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"To Design for the Future You Must Leaf Through the Past": Museums as Part of Systems of Innovation

Mary Rose and Lorraine Johnston

Museums are not conventionally associated with innovation or viewed as part of innovation systems. After all, we could argue, museums are about the past, heritage, and nostalgia, whereas innovation is about the future. Yet, if this is the case, why does a company such as BMW co-locate its archive, museum, and innovation center? In this preliminary essay on the combination of past and present knowledge in innovation, we revisit the academic literature on innovation systems. We explore how, historically, museums and their collections have contributed to innovation and to the development of innovative designs. We ask: How have organizations set up to preserve the past contributed to the future, and what has encouraged and inhibited these processes? We focus primarily on nineteenth- and twentieth-century experience in the United Kingdom and on the relationships among the arts, design, and industry on the one hand and museum collections on the other.

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and inhibited these processes? We focus primarily on nineteenth- and twentieth-century experience in the United Kingdom and the relationships among the arts, design, and industry on the one hand and museum collections on the other. We place U.K. experience of the role of museums in a wider international context by comparing the differing histories and considering the implications for behaviors. We set U.K. experience and attitudes toward museums against those in Europe to reveal how differing histories created distinctive relationships among museums, universities, and industry. We highlight the complex social, political, and economic forces that both shaped and sometimes inhibited development, and we explore the implications of these divergent histories for twenty-first century innovation systems.

Past as Future

Innovation, or the commercialization of a new product, service, or process, is socially embedded and only rarely carried out in isolation. Taking Joseph Schumpeter's definition as a starting point, innovation involves "combining productive services . . . combining factors in a new way [such] that it consists of 'new combinations'."[1] In this observation, innovation takes place at the boundaries of areas of knowledge and expertise, underpinned by interactive learning processes involving exchange of both codified and tacit knowledge. However, the iterations that occur have the potential to develop new knowledge, which may stimulate innovation. The idea that innovation is a collaborative process, leading to new combinations of knowledge, lies at the heart of much recent work on innovation.[2]

What roles do the past and past knowledge play? How might combinations of old and new knowledge lead to innovation? Most scholars use path dependency theory to explain lock-in in the innovation process, whether in organizations or in regions. Yet, although the past provides a foundation for the future, history is as much about discontinuity and change as it is about continuity and tradition. This means that, as well as the limitations of path dependence, path creation and path destruction are also important.

Path creation involves co-evolution or the bringing together of previously separate areas of knowledge or expertise and consciously

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[1] Joseph Schumpeter, *Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process* (New York, 1939), 1: 87-88.

[2] Charles Edquist, *Systems of Innovation: Technologies, Institutions, and Organizations* (London, 1997); John Seely Brown and Paul Duguid, *The Social Life of Information* (Cambridge, Mass., 2000); Mark Freel, "External Linkages and Product Innovation in Small Manufacturing Firms," *Entrepreneurship and Regional Development* 12 (Sept. 2000): 245-66; Andrew Hargadon, *How Breakthroughs Happen* (Boston, Mass., 2003); and Mary Rose, Terence Love, and Mike Parsons, "Path Dependent Foundation of Global Design-driven Outdoor Trade in NW of England," *International Journal of Design* 1 (Dec. 2007): 57-68.

deviating from what has gone before.[3] History, then, is not just about the past. We can use it to understand the present and shape the future. The links between past and future and the cumulative nature of innovation are the result of the associated social learning processes.[4] Innovation is, by implication, an evolutionary process with the discontinuities typically coming from boundary crossing, which leads to new combinations. It is less about having access to alternative bodies of knowledge per se, than about having the imagination to combine skills and expertise from one area to alter another fundamentally. This helps transform the shadow of the past into an inspiration for the future. Innovation, therefore, involves seeing what everybody else has seen, but thinking about it and interpreting it with originality.

History shapes behavior, attitudes, and social processes and is intimately related to the "rules of the game" or "institutions" that underpin all forms of human activity. These ". . . humanly devised constraints . . . shape human interaction. In consequence they structure incentives in human exchange whether political, social or economic. Institutional change shapes the way societies evolve through time and is the key to understanding historical change."[5]

Innovation Systems and Museums

Innovation systems are about how innovation takes place, who is involved, and how and where they interact. The iterations that occur have the potential for developing new knowledge, which may stimulate innovation. These ideas lie at the heart of wide-ranging research on national, regional, and sectoral systems of innovation.[6] As Charles Edquist observed:

> In the pursuit of innovation they interact with other organizations to gain, develop and exchange various kinds of knowledge, information and resources. These organizations might be other firms (suppliers, customers competitors) but also universities, research institutes, investment banks, schools, government ministries. Through their innovative activities firms often establish relations with each other and other kinds of organiza-

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[3] Paul M. Hirsch and James J. Gillespie, "Unpacking Path Dependence: Differential Valuations Accorded History across Disciplines," in *Path Dependence and Creation*, ed. Raghu Garud and Peter Karnøe (London, 2001), 69-90 ; and Franco Malerba, "Innovation and the Evolution of Industries," *Journal of Evolutionary Economics* 16 (April 2006): 3-26.

[4] William Lazonick, "The Innovative Firm," in *Oxford Handbook of Innovation*, ed. Jan Fagerberg, David C. Mowery and Richard R. Nelson (Oxford, England, 2004), 29-55.

[5] Douglass North, *Institutions, Institutional Change and Economic Performance* (Cambridge, England, 1990), 3.

[6] Bengt-Åke Lundvall, *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning* (London, 1992); and Edquist, *Systems of Innovation*.

> tions; therefore it does not make sense to regard innovating firms as isolated, individual decision making units.[7]

Successful interaction of this kind depends heavily on building shared understanding and perspectives, which in turn aids communication. A useful way of approaching this is through exploring the development of communities of practice. Jean Lave and Etienne Wenger formalized and developed this social learning theory during the 1990s; they based it on the experiential learning achieved within groups united by the shared passion for, and practice of, particular activities. Sharing history and experience brings with it free-flowing communication, which in turn fosters a creative and innovative solution to problems, often at the interstices of communities of practice.[8]

The idea of a "national system of innovation" that would bring together universities, industry, and government dates back to the nineteenth century; it was implemented as science became increasingly important to industrial innovation from the 1860s on. Businesses in Germany and the United States, where the R&D (research and development) departments of large firms in chemicals and electronics developed close ties with universities, enjoyed considerable inter-national competitive advantage.

The form that a system of innovation takes depends very much on the type of knowledge exchanged, whether predominantly tacit or formalized. This, in turn, depends on the industrial base, its needs, and the society in which it is embedded. Closer analysis of nascent nineteenth-century innovation systems reveals a key role for museum collections in those systems and in the development of originality of design. In this essay, we explore the emerging and changing role of museums and museum collections and their links to emerging ties between universities and industry from the mid-nineteenth century onward. We explore the forces shaping nineteenth-century experience of knowledge exchange in South Kensington, London, and Manchester. Factors include community-based initiatives, fears of foreign competition, the impact of the Great Exhibition on the role of collections in technical education, and changing attitudes toward art education. We explore the importance of personal networks, the development of innovation systems, and the implications of past practice for the contemporary role of museums.

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[7] Edquist, *Systems of Innovation*, 1.

[8] Jean Lave and Etienne Wenger, *Situated Learning: Legitimate Peripheral Participation* (Cambridge, England, 1991); Jean Lave, "The Practice of Learning," in *Understanding Practice: Perspectives on Activity and Context*, ed. Seth Chaiklin and Jean Lave (Cambridge, England, 1993), 3-32; Etienne Wenger, *Communities of Practice: Learning, Meaning and Identity* (Cambridge, England, 1998).

South Kensington in the Nineteenth Century: An Innovation System Based on the European Model

Museums of science and industry were a product of the industrial age; the Science Museum in London was founded in 1883. National science museums became a rite of passage to celebrate technological advance, as in the case of the Deutsches Museum in Munich, established in 1903.[9] By the 1920s, most industrial nations had museums of science and industry that celebrated the development of technology.[10] Such collections demonstrated more than national prowess, however. They provided links to the notion that the past informed the future, as John Elreth Watkins, the engineer curator of the Smithsonian, observed:

> The most remarkable trend of modern thought, notwithstanding the effervescent boastfulness of the nineteenth century, is an appreciation of the work done by those who have gone before. During this busy age of specialties in every profession, the active thinking men that can spare time from bread winning are engaged more or less in looking backward. Retrospection is surely the watch word of the modern philosopher, as was introspection of his medieval brother. In the world of applied science, no less than the domain of ideas, we must reverse our mental telescopes, if we are to measure at its full the glory of human achievement. To aid us in our investigations the excavator, the archaeologist, the ethnologist and the philologer are constantly at work.[11]

Watkins is clear, therefore, that history is crucial to the understanding and development of science in the twentieth century, and that over-specialization and the separation of areas of thought would constrain innovation. The original statute of the Deutsches Museum in Munich, outlined objectives as follows: ". . . to demonstrate the historical interaction of science, technology and industry to illustrate the most important stages of development by exhibiting eminent and characteristic masterpieces."[12]

Clearly, an aim of the Deutsches Museum was to build the prestige of engineering, so important to growing German prosperity, but there is also evidence of links among history, science, and technology. What if interdisciplinary thinking that places museums within systems of innovation pre-dates the science museums and links art collections to industrial and technological development? What were the nineteenth-century origins of this thinking, how did it come to be applied in

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[9] Wolf Peter Fehlhammer and Wilhelm Fuessl, "The Deutsches Museum: Idea, Realization and Objectives," *Technology and Culture* 41 (July 2000): 517-20.

[10] Neil Cossons, "Museums in the New Millennium," in *Museums of Modern Science*, ed. Svante Lindqvist (Stockholm, 1999), 3-15.

[11] Quoted in Arthur P Molella, "The Museum That Might Have Been: The Smithsonian's National Museum of Engineering and Industry," *Technology and Culture* 32 (April 1991): 237-63, quotation at p. 244.

[12] Quoted in Fehlhammer and Fuessl, "The Deutsches Museum," 517.

nineteenth-century South Kensington in London, and with what implications?

In continental Europe, the origin of the industrial museum dates back to 1794, with the Musée des Arts et Métiers in Paris. This collection of machines, models, tools, drawings, descriptions, and books was located in the craft and artisan area of Paris.[13] Museum collections, including art and textiles as well as machinery and crafts, were integral to technical and design education in France, Italy, and several of the German states, especially Prussia and Bavaria. This linked to distinctive education systems, especially exemplified in Lyon, where the mix of art and industry produced impressive results. Within this education system, exhibitions and museums were an integral part.

The knowledge of art, derived from fine art and historical textile collections, was key to originality and innovation. Creative textile design involved more than links between art and technology. It embraced chemistry, too, with knowledge of dyestuffs and their impact on textiles becoming of increased importance to design education in both France and Germany. This interdisciplinary approach therefore created an environment where museums were integral to education and the industrial system. A significant blurring of boundaries between art and technology was underway in Europe by the 1830s, but not in England.

The specter of foreign competition began to change attitudes. There was a growing realization that while Britain enjoyed a competitive advantage in the production of manufactured goods, this did not necessarily include their aesthetic design. The 1835 *Report from the Select Committee on Arts and Manufactures* highlighted the superiority of much Continental design, especially in textiles; the majority of English patterns were copied from the French. [14] This alarm call was a stimulus to the establishment of London and provincial schools of design and to a succession of government reports on design education to ensure that:

> Besides the class of designers whom it is the especial object of the schools in question to produce, it ought to endeavour to diffuse some degree of artistical knowledge among the numerous bodies of workmen. In foreign schools this is done in an admirable way which whilst it inculcates the necessity of educating designers as if they were to become workmen and educates workmen as if they were to become designers.[15]

Unusually for Britain in the mid-nineteenth century, the design school initiative received government funding of £15,000 per year and was

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[13] Dominique Ferriot and Bruno Jacomy, "The Musée des Arts et Métiers: Renovation Issues. 1988-1998," in *Museums of Modern Science*, ed. Lindqvist, 29-42.

[14] 1835 (598) *Report from the Select Committee on Arts and Manufactures*.

[15] *Manchester Guardian*, 20 May 1840, Foreign Schools of Design.

closely associated with a core role for museum collections.[16] The development and diffusion of innovative ideas normally requires a champion, someone influential within crucial networks who throws personal weight behind an idea.[17] Prince Albert fulfilled this role in championing the links between art and industry through museums. Awareness of Continental ideas about the links between art and industrial design training had been growing since the 1830s. Without the combination of the Great Exhibition in 1851 and the informed enthusiasm and personal network of Prince Albert, however, it is unlikely that the vision of South Kensington, with its integration of art and science museums, ever would have emerged in London. During the 1840s, Prince Albert chaired the Society of Arts and the Royal Commission for Decorating the Houses of Parliament. He was far from an honorary figurehead, bringing an exceptional grasp of the relationship between arts and industry. This, combined with his support for the idea of an international industrial exhibition, brought him into working contact with a range of men, including Henry Cole and Lyon Playfair (whose careers are summarized in Table 1), who were pivotal in transforming his vision for South Kensington into a reality.

A difficult, idiosyncratic individual, Cole was highly influential within Albert's inner circle and beyond. An early enthusiast for the Great Exhibition and involved in its planning, he was also founder of the *Journal of Design and Manufacturing*, in 1849, and, beginning in 1853, was joint secretary of the Department of Science and Art (with Lyon Playfair) and director of the South Kensington Museum. A German-trained academic chemist with industrial experience, Playfair was one of the most exceptional chemists of his generation. He completed his Ph.D. under Justus Liebig in Giessen, training that alerted him to the distinctive features of German scientific education. After Albert's death in 1861, these men remained driving (and at times controversial) forces behind the complex around the South Kensington Museum.[18]

The Great Exhibition of 1851 was an international showcase of industrial design and technology. It was unusually successful; it attracted six million visitors, leaving a surplus of £180,000.[19] This made it a financial catalyst for an imaginative initiative, which had within it all the elements of a system of innovation. Arts and science overlapped through organizations co-located around museums, based on the site of the original exhibition. The central idea was for a museum, modeled on the Musée des Arts et Métiers, to function as a college of arts and

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[16] Michael Argles, *From South Kensington to Robbins: An Account of English Technical and Scientific Education since 1851* (London, 1964).

[17] Everett M. Rogers, *Diffusion of Innovations*, 5th ed. (New York, 2003).

[18] Robertson, "The South Kensington Museum in Context: An Alternative History," *Museum and Society* 2 (March 2004): 1-14.

[19] Hermione Hobhouse, *Prince Albert: His Life and Work* (London, 1983), 82-93.

manufacture, but with a wide remit linking science, the arts, and industry in a creative way.[20] Although elements of Albert's wider vision did not materialize, the range of institutions, which eventually combined to form

TABLE 1
Summary of the Careers of Henry Cole and Lyon Playfair, 1840-1873

	Henry Cole, 1808-1882		**Lyon Playfair, 1818-1898**
1840	Assistant Keeper of Public Records	1841	Ph.D. in Germany with Liebig
1849	Established the *Journal of Design and Manufactures*	1841	Honorary Professor of Chemistry, Royal Manchester Institution
1851	Great Exhibition	1841-1845	Manager of James Thomson's Dye works (John Thomson, the calico printer who supported and financed the Manchester School of Design
1852	President of London Design School	1845	Chemist to the Geological Survey and Professor of Chemistry in the School of Mines and responsibility for the Museum of Practical Geology
1853-1873	Joint Secretary of Department of Science and Art	1851	Special Commissioner to the Great Exhibition
		1853-1858	Joint Secretary, Science and Art Department
1857-1873	Director of South Kensington Museum	1858	Chair in Chemistry, University of Edinburgh
		1868	Member of Parliament

Source: Robert H. Kargon, *Science in Victorian Manchester: Enterprise and Expertise* (Baltimore, Md., 1977), 16, 31, 88; Kenneth Dixon, "The Manchester School of Design and the Calico Printing Industry" (M.Ed., University of Manchester), 213; Obituary of Henry Cole, *The Times*, 20 April 1882; Hermione Hobhouse, *Prince Albert: His Life and Work* (London, 1983), 91; Bruce Robertson, ""The South Kensington Museum in Context: An Alternative History," *Museum and Society* 2 (March 2004): 1-14.

[20] Robertson, "The South Kensington Museum"; Hannah Gay, *The History of Imperial College London, 1907-2007* (London, 2007).

the South Kensington complex, is formidable as an interdisciplinary innovation system (see Table 2).

TABLE 2
Development of the South Kensington Complex, 1852-1909

Institution	Date Established
South Kensington Museum—The Museum of Manufactures (became Victoria and Albert Museum in 1899)	1852
Royal College of Art	1857
Natural History Museum	1864
Royal Albert Hall	1867
Royal School of Needlework	1875
Royal College of Music	Began 1883
Royal College of Organists	1903
Imperial College—amalgamated Royal College of Science, Royal School of Mines, and the City and Guilds College	1907
Science Museum—included Geology Museum (1835), Patent Museum (1857), The Museum of Scientific Instruments (1876), the natural history collections of the British Museum	Originally founded 1893 Amalgamations: 1909 New building: 1920s

Source: Robertson, "South Kensington Museum," 1-2; Trippi, Peter, "Industrial Arts and the Exhibition Ideal," in *A Grand Design—The Art of the Victoria and Albert Museum* (London, 1997). URL: http://www.vam.ac.uk/vastatic/microsites/1159_grand_design/index.php.

Drawing its initial collections from the Great Exhibition, the South Kensington Museum was the springboard from which this extraordinary development began. Especially noteworthy was the integration of advanced training in chemistry within the museum, which involved the blurring of the boundaries between arts and science, and among the

museum, education, applied research, and industry, so crucial to an innovation system.[21]

The priorities of the South Kensington Museum included instruction in science in industry and in drawings of fine arts as applied to industry. These reflected the priorities of Henry Cole (its first director, 1857-1873), his position within the Department of Science and Art, and the museum's relationship to government policy.[22] The central educational and research role of the museum was clearly a reflection of Continental practice, as outlined in many government reports. It also reflected a very different role for universities in the third quarter of the nineteenth century. The University of London, for example, was an examining body for external colleges rather than a teaching and research institution.[23] This reinforced the museum's educational and applied research role.[24] Lyon Playfair's direct role in the South Kensington complex was shorter than Cole's. However, he continued to campaign for the development of technical education and reform of universities to provide science and technology and better training for industrialists, as fears of foreign competition grew through the nineteenth century.[25] As an MP, he was also a key player in the late nineteenth-century educational commissions, which paved the way for Imperial College, which received its charter in 1907. The College was "to give the highest specialized instruction and to provide the fullest equipment for the most advanced training and research in various branches of science especially in its application to industry."[26] We have this description of South Kensington, written in 1871:

> South Kensington, incomplete as it is, has already done enough to stamp its character and insure the success of its destiny. What has been done? South Kensington has created buildings, marking a new epoch in architecture . . . has established gardens . . . has instituted a new Museum for the Arts and Sciences which millions consult and frequent, and to which is allied more than a thousand schools and classes for teaching the sciences and arts bearing on productive industry.[27]

The development of the South Kensington complex gathered momentum during the late nineteenth and early twentieth century, with the formation of Imperial College and the Science Museum within two years of each other, in 1907 and 1909, respectively. The interplay between science and the arts and among art, industry, and education did not

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[21] Robertson, "South Kensington Museum."

[22] Ibid.

[23] Michael Sanderson, *The Universities and British Industry, 1850-1970* (London, 1972).

[24] Robertson, "South Kensington Museum."

[25] Kargon, *Science in Victorian Manchester*.

[26] Gay, *History of Imperial College*, 58.

[27] Robertson, "South Kensington Museum," 9.

continue after Cole's retirement in 1873; by the turn of the century the Department of Science and Art was divided. When the South Kensington Museum became the Victoria and Albert in 1899, it focused entirely on art, and its industrial collections were largely in storage until the exhibition of Victorian and Edwardian decorative arts in 1952.[28]

Experiments in Manchester

Manchester, which lay at the commercial heart of the nineteenth-century Lancashire cotton industry, provides an interesting case study for exploring the role of museums in a regional innovation system during the Industrial Revolution. We must consider the origins of thinking in Manchester that linked art and industry before tracing the development of design education, where museum collections became vital resources—for example, the forces that undermined the links between the School of Design, founded in 1838, and industry. The Whitworth Institute was a grandiose scheme with strong echoes of South Kensington, yet many of its aspirations for linking art, industry, and innovation were stillborn.

The exchange of scientific knowledge during the Industrial Revolution occurred as a "bottom up" process, based on informal social contacts between scientists and industrialists through scientific societies, which sprang up in newly industrializing areas in the late eighteenth century.[29] However, the Manchester Literary and Philosophical Society, set up in 1781, was about much more than science. Discussions reflected links between art and industry, as well as between art and science, through the overlapping interests of its members. As Thomas Henry observed at the opening of the society:

> . . . a taste for the polite arts and especially those of drawing and design, should appear a desirable acquisition to the manufacturer of finer and more elegant wares. If not possessed of this, he is always dependent on others for patterns for his fabrics; whereas were he capable of inventing them himself he would possess considerable advantages over his less accomplished neighbours. His imagination would continually supply him with something new; and of what importance novelty is in these times of fashion and fancy, every day's experience furnishes convincing proofs. It is this supereminent taste that has distinguished productions of Wedgwood and Bentley above all competitors in the same line of

[28] Hobhouse, *Prince Albert*; Peter Trippi, "Industrial Arts and the Exhibition Ideal," in *A Grand Design: The Art of the Victoria and Albert Museum*, ed. Malcolm Baker and Brenda Richardson (New York, 1997), 79-*84*.

[29] Robert E. Schofield, "The Industrial Orientation of Science in the Lunar Society of Birmingham," in *Science, Technology and Economic Growth in the Eighteenth Century*, ed. A. E. Musson (London, 1972), 72-91.

> business. Such a taste would doubtless be equally beneficial to the manufacturer of fine cotton and silk goods of Manchester. [30]

Henry was also quite clear that industrialists, especially those involved in printing textiles, needed knowledge of science and art, and an ability to understand the applications of different elements of chemistry. However, ". . . the misfortune is, that few dyers are chemists and few chemists dyers. Practical knowledge should be united to theory in order to produce the most beneficial discoveries. . . . This was amateur science but seems to have been based on genuine exchanges."[31]

Not until the 1820s, and especially during the 1830s, prompted by the 1835 Select Committee, were the links among art, industry, and science captured in organizations within Manchester. The establishment of the Manchester School of Design in 1838 was "for the encouragement of the fine arts and those branches of mechanical science immediately connected with art."[32] The provincial design schools were a direct response to the government initiative to improve industrial design in Britain. In Manchester, the prime supporters were from high-quality calico printing, including James Thomson (who was the school's first vice-president) and engineers such as William Fairbairn.

For a number of reasons, including leadership, finance, and curriculum, links between art and industry were fragmentary and tenuous in Manchester during the nineteenth century, despite the establishment of the Design School. The appointment of a professional artist with no knowledge of calico printing as the first headmaster of the Manchester Design School was a poor move. A succession of headmasters with better industrial credentials replaced him. However, leadership of the school was by no means the only reason for the Manchester School of Design's struggling start; a combination of financial difficulties and tensions over curriculum made the early years difficult.[33]

Concern about developing the links between industry and art continued, however. In the 1840s, reports in the *Manchester Guardian* of a range of events initiated by the School of Design pointed to the way in which good art training for industrial design, as experienced in France, enhanced originality and the understanding of art and design processes. In an 1844 speech, George Jackson, honorary secretary of the Manchester School of Design, wanted to enhance the standing and importance of

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[30] *Manchester Guardian*, 21 Feb. 1838: Discussion of meeting to set up a Manchester School of Design.

[31] Kargon, *Science in Victorian Manchester*, 9.

[32] *Manchester Guardian*, 21 Feb. 1838.

[33] Moira Stephenson and Maureen Wayman, "The Relevance of the North West Textile Legacy to the Creative Industries of the 21st Century," paper delivered at "Regions as Reservoirs of Innovation" colloquium, Institute for Advanced Studies, Lancaster University, April 2007.

linking art and design. Pointing to the blurring of industrial and fine art in continental Europe, Jackson stated:

> The industrial arts must therefore be made the means, not only of educating public taste, but of teaching the elements of art to those who would soar to its highest end. What would be our national fame if we could produce a Michelangelo. . . . Did not this great man manifest and apply in various branches of production, that very knowledge of art that we should endeavor to convey?

Later in the same speech, he emphasized the importance of linking science and art in this process:

> In modern times, science has developed a means of execution and introduced materials unknown in their ages. . . . the arts ought not only avail themselves of these aids, but endeavour to assimilate their practice to increased facilities afforded to take advantage of the finer fabric and follow the chemist in his addition to our stock of tints and colours. Thus no sooner has science developed a new principle of action, than its requirements should be made known and art step in, seize the thought and add its beauty to it.[34]

The school's financial status was precarious throughout its early history, not least because of serious divisions among the calico printers. The founding of the school in 1838 coincided with a government bill to increase the length of copyright on patterns for calico printing, from three to twelve months. Two years later, a private member's bill followed, proposing a further extension from one to three years. This divided the Manchester calico printers' community. There were those (led by James Thomson) who saw their competitive advantage dependent on design training and protection of intellectual property. At the other extreme were those at the lower end of the market who relied on copying designs. The bitterness of the political dispute around copyright in the late 1830s and early 1840s undermined what little interest this second group had in design education.[35]

On the Continent, the approach to industrial design was holistic, from across industries; in Manchester, that was not the case. The specialized structure of the Lancashire cotton industry meant that, outside calico printing, there was little interest among cotton manufacturers, or even among dyers, in the design of the finished product. As a result, few alternative sources of funding existed within the cotton industry for buildings and other facilities. In addition, it is worth noting that, although calico printers constituted the largest category of students, by 1850 they represented only 15 percent of the 352 enrolled.[36]

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[34] *Manchester Guardian*, 4 Dec. 1844; Manchester School of Design: Special Conversazione Speech by Mr. George Jackson, honorary secretary to the Manchester School of Design.

[35] Dixon, "Manchester School of Design."

[36] *Manchester Guardian,* 11 May 1850, Annual Meeting of the School of Design.

In 1853, fifteen years after its foundation, the name of the School of Design changed to the Manchester School of Art; interestingly, this was partly at the suggestion of Henry Cole. Twenty years later, the gap between the school's original objectives and its later curriculum was enormous, as the author of a report in the *Manchester Guardian* suggests:

> The School of Design, in changing itself into the School of Art, did not change its name only; the change of nature was to due to a change of character. The school was founded with the special object of improving taste and educating skill in the art of decorative design, more especially of design for our local manufactures. This has so far ceased to be the principal objective of the school as it now is and for many years has been conducted that it can hardly be said to be recognized as a direct object at all. We do not know how far this change may have been due to deliberate policy on the part of the committee of management and how far a natural preference on the part of the teachers, but it also appears now at least to be thoroughly recognized and established.[37]

The Manchester School of Design is illustrative of the often-struggling development of the relationship between art and industrial design in a provincial city during the nineteenth century. It shows the range of forces inhibiting this vital element of the innovation system. What role did museums, objects, and exhibitions play in this process? Even before the Great Exhibition brought national and international prominence to the industrial arts, organizers presented a series of exhibitions in Manchester. These began at the Mechanic's Institution in 1837, and led to discussion of the benefits of exhibitions of both art and industrial objects and their possible links to the proposed new Design School:

> In a town like Manchester, such institutions [exhibitions] must be of greatest possible importance. There models of machinery of different kinds were exhibited in all their varieties; there the artisan and mechanic had the opportunity of seeing these models; everyone beheld there must attract his attention and might stimulate his ingenuity. From imitation some of the greatest of human achievements had been accomplished; for imitation led to comparison and comparison enabled us to take a portion of one structure and apply with advantage to another. All these great objects were more certainly and readily attained by means of a gallery of practical science. . . . How desirable it would have been to have possessed a gallery of art. It would have been preparatory and auxiliary to that School of Design which was now in contemplation . . . it was calculated to excite and call for the highest degree of genius and to add not only to our local elevation but to the national advantage.[38]

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[37] *Manchester Guardian,* 26 Dec. 1873.

[38] MM1/2, Minutes of Manchester Mechanics' Institution, 28 Feb. 1838 [held in Manchester University Archive].

There was, then, an early awareness in Manchester of the importance of museum collections, of both industry and art, for improving industrial design. This enthusiasm continued through the 1840s, culminating in the 1845 Exhibition, jointly organized by the Royal Manchester Institution and the School of Design. What was lacking was the kind of holistic and systematic approach linking museums' collections to schools of design found in developing industrial areas in continental Europe. By the 1880s, fears of foreign competition, which had been the spur to the select committee of 1835, were looming ever larger, frequently accentuating the shortcomings of technical education. Drawing heavily on Continental observation, the 1881 Royal Commission on Technical Instruction placed local museums at the heart of a reformed system:

> . . . amongst the most important means of stimulating industrial art education . . . is the foundation of local museums of applied art of such character as is best adapted to advance the industries of the districts in which they are situated . . . and advocated that the connection between these museums and the local schools of art should be of an intimate character.[39]

Drawing, no doubt, on the experience of South Kensington, the legatees of the engineer Joseph Whitworth embraced this thinking in an ambitious scheme for the Whitworth Institute, which began in 1888. The objectives and vision were not unlike those for South Kensington, and the 1881 Royal Commission clearly influenced them. The general objectives of the institute, which gained its charter in 1889, were to:

> . . . aid and direct the establishment, organization and development of proper means for the collection, exhibition and illustration of works of fine arts; the provision and development of a technical museum and school; the formation of a museum of commerce and manufacture; and to provide and maintain a woodland park and pleasure ground for the use of the public in connection with the Institute. The governors and members will appoint an executive council.[40]

The opening the following year heralded the institute as an ambitious departure and an important step toward a Continental system linking science, technical, and art education with museums. A fully integrated institute was short-lived, however, and by 1891 the Manchester Corporation had taken over the Technical College and College of Art. This left the Whitworth Institute "free to work in fine arts and their history and exhibits in any department and for the development of illustrations of mechanical and industrial arts and manufactured product."[41] This meant that although the origins of the Whitworth Art Gallery lay in its art and its textile collections, the ambitious institute never reached fruition.

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[39] Stephenson and Wayman, "The Relevance of the North-West Textile Legacy," 10.

[40] *Manchester Guardian*, 24 June 1889.

[41] Ibid., 2 May 1895.

This raises a number of questions. First, why did it prove so difficult to develop Continental-style models that truly integrated museums into a local education and, indeed, innovation system? Second, why did it prove easier to achieve such integration in South Kensington than in Manchester? Third, what were the consequences both immediate and into the twenty-first century?

Museums and Innovation Systems: Past and Future in the Twenty-First Century

The purpose of our historical review of the links between museums and innovation in the past was to trace and explain the forces shaping the role of museums in the nineteenth century. There was considerable variation in experience at both the national and regional levels. In continental Europe, in contrast with Britain, museum collections were an integral part of, and critical bridge among, art, technical education, and industry. In Britain, from the second quarter of the nineteenth century, a range of government-induced initiatives was inspired by a growing awareness of foreign competition. Personal networks were powerful in the development of the South Kensington complex. Royal patronage was important, as was boundary-crossing to build shared understanding. There were shifting priorities and activities within universities and museums across time. Regionally based efforts in Manchester demonstrate the more piecemeal experience in an industrial city, explained by a combination of financial, political, industrial, and educational contradictions.

History has a number of implications for the role of museums in contemporary innovation systems. Is the role of museum collections in innovation merely a feature of nineteenth-century industrial development, or does it have implications for the twenty-first century? What impact does experience with museum-industry engagement have for the twenty-first century? Finally, how does the role of museums relate to long-term changes in both industry and technology?

Museums and Innovation in the Twenty-First Century

It is all too easy to assume that the examples of museums within innovation systems are no more than relics of a bygone era, a feature of a period when industry was evolving from a largely craft base or when science and technical museums were symbols of national prestige. This would be to misunderstand both the function of the museum and the innovation process. Museums are an important and extraordinarily enduring part of our culture and civilization. In addition, the central purpose of a museum, in its underlying essentials, has hardly changed. Museums hold collections and reveal them to audiences. In addressing the role of science museums on the eve of the twenty-first century, Neil Cossons points to the extraordinary continuity of the function, if not methods, of interpretation in museums over a 250-year period.[42] Museum

[42] Cossons, “Museums in the New Millennium.”

collections, whether scientific or art, and their associated archives, represent a remarkable resource for research, including industrial research and modern digital technologies, by dramatically increasing accessibility.

Governments have shared a growing emphasis on creative industries as sources of innovation. The range of often-collaborative initiatives related to the digitization of art and textile collections serves as inspiration for the creative industries. For example, at the prompting of the Municipality of Prato, the Twintex Museums' project devised by the executive committee of the European Textile Collectivities Association included several European project partners (see Table 3).

TABLE 3
Partners in the Twintex Museums' Project

Museo del Tessuto di Prato, Italy
Centre de Documentaciò i Museu Textil de Terrassa (Spain)
Associação CCG/ZGDV—Centro de Computação Gráfica (Portugal)
Escola Profissional Cenatex Guimaraes (Portugal)
Amave, Associaçao de Municipios do Vale do Ave (Portugal)
Winchester School of Art, University of Southampton (United Kingdom)
ACTE—European Textile Collectivities Association

Source: Twintex Project website. URL: http://www.museodeltessuto.it/activities/project-archive.

This international partnership of textile museums, trade associations, fashion and design institutes, and documentation centers has the potential for an innovative knowledge exchange system. The underpinnings of the project include digital technology and the creation of what is described as a database of the DNA of European textiles, drawing on the archives, textiles, and clothing in museum collections. The prime objective of this project is to ". . . exploit the traditional know-how of each textile community in such a way to generate new inspiration and innovation [while] its innovative strength lies in its ability to set up European-wide interaction between the world of training, the world of industry and the world of culture."[43]

[43] Twintex Project website. URL: http://www.museodeltessuto.it/activities/project-archive.

The globalization of the textile industry and the movement of manufacturing offshore began to be felt in Britain in the 1970s and 1980s, and continued to gather pace elsewhere in Western Europe in the early twenty-first century. This has led to economic decline in such places as Catalonia, Portugal, and northern Italy, which had previously depended on textile manufacturing. This project represents an imaginative and innovative response to economic regeneration. It uses the textile legacy embedded in museum and business collections to develop inspiration for design for the fashions of the future. As such, it provides a platform for the development of innovative "new combinations" in fashion design.

The success of this project will depend on the development and maintenance of shared visions and perceptions among the different players in each region and internationally. To facilitate continued and sustained collaboration, the various parties met to draw up the Terrassa Charter in 2008.[44] This initiative is in sharp contrast to the typical role of museums and their relationship to industry, universities, and innovation revealed in Britain in the late twentieth and early twenty-first centuries. Links between the Science Museum and Imperial College in London remain strong. Yet, despite co-location there is a chasm of outlook and understanding between the science and technology institutions in South Kensington and the Victoria and Albert Museum, which began with the separation of the institutions' governance and objectives in the late nineteenth century.

The lack of overlap among museums, universities, and industry is sharper in the provinces. In the 1980s, when the staple industries, including textiles, had been in terminal decline for at least twenty years, one commentator observed that every week or so a museum opened. Many of these museums and their collections, far from being an inspiration for innovation, became a focus for nostalgia, so much so that: "hypnotized by images of the past we [risked] losing all capacity for creative change."[45]

While Robert Hewison exaggerated the stultifying effect of this upsurge of nostalgia, the gaps between the cultures of those working in museums, business, and, indeed, universities became ever wider. A complete analysis of the causes of this phenomenon is beyond the scope of this essay. Part of the explanation, however, may lie in the nineteenth-century development of provincial museums, such as those in Manchester. Whereas on the Continent museum and art collections were embedded in (and informed) industrial design education, this was not consistently the case in Manchester. Reflecting on museum-business relationships in Lyon, where art, science, technology, and textile design were inseparable in the nineteenth century, one Manchester museum director commented: "It's

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[44] ACTE Terrassa, Museu Nacional de la Ciència i de la Tècnica de Catalunya, [MNACTEC], 17 Oct. 2008.

[45] Robert Hewison, *The Heritage Industry: Britain in a Climate of Decline* (London, 1987).

interesting that those areas still have strong textile collections that are engaged with the Chamber of Commerce. Lyon (museums) are not run by the municipality but by the Chamber of Commerce and there is still that commercial engagement."[46]

One of the legacies of nineteenth-century experience in Manchester, especially of the quite short-lived union of art, design museums, and industry, was a widening gulf of understanding during the twentieth century. The analysis of the forces that increased this gap are worthy of further research. An important consequence is the considerable distance between the worlds of many of those working in museums (whether industrial or art museums) and those in universities and industry. Limited shared practice often inhibits diffusion of knowledge within and between organizations. This is because shared practice brings with it norms of behavior, language, and attitudes, which make communication and understanding easier. Consequently, in identifying the potential barriers to museums as part of regional innovation systems in twenty-first–century Britain, it is worth remembering that "innovative people tend to cluster, staying close to people who share their vision, understand their insights and advance their ideas."[47]

In discussing efforts to respond to the needs of the creative industries in the early 2000s, one faculty dean in Manchester was quite clear that there were what she called "silos" of knowledge within her university, among the university, the city, and museums and galleries:

> I think our idea is really based around collaboration and the spirit of collaboration because we've got silos within universities that we're trying to break out of and we've also got silos in terms of the university and the city. And I think what we're trying to do is to forge really sound relationships with the people in the city like the museums and galleries and also striking relationships or forging relationships with people in the city that are to do with business to do with the creative industries. So we recognize that in order to sort of get rid of this silo effect or silo mentality we've got to be able to join things up and at the minute things are very fragmented and they always have been.[48]

The museum director quoted above echoes that view:

> Sometimes institutions become barriers and the organizational structure of institutions and the traditions of institutions, what they used to do in the kind of railway track they're on can be an issue. But if you've got the individuals cross those boundaries its

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[46] Interview with a Manchester museum director, by Lorraine Johnston and Mary Rose, 2008.

[47] John Seely Brown and Paul Duguid, "Local Knowledge: Innovation in a Networked Age," *Management Learning* 33 (Dec. 2002): 427-37, quotation at p. 430.

[48] Interview by Lorraine Johnston and Mary Rose with faculty dean of a Manchester university, 2008.

> always, you know its individuals that make that difference. Whatever the rigid system is if you've got the right individuals you get breakthroughs.[49]

As the title of our essay implies, future design depends on understanding the past and combining it with present knowledge. The benefits for the creative industries and innovation of boundary crossing among art, science, and business are enormous, bringing the potential for truly disruptive innovation, as one Ph.D. student observed: "In my personal work I want to look at how to weave pixels, so how to use the fibres to create movement in the cloth. I know they have done it, Phillips are doing it . . . but you can't buy the cloth yet. UMIST is keen, I've talked to them and they've said they'd weave it but I have to get them a sample."[50] Clearly, achieving such potential gains depends on the ability to over-come the potential barriers to successful knowledge exchange.

Conclusion and Questions for Discussion

This is a preliminary essay in which we analyze the position of museums in systems of innovation. We use history to explore some of the differences between the role of museums in England in the nineteenth century and those in continental Europe. We sought to contribute to a range of historical debates around the international competitive advantage in industry and the role of museums in national and regional innovation systems. By drawing on contemporary experience, we explore how U.K. museums could learn from their Continental counterparts to become useful sources of innovation for creative industries. We raise a number of important questions for further discussion. First, how can historical awareness influence the development of new pathways to innovation? Second, how can an appreciation of regional variances contribute to innovation systems? Third, how can individuals acting as creative enablers facilitate changing pathways to innovation to prevent lock-in? Finally, museums and their collections are a potential source of innovation; how can governments, universities, and business take them more seriously to inform creative practice?

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[49] Interview by Lorraine Johnston and Mary Rose with museum director from Manchester, 2008.

[50] Interview by Mary Rose and Lorraine Johnston with Ph.D. student, Manchester Metropolitan University, 2008.