been unable to tackle the entire field. For example, only passing reference has been made to the Chicago's Century of Progress exposition of 1933-4. This was an unprecedented public proclamation of the hopeful promise of science history and the only international exposition of any period to explicitly take on science history as its unifying theme. It was, as the exposition's newsletter put it, 'a tribute to science's past and ... a herald to the possibilities of her future.'[527] Similarly, science history flourished in other popular contexts. H. G. Wells, for example, may be remembered mostly for his science fiction, but his most popular work of the interwar period was undoubtedly his *Outline History of the World*, which although it was written for a popular audience was just the kind of encyclopaedic and ecumenical history of civilization envisioned

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[527] 'Our Debt to Science', *Progress*, 22 July 1933.

by Sarton and Singer.[528] The same can be said for the popular radio programme, *The World is Yours*, which every week brought science history to children across America, covering subjects as diverse as the history of flight and the history of medicine.[529] Likewise, there was a strong strain of amateur involvement in science history that has not been fully accounted for. Although the period's influential collectors were introduced briefly in Chapter 5 and have received occasional attention from historians, they do not, however, represent the extent of amateur interest in science history between the wars. In 1919, for example, there emerged a short-lived movement to establish a 'Permanent Exposition at Washington, D. C. — Interstate, National and International, of an Industrial, Commercial, Educational and Social Character.' Led by a certain Dr Kernoodle and supported by the President of the United States, this 'Greater Smithsonian Institution' intended displays of scientific progress to directly effect post-war peace:

> As the war clouds disappear, and the work of reconstruction proceeds, may the spirit of unity of all mankind strengthen, and intellectual supremacy become more and more pronounced. May 1919 be the beginning of the era when —
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> 'The war drums throb no longer, and the battle flags are furled; In the parliament of man, the federation of the world.'[530]

To this list could be added countless other examples of science history's vast proliferation in the interwar period. Yet one last example should suffice as a final

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[528] H. G. Wells, *The Outline of History: Being a Plain History of Life and Mankind* (2 vols., New York, 1923).

[529] Smithsonian Institution Archives RU 83, Boxes 68-77, '*The World is Yours* Transcripts and Curriculum Materials'. Produced by the Department of the Interior in co-operation with the Smithsonian Institution, *The World is Yours* aired weekly on the National Broadcasting Company network from 1936 until 1942. Science history was a staple of its programming. See, for example, transcripts from 11 September 1936 ('Medicine and Health'), 20 September 1936 ('Men in Flight'), 12 February 1938 ('Great American Biologists'), 5 June 1938 ('Twentieth Century Physics'), 24 July 1938 ('Great Astronomers'), 23 October 1938 ('Heroes & Heroines'), 30 October 1938 ('Great Feats of Engineering'), 22 February 1941 ('Disseminating Knowledge Throughout the Earth'), 15 March 1941 ('Three Hundred Years of Chemistry'), etc.

[530] Smithsonian Institution Archives RU 192, Box 203, Folder 2: G. W. Kernoodle, 'A Permanent Exposition', 1919.

example of science history's diversity and its complex relationship to post-war memory and culture. Oxford's R. T. Gunther is not usually considered a central figure in the history of the history of science. In many ways, Gunther was an outcast. He was certainly an outcast in academic circles. On the one hand, as was demonstrated in Chapter 5, Gunther's unorthodox archaeological and instrumental approach to science history was obviously marginalised by other university-based historians of science. On the other hand, Gunther never hit it off personally with academic colleagues like Sarton and Singer. Gunther never published in *Isis* and actively avoided the History of Science Society until the end of his life. His years as University Reader in the history of science at Oxford left no students to carry on his legacy in the field. He was little involved with other science history endeavours at Oxford, most notably with Charles Singer's history of science reading room, which stood just outside Gunther's Museum of the History of Science in the Bodleian Library. Similarly, his association with the Cambridge History of Science Committee's Exhibition of Historic Scientific Apparatus in 1936 did not extend to any involvement in their lecture series and other activities. In fact, his frequent, vociferous and often aimed published opinions made him few trusted associates in academe. In short, then, Gunther had his own ideas about the proper direction of history of science and perused them on his own.[531]

In light of this, it might seem more reasonable to consider Gunther among other museum practitioners. After all, Gunther was based from the earliest age in a science museum. Gunther's father was Keeper of Zoology at the British Museum,

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[531] Singer, in particular, seems to have been wary of Gunther. At one point Singer begged not to be involved in Gunther's ongoing struggle against the Bodleian. Such requests of Gunther were not uncommon among his academic correspondents. See Singer-Gunther correspondence, Old Ashmolean Letter Book, Volume III. For a lengthier account of Gunther's many scuffles, see A. E. Gunther, *Robert T. Gunther: A Pioneer in the History of Science, Volume 15 of Early Science in Oxford, by Robert T. Gunther* (Oxford, 1967).

and the Gunther family lived on site. He is, of course, best remembered as the founding curator of a science museum. Yet in both his temperament and interests, Gunther shared precious little in common with other museum-based 'scientific servants' like Henry Lyons, and his relationships with these were perhaps even cooler than with academics like Sarton and Singer.[532]

Another possible match might be with the private enthusiasts with whom in later life he would most closely ally himself. Like Bern Dibner, Robert Whipple, Lewis Evans and other private enthusiasts, Gunther's first foray into science history was as a book collector. Later, as science tutor at Magdalen College, Gunther began gathering together and displaying pieces of old apparatus. In 1904, Gunther published his first historical work, *A History of the Daubeny Laboratory*, which provided brief history and extensive catalogue of the instruments of the College's old laboratory.[533] Gunther's attention turned more fully to collecting with the onset of war and the launch of his University-wide collecting programme, the results of which formed the basis for *Early Science in Oxford.* In 1920, at the age of 51, Gunther's career as a working scientist ended, and he devoted the rest of his life to augmenting and securing a home for the collections he had assembled. Yet here again are significant differences. As with other colleagues, even Gunther's relationships with allied private collectors were sometimes strained. More importantly, as Gunther's biographer, Tony Simcock rightly points out, Gunther's archaeological approach differed fundamentally from that of the private collector in that 'at its centre was the

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[532] See, for example, Lyons-Gunther Correspondence, Old Ashmolean Letters, 1930, 1931, 1932, and Old Ashmolean Letter Book, Volume III. See also Museums Association correspondence, Old Ashmolean Letters, 1938, in which the Museums Association repudiates Gunther's 'repeated claim to be the oldest Museum of Science in Britain', arguing that 'it is not really possible to acquire history in this way' and that 'the claims you make for the Museum of the History of Science have seriously injured its reputation.'

[533] R. T. Gunther, *A History of the Daubeny Laboratory, Magdalen College, Oxford* (Oxford, 1904).

taxonomic and evolutionary study of scientific instruments as such, and not as art objects, nor even as sacred relics.'[534]

In many ways, Gunther seems completely anomalous, disconnected from potential colleagues in the private sector, the museum and the university—that is, in all the locations in which he operated. How, then, to tackle Gunther? Perhaps it is worthwhile first to consider Gunther's Museum, before turning to the man himself.

Oxford's Museum of the History of Science was born of wartime necessity. Concerned about German air raids, Gunther — then working as a science tutor at Magdalen — set about to survey the University's historic scientific collections. He began in the University Museum with the zoological remains of the Tradescant collection, the foundation of the seventeenth century Ashmolean Museum. As the war dragged on, he extended his survey to the Colleges, everywhere unearthing 'unsuspected hoards of early scientific instruments'.[535] Gunther's wartime preservation efforts spawned two related projects. The first was the writing of the first three volumes of his fourteen-volume *Early Science in Oxford*. These provided essentially a statement of purpose and a catalogue of his findings in the University's cupboards. The second was the start of Gunther's campaign to found a science museum in the 'Old Ashmolean' building.

The Ashmolean Museum was purpose-built in 1683 at the centre of the University beside Wren's new Sheldonian Theatre. Its three levels were divided between a chemical laboratory in the basement, a lecture theatre in on the ground floor and an exhibition gallery on top. Though several things occasioned its erection

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[534] A. V. Simcock, 'A Dodo in the Ark', in A. V. Simcock (ed.), *Robert T. Gunther and the Old Ashmolean* (Oxford, 1985), p. 80.

[535] R. T. Gunther, 'The Story of the Old Ashmolean', in A. V. Simcock (ed.), *Robert T. Gunther and the Old Ashmolean* (Oxford, 1985), p. 18.

— not only Elias Ashmole's acquisition of the Tradescant family's cabinet of curiosities and subsequent donation to the University and the new prominence of the natural sciences in the late seventeenth century, but also the ongoing University building boom that had begun at least a century earlier and Restoration favour of Oxford, which had served as a Royalist stronghold throughout the Civil War — the building nevertheless served as the centre of Oxford science and collecting for nearly the next two centuries. In the mid-nineteenth century, demands of space and disciplinary divisions prompted the construction of a new University Museum, which received the science collections in 1860, and a new Ashmolean Museum, which received the antiquities collections in 1894. Thus as Gunther became increasingly interested in the University's scattered scientific detritus in the 1910s, he found the 'Old Ashmolean' building mostly vacant.

Gunther first proposed an exhibition of historic scientific apparatus in the Old Ashmolean in 1916. His first request was rejected, as the Oxford English Dictionary and the new School of Geography had taken up temporary residency. Several later attempts were met with similar resistance, and Gunther's doggedness gained him new enemies. Then in 1922, Gunther secured the conditional donation of the private collections of Lewis Evans, on the understanding that they would be provided suitable permanent housing. The Evans donation gave Gunther the leverage he needed, and after more negotiation and more enemies, Gunther secured the best part of the Old Ashmolean building in 1924. In 1925 the collections opened to the public, and in 1935 the Museum of the History of Science was established as a fully-fledged University department.

Simcock has pointed out that Gunther's aims were fundamentally local — 'the identification and preservation of things with a real history of use and found *in situ* in

Oxford's colleges, laboratories, museums and observatories'.[536] These things were, moreover, to be housed in a particular Oxford location, the Old Ashmolean Museum. Even today Gunther's fourteen volumes on *Early Science in Oxford* are the greatest work of local history of science. Yet while Simcock is certainly correct in pointing out the importance of *locality* in Gunther's science history, Gunther's focus on Oxford, and more particularly on the Old Ashmolean, can also be examined in terms of his intense enthusiasm for *historical and scientific unity*. That is, Gunther was determined to establish his own work as a continuation of the longstanding and ongoing tradition of Oxford science.

The Old Ashmolean was much more that a convenient and sentimental exhibition space for Gunther. Gunther believed that the University had betrayed its mandate when the Ashmolean was divested of its original scientific purpose and made a 'knick-knackatory'.[537] He argued that 'Ashmole's name should stand, not for art and archaeology, or for more or less important bric-a-brac, but for his incomparably greater achievement, the establishment of the first Museum of Natural History in Britain.'[538] He often quoted Ashmole's foundational intentions:

> Because the knowledge of Nature is very necessarie to humaine life, health, & the conveniences thereof, & because that knowledge cannot be soe well & usefully attain'd, except the history of Nature be knowne & considered; and to this end, is requisite the inspection of Particulars, especially those as are extraordinary in the Fabrick, or usefull in Medicine, or applyed to Manufacture or Trade: I Elias Ashmole, out of my affection to this sort of Learning, wherein my selfe haue taken, & still doe take the greatest delight; for which cause alsoe, I haue amass'd together great variety of naturall Concretes & Bodies, & bestowed them on the University of

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[536] A.V. Simcock, 'An Ark for the History of Science', *International Association of Technological Libraries Quarterly*, 1 (1987), 199. See also A. V. Simcock, 'A Dodo in the Ark', in A. V. Simcock (ed.), *Robert T. Gunther and the Old Ashmolean* (Oxford, 1985), pp. 44-92.

[537].R. T. Gunther, 'Elias Ashmole: Founder of the First Public Museum of Natural History', *Nature*, 99 (1917), 234-5.

[538] R. T. Gunther (ed.), *The Diary and Will of Elias Ashmole*, *Old Ashmolean Reprints, 2* (Oxford, 1927), preface.

> Oxford, wherein my selfe haue been a Student, & which I haue the honor to be a Member.[539]

Though the Ashmolean had never been, and was never intended to be, a museum of the history of science, Gunther repeatedly asserted the identity of his own work with these original purposes of the Museum and the esteemed tradition Oxford science. He argued vigorously for the building's attribution to Wren, in order to remind 'the public of his work as a great man of science in Oxford, and of the proposed plan to restore the Old Ashmolean Building as a Museum to include instruments that were essential to science when he was Savilian Professor of Astronomy at Oxford.'[540] Here he implored that 'the vacant rooms in the old Museum may be once more used for the purposes of natural science for which they were built'.[541] When the building had opened as a museum of the history of science, Gunther could rejoice that 'the first fruit of the reversion of a part of the Old Ashmolean building to its original use as a Science Museum are now on exhibition.'[542] Having installed his science collections, Gunther still took every opportunity to assert his foundation's connection Old Ashmolean. He installed old-style stained-glass windows, placing the arms of Lewis Evans alongside those of Ashmole, Tradescant, Christopher Wren and Robert Plot. He commissioned a series

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[539] Elias Ashmole, 'Statutes, Orders & Rules, for the Ashmolean Museum, in the University of Oxford, 1686', in C. H. Josten (ed.), *Elias Ashmole (1617-1692): His Autobiographical and Historical Notes, His Correspondence, and Other Contemporary Sources Relating to His Life and Work* (5 vols., Oxford, 1966), iv, 1821-2; R. T. Gunther, *Historic Instruments for the Advancement of Science: A Handbook to the Oxford Collections Prepared for the Opening of the Lewis Evans Collection on May 5, 1925* (2 vols., Oxford, 1925), i, 1.

[540] R. T. Gunther, 'The Story of the Old Ashmolean', in A. V. Simcock (ed.), *Robert T. Gunther and the Old Ashmolean* (Oxford, 1985), p. 25.

[541] R. T. Gunther, 'Sir Christopher Wren's Science Museum at Oxford', *Nature*, 111 (1923), 288.

[542] R. T. Gunther, 'The Lewis Evans Collection at Oxford: Recent Additions', *Nature*, 118 (1926), 160-1.

of 'Old Ashmolean Reprints' of the works of famous Oxford scientists.[543] He even ran afoul of the University when he hijacked celebrations of the 250th anniversary of the Ashmolean's foundation.[544]

In his unpublished *Story of the Old Ashmolean*, Gunther wrote, 'The Old Ashmolean of Oxford is 257 years old today. It is the oldest British Museum. And, while it still contains a part of its original scientific collections, it strictly conserves the ideas of a scientific Institution for the study and teaching of Natural History for which it was founded.'[545] If isolated in other aspects of his personality and work, Gunther was here in keeping with contemporary emphases in the wider world of science history. Gunther emphasis on continuity and his tendency 'to think of his historical work as belonging to the realm of science' were intended both 'to enhance the reputation of science in Oxford and to contribute to scientific education.'[546] At the same time, by identifying his foundation with the Old Ashmolean, Gunther was identifying himself with the Old Ashmolean's scientific practitioners. By stressing continuity with these Old Scientists — in his editorials, anniversary celebrations and armorial windows — Gunther hoped to fashion himself as a New Scientist.

Seen in this light, Gunther seems not so foreign after all. Indeed, his credentials as a New Scientist are much like Sarton's and Singer's. Like these, Gunther enjoyed a comfortable and learned childhood, roaming the halls of the Museum of Natural History. In fact, much like Sarton, Gunther's mother died in his

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[543] See, for example, Thomas Digges and Leonard Digges, *The Theodelitus and Topographical Instrument of Leonard Digges, of University College, Oxford, Old Ashmolean Reprints 4*, ed. R. T. Gunther (Oxford, 1927); Robert Boyle, *Electricity and Magnetism, 1675-1676, Old Ashmolean Reprints 7*, ed. R. T. Gunther (Oxford, 1927).

[544] See *The Times*, 12 October 1933.

[545] R. T. Gunther, 'The Story of the Old Ashmolean', in A. V. Simcock (ed.), *Robert T. Gunther and the Old Ashmolean* (Oxford, 1985), p. 3.

[546] Editor's note in Ibid., p. 33.

infancy, and Gunther was left with the Museum's curators for playmates. Gunther was, moreover, Singer's rough contemporary at Magdalen College and the University Museum. As Simcock points out, Gunther was a product the new humanist vision of the unified sciences 'reconciled to the humanities and fine arts' inherent to the Oxford system of scientific training. In fact, Gunther was President of the Oxford Junior Scientific Club when Acland gave his inaugural lecture explaining the unifying purposes of the Oxford system. Later on in his career and again like Singer, Gunther enjoyed and often proudly referred to his patronage by Sir William Osler. In particular Gunther liked to recall Osler's presidential address before the 1919 meeting of the Classical Association, with which Gunther's first exhibition of historic scientific apparatus was coordinated.[547] This was 'The Old Humanities and the New Science' speech in which Osler presaged a new kind of scientist, reconciled to history and the humanities. Installed in the scientific premises of the Old Ashmolean, Gunther could believe he was just such a New Scientist.

Thus while his museum location and collecting activities might place him alongside contemporary museum practitioners and private enthusiasts, his background, outlook and self-image place Gunther firmly among contemporary academics. Despite his personal and intellectual foibles, historians of the history of science have been wrong to neglect Gunther in their accounts of university developments. Indeed. Gunther's background follows a familiar pattern — one strikingly similar to his academic contemporaries like Sarton and Singer. Based in the museum and privately pursuing material collections, Gunther nevertheless most closely resembles the Sartonian New Scientists who — in the absence of his

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[547] See, for instance, R. T. Gunther, *Early Science in Oxford* (15 vols., Oxford, 1923-67), i, vi. See also R. T. Gunther, 'The Story of the Old Ashmolean', in A. V. Simcock (ed.), *Robert T. Gunther and the Old Ashmolean* (Oxford, 1985), p. 20.

eccentricities — might have been his peers. Ironically, academic history of science's most eccentric practitioner might serve as its most telling example.

Finally and more generally, it is doubly ironic that one of the period's most notoriously eccentric practitioners and his stubbornly pointed Museum of the History of Science should provide one of the best examples of interwar science history's typical fluidity. Though Gunther and the Museum of the History of Science had little formal connection with the mainstream institutions of university-based science history, the very fact that they could exist outside these more established structures demonstrates the flexibility of interwar science history. Despite his personal and intellectual idiosyncrasies, Gunther was nonetheless able to fashion a place in science history. To single out Gunther as eccentric is not to say that he couldn't sail in the sea of interwar science history. It is just to say that its waters were big enough and open enough to allow him to chart his own course.

Two points in conclusion:

First, while this thesis has dealt only with science history in the period between the two World Wars, it nevertheless implies a rethinking of the entire history of organized science history. Too often the history of the history of science has been told as the history of increasing independence from scientific mythologies. The usual narrative lambastes earlier science historical practitioners for being apologetic, biased, parochial, positivistic — that is, for explaining past science in terms of present science. The problem with this narrative is that it falls victim to its own criticism. Current historians of science too often judge past historians of science by current standards, according to what they have contributed to the present state of the field. Essentially this approach is whiggish and anti-historical, and this thesis rejects it. Rather than in interwar science history's relation to the science history of today, this

thesis is interested in interwar science history's relation to interwar culture, and to the memory of war in particular. The post-World War Two period should be rethought in similar terms. Just as the interwar period was not some dark ages, similarly the post-World War Two period was not an emergence into light. In fact, this thesis suggests that the shift from an interwar science history that placed great faith in science to a post-war science history that viewed science skeptically has as much to do with the progress of politics, war and peace as it does with increasing historiographical sophistication. In this post-World War Two science history can, like interwar science history, be viewed simply as a series of opportunistic shifts and reactions to changing cultural conditions. In the aftermath of a second and more terrible war, the hope that was so keenly felt in the early years of the interwar period was no longer sustainable. The scientific horrors of the atomic bomb and scientific genocide translated into a new suspicion of science, and in turn to relativism, constructivism, and the other currents we know today.

Secondly — to go even further out on a limb — this thesis suggests the need for a rethinking of general cultural history of interwar period. It is an unfortunate fact of historiography that existing cultural histories focus almost entirely on post-Great War disillusionment and generally ignore contemporary expressions of hope and promise. Too often the history of the interwar period has been told as one of post-war despair and rejection. This thesis shows this to be not entirely correct on either count.

On the one hand, the interwar period cannot be characterized only in terms of despair. This thesis, for example, has shown that in the immediate aftermath of the First World War, a culturally powerful and pervasive current of science history emerged offering hope to an uncertain world. Similarly, while it is easy to see the Britain's General Strike and certain of Picasso's or Fitzgerald's works as desperate, it

is more difficult to see the founding of the League of Nations and the rise of New York skyscrapers that way. Finally, just because these hopes were ultimately dashed with the coming of a second and more brutal war is no reason to ignore their prior existence and importance to contemporary actors.

On the other hand, the interwar period cannot be seen simply in terms of rejection of the past. As this thesis has shown, past science was hopefully embraced by millions between the wars, and it was not until the coming of the Second World War that their hopes were placed elsewhere. Likewise, while the interwar period saw modernist rejection of earlier forms in art and music, it also saw a strong strain of traditionalism and reverence for the past. Jay Winter has recently traced these strains of continuity with regard to the post-Great War experience of mourning. I hope this thesis has done the same with regard to the post-Great War experience of science history.[548]

In the end — and in both disciplinary and cultural historiography — constructs of old and new, traditional and modern oversimplify what is really a richer and much more complex story. As Winter says, 'To array the past in such a way is to invite distortion by losing a sense of its messiness, its non-linearity, its vigorous and stubbornly visible incompatibilities.'[549] Marking out this complexity is ultimately what this thesis is about, and if it focuses on the memory of war, it does so only to draw out science history's diversity. Happily there's more, much more work to be done.

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[548] Jay Winter, *Sites of Memory, Sites of Mourning: The Great War in European Cultural History* (Cambridge, 1998).

[549] Ibid., p. 5.

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