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THE NATURALIZED HISTORY MUSEUM

[in Peter Galison and David Stump, eds., *The Disunity of Science: Boundaries, Contexts, and Power*, Stanford; Stanford University Press, 1996, pp. 370-397.]

The claim of this paper is that a historically conceived semiotics is required to understand how science functions as a disunified enterprise. The disunity of science features prominently in recent discussions in science studies. Proposals of a heterogeneous and more fragmented picture in which experiment and traditions of instrumentation have lives of their own independent of the guiding hand of "high theory" have focussed on the sites of knowledge production — the laboratory and the agonistic field of scientific controversy — and they have emphasized the negotiated character of science in the making along with the instrument-and-practice-laden character of modern technoscience.[1] Whereas earlier work tended to de-emphasize the labor involved in creating instrumentation and in stabilizing and replicating experiment, newer accounts have insisted that the objects of scientific investigation are constructed and stabilized through instruments.[2] A closely related genre of recent studies has emphasized understanding the evidentiary context, the socially negotiated conventions and criteria for coming to local agreement about the outcome of experiments, their replication, and standards of competency, trust and evaluation.[3] These lines of research have foregrounded the division of labor and the differential distribution and dispersion of skill essential to scientific work. Studies arguing for an enculturation model of scientific work have stressed the economies of skill, attitudes, and values that must accompany the formal elements of mathematics, physical theory, and engineering principles in scientific work.[4] In such studies, theorists no less than experimenters are depicted as practical reasoners.

One of the consequences of such research is that the smooth integration of the different aspects of science taken for granted in theory-dominated accounts has itself become an object of investigation. Stress upon the heterogeneous, disunified structure of science, the practice-and-instrument-laden character of scientific work, and enculturation has left science studies struggling to account for the ways in which the work of theorists, experimenters, and technicians is locally coordinated. No less pressing is the need for an attack on the manner in which local contexts are multiplied in order to account for the striking capacity of science to capture supposedly universal features of the world.[5] Although considerations about language have always been part of science studies in one form or another some researchers have suggested that semiotics, another tradition stemming from linguistics, can usefully address such problems.[6]

The semiotic turn taken by recent science studies offers a promising route for addressing these issues — when it takes a particular direction.[7] The kind of semiotics we have in mind, and which we attempt to illustrate below, is practiced by scholars with

an interest not in essences and deep structures but in tangled and layered political and economic histories and the way they become naturalized by signs. Such studies stress both the material and the contested nature of signs and avoid arid formalism by insisting upon historical accidents and contingencies. The main strategy of this research is to trace the construction of meaning through the configuration of chains of signifiers linked metonymically and metaphorically and fused together through complex narratives constructed by contentious constituencies and adapted to particular social struggles. Inscribed into the social imaginary through technologies of writing, photography, film, museum exhibits, teaching materials and guidebooks, these are struggles to define both society and nature.

This essay focuses upon the historical construction of signs and their simultaneous political and cognitive roles. We intend to demonstrate that the power of a sign, a representation, or an interconnected set of representations to support scientific work is not merely a function of their own internal logic but also of their capacity to forge rhetorical links to representations in other domains by drawing upon metaphor as well as repertoires of tropes and narrative structures.[8] In what follows, we explore the manner in which “nature” comes to stand as the author and legitimator of socially constructed practice through such fashionings of politically and ideologically freighted images of natural order.

In the nineteenth century, professional curators and staffs of scientific specialists financed by state and municipal governments edged out of the field the gentlemanly collector of rarities who displayed treasures in a Wunderkabinet; public museums of natural history replaced private cabinets of curiosity. These new museums embodied a number of purposes. Certainly the urge to preserve and exhibit rarities--the motives associated with the wonder-cabinets--was not altogether unfamiliar to the early natural history curator. But, more importantly, these museums were intended to educate their visitors. Although written in 1958, the following discussion by Lothar Witteborg, Chief of Exhibitions at the American Museum of Natural History, epitomizes the norms followed by the directors of most natural history museums throughout the nineteenth century:

Specimens, reconstructions, and processes should be exhibited because they have the authentic power to open the visitors' eyes to the movement and meaning of the stream of life. The natural history museum should take elements from nature and from life itself along with the theories, concepts, and philosophies achieved through scientific research, and combine them all into a meaningful presentation which tells a story. Within this basic philosophy it is the job of the museum designer and exhibit specialist to arrange the material into an aesthetically pleasing exhibit.[9]

In Witteborg's view, which follows the nineteenth century tradition, the museum is a window onto nature, a microcosm standing in for the macrocosmic stream of life. To illustrate and to reflect nature, Witteborg assumes that within the walls of the museum elements "from life itself" are pieced together by science into a meaningful representation. But what is being represented in an exhibit? Whose nature is being

depicted? Witteborg further urges that a good exhibit should tell a story, and an aesthetically pleasing one at that. But what role should narrative, rhetoric and aesthetics play in the depiction of nature with scientific tools? Most interesting is the author's claim that the museum exhibit has the "authentic power" to open a viewer's eyes to nature. What gives the representation its authenticity? The following examines two sets of events in museum history, connected with the establishment of the British Museum of Natural History in South Kensington and the American Museum of Natural History in New York, in order to suggest some answers to these questions.[10]

Museums and Tourism: Producing Authenticity

An 1833 entry in Ralph Waldo Emerson's journal records one nineteenth-century viewer's reaction to a natural history exhibit. Still known as a "cabinet," the Jardin des Plantes in Paris elicited this from an American tourist in Europe:

I carried my ticket . . . to the Cabinet of Natural History in the Garden of Plants. How much finer things are in composition than alone. 'Tis wise in man to make Cabinets. When I was come into the Ornithological Chambers, I wished I had come only there. The fancy-coloured vests of these elegant beings make me as pensive as the hues & forms of a cabinet of shells, formerly. It is a beautiful collection & makes the visitor as calm & genial as a bridegroom. The limits of the possible are enlarged, & the real is stranger than the imaginary. . . . Ah said I this is philanthropy, wisdom, taste--to form a Cabinet of natural history. Many students were there with grammar & note book & a class of boys with their tutor from some school. Here we are impressed with the inexhaustible riches of nature. The Universe is a more amazing puzzle than ever as you glance along this bewildering series of animated forms--the hazy butterflies, the carved shells, the birds, beasts, fishes, insects, snakes--& the upheaving principle of life everywhere. . . . I am moved by strange sympathies, I say continually "I will be a naturalist." [11]

As the presence of tutor and students attests, the exhibit is evidently held to be educational, but this quality takes on a very specific form. For Emerson, the museum exhibit is superior to the direct experience of nature. By its selection, juxtaposition, and ordering of elements ("how much finer things are in composition than alone"), the museum exhibit, though a fragment, evokes the experience of nature's meaning and variety more completely than would the thing itself. The exhibits do not provide nature itself but rather icons for meditation and study. Nature, as Emerson often declared, is a text, a sign to be read most conveniently within the frame of the exhibit hall. Emerson hints at the spiritual truth he locates in the exhibit: the artificial plenitude of the cabinet witnesses to a prelapsarian fullness and variety in nature--"the limits of the possible are enlarged"--and he stands as a new Adam, with all the world before him, contemplating a restored Garden of Eden.

Emerson's thoughts on the collection betray something more than these moral and spiritual truths, however. The bridegroom of Emerson's diary who calmly gazes at the

scene before him is genial in anticipation of more intrusive pleasures to come. Adam stands poised, ready to take possession of his garden. The museum provides a vantage point, a prospect from which he can command nature.[12] The production of desire for a certain approach to nature is the ultimate effect of the collection Emerson views: "I am moved by strange sympathies, I say continually "I will be a naturalist."

Emerson comes to Europe, then, as a tourist and a consumer of natural history. The two phenomena--tourism and natural history--are not unconnected. Indeed, the growth of foreign travel is contemporaneous with the development of public museums of natural history. Even today, museums such as the British and American Museums of Natural History are major tourist attractions. At a deeper level, too, museums and tourism are connected: they both signify the "authentic."

If we consider further, the production of authenticity through signs is as true of tourist sites as it is of museums: authenticity in touristic experience is not simply there for the taking. In discussing the "semiotics of tourism," Jonathan Culler argues that the reflective tourist learns there is no unmediated, original experience of another culture.[13] Though any spot in London could read "London," by virtue of its mere location in that city, not all such sites are notable as tourist attractions. What the tourist in search of the true London experience encounters is a site turned into a sight: a place marked as authentic--as "worth a visit" or "worth a detour"--by previous travellers. The "real thing," the authentic, must be marked as real and sight-worthy; some sites are, in fact, made more representative than others by the very labor of marking them. Culler points out that reproductions and representations--"markers" in the form of plaques, souvenirs, postcards, guidebooks, and videotapes--create the original. In short, without the markers there is simply no "there" there. In the case of tourism, the existence of markers is what makes the thing marked a recognizably original and therefore real thing.

Tourism, in effect, makes a place into a museum, its markers framing the sights that deserve notice as if placed in an exhibit hall. And just as in an exhibit hall, the aim is to have the viewer look past the marker and see only the thing marked. For the touristic experience to be authentic, it should be perceived to be unmarked: it should be found "off the beaten track" or remain "unspoiled." But even if the tourist explores such a place, its authenticity does not result from the absence of markers; the markers are simply of a less obvious, more sophisticated sort. The "dilemma of authenticity," as Culler observes, is that authentic sights require markers to be recognized as authentic, but our notion of the authentic is the unmarked or unmediated: "We want our souvenirs to be labeled 'authentic native crafts produced by certified natives using guaranteed original materials and archaic techniques' (rather than, say, 'Made in Taiwan'), but such markers are put there for tourists, to certify touristic objects." [14] Ideally, then, markers should remain silent, not calling attention to themselves as such.

An example from the early work of semiotician Roland Barthes can help explain the silencing characteristic of markers, or in his terms, signifiers. In a barbershop, Barthes is handed a copy of Paris-Match, featuring a cover photo of a black soldier saluting an unpictured tricolour. Barthes explicates this sign, in the context of its association with a

popular magazine and its placement in the everyday space of a barbershop (rather than, say, at a political rally), as indicating the greatness of the French empire: all her sons serve faithfully under her flag without any racial discrimination.[15]

In the construction of this signifier, wide and complex histories, including the biographies of both the soldier and the empire he serves, have been silenced and turned into natural states. Even more: once this transformation "from history to nature"[16] has been accomplished, the signified becomes a reference that establishes French imperialism; the sign of the photograph "naturally" evokes the concept. The signifier thus gives foundation to the signified; it helps to produce and reproduce it through naturalization. In the case of natural history museums, such signifying practices amount to the very production of nature: museums produce nature with their storage rooms, laboratories, and staffs of taxidermists, artists, and curators. And they produce it in the light of specific interests. To analyze and deconstruct the semiotics of this kind of museum is to account for the naturalization of the history of nature production--a history involving, among other things, politics and economics.[17]

Richard Owen and the Invention of the Dinosaurs

The controversies connected with the construction of natural history displays for the 1854 Crystal Palace exhibition at Sydenham and the design of the British Museum of Natural History provide a glimpse into the processes at work in the naturalizing of natural history. The exhibits of interest here were reconstructions of fierce looking dinosaurs, built by Benjamin Hawkins under the direction of Richard Owen. As Adrian Desmond has shown, the dinosaurs as an order were literally invented in 1838-41 by Owen, the "Cuvier of British Comparative Anatomists" and director of the London Zoological Museum at the time.[18] The story turns around the notion of evolution--but not Darwinian evolution. Owen's defensive invention of the dinosaur took place during the late 1830s and 1840s when the threat was not Darwin's theory but Lamarck's notion of evolution--much more dangerous in its association with radical social and religious reform.

The period had many radical sects; the social and political uses made of science by one leading educational reformer, Robert Owen (no relation to Richard), illustrate the kind of threat Richard Owen's dinosaurs were armed to combat. Crucial to Robert Owen's rationalist, progressive reforms was a belief in the perfectability of humankind and the self-organizing power of matter according to natural laws, joined to a faith in the environment as a determinant of form and character. Owenites believed that through the appropriate social and material environment, humanity's spiritual qualities could be molded as a prelude to political change.

Lamarck's evolutionary theory provided a useful and necessary supplement to this environmentalist position. In his *Philosophie Zoologique* of 1809, Lamarck had argued for an ascending scale of animals increasing in complexity without gaps or breaks between each level. Lamarck maintained that organic matter and individual animals have innate drives to complexity, so that each generation will produce a successor generation

infinitesimally more complex than its progenitor. The increase in complexity is made possible by the inheritance of acquired characters. According to Lamarck, changes in the environment--in climate, nutrition, or social organization--induce new habits in the organism. The nervous fluid stimulates the development of new structures to accommodate these new habits.

Relying on Lamarck's theories, newly available in a 1831 English edition, Owenites projected a cooperative society in which egalitarianism, female emancipation, secularization, and educational institutions called "halls of science" would be central. Lamarckian biology, with its emphasis on progressive transmutation, supported the Owenite socialists in their accounts of mankind's progress from barbarism to civilization.[19]

The social consequences of Owenite views were apparent to the Anglican authorities. Opponents of Lamarckism in the 1830s attacked the central premise that nature had inherent powers of organization and argued that social and natural change emanated from above. For the Anglican hierarchy, judicial and natural law were divinely sanctioned. Richard Owen's treatise, "Report on British Fossil Reptiles," a speech delivered in two parts to the British Association for the Advancement of Science in 1839 and in 1841, in which he coined the name "dinosaur," was informed by the concerns of the Anglican dons who had taken control of the BAAS in the late 1830's.[20] The BAAS supported Owen's work with ample funding in 1838 and awarded additional funds upon its completion in 1841.

Before unveiling his dinosaurs, Owen demolished the Lamarckian transformationist position, represented by Etienne Geoffroy Saint-Hilaire and the materialist Robert Grant, who had claimed the gigantic saurians--ichthyosaurs, plesiosaurs, and teleosaurs--had been transformed in a series of evolutionary steps from crocodiles. Owen used the stratigraphical record to show that the ichthyosaur retained its character unchanged throughout the immense succession of Mesozoic strata, and that it emerged and disappeared from the strata suddenly. Moreover, throughout these expanses of time the species of teleosaurs, ichthyosaurs, and plesiosaurs had remained completely distinct. Even worse for the Lamarckian transmutationist camp, teleosaurs, supposedly the highest forms in the reptilian group, had disappeared in the Oolitic (our Jurassic) era, before the lower ichthyosaurs and plesiosaurs, which both persisted into the Cretaceous era. The Lamarckian interpretation did not hold, Owen argued, for "if the present species of animals had resulted from progressive development and transmutation of former species, each class ought now to present typical characters under their highest recognized conditions of organization." [21]

Owen's final onslaught came in unveiling his analysis of his new creatures, recreated from fossil evidence: the iguanodon and the megalosaurus. Among the anatomical peculiarities of these species was their possession of five fused vertebrae welded to the pelvic girdle, ribs, and extremities with hollow longbones, which "more or less resemble those of the heavy pachydermal Mammals, and attest to the terrestrial habits of the species." [22] By 1868, T.H. Huxley, looking for "missing links" between classes of

animals in defense of Darwin's theory of macroevolution, would focus on the three-toed character of the fossil hind-foot of the iguanodon, which he would argue, was bipedal, an evolutionary forerunner of the birds. But Owen wanted to make the dinosaurs proto-mammals: "prophetic types" of mammals, placed by the Creator on the earth as precursors, the relation between the two analogous to the typological relation between the Old and the New Testaments. Indeed Owen's dinosaurs looked something like rhinoceri and elephants. He made this last step by arguing even more tenuously, speculating on physiological and ecological grounds that since dinosaurs have the same thoracic structure as crocodiles, their degenerate relatives, they may be assumed to have had four-chambered hearts like the Crocodilians, "and enjoyed the function of such a highly organized center of circulation in a degree more nearly approaching that which now characterises the warm-blooded Vertebrata." [23]

Owen was lionized for his achievement by the Anglican scientific clergy, receiving 200 of the 300 pounds available from the Civil List for 1842--in addition to the support he received from the BAAS. Roderick Murchison praised Owen for having completed "Cuvier's temple of nature" with English building materials, while Lord Francis Egerton marvelled that Owen's fossil animals were "pregnant with the proofs of wisdom and omnipotence in their common Creator." [24] Owen's dinosaurs had, at least temporarily, vanquished the Lamarckian evolutionists from the scientific field. Furthermore, at the



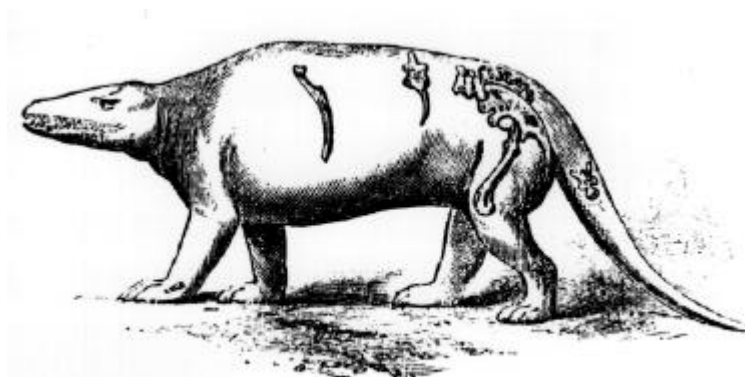
Crystal Palace exhibition of 1854, these creatures stalked, long-legged, into the fray to reveal God's order in the popular mind as well. Heralded by ominous warnings in the press about invading monsters, the life-size restorations



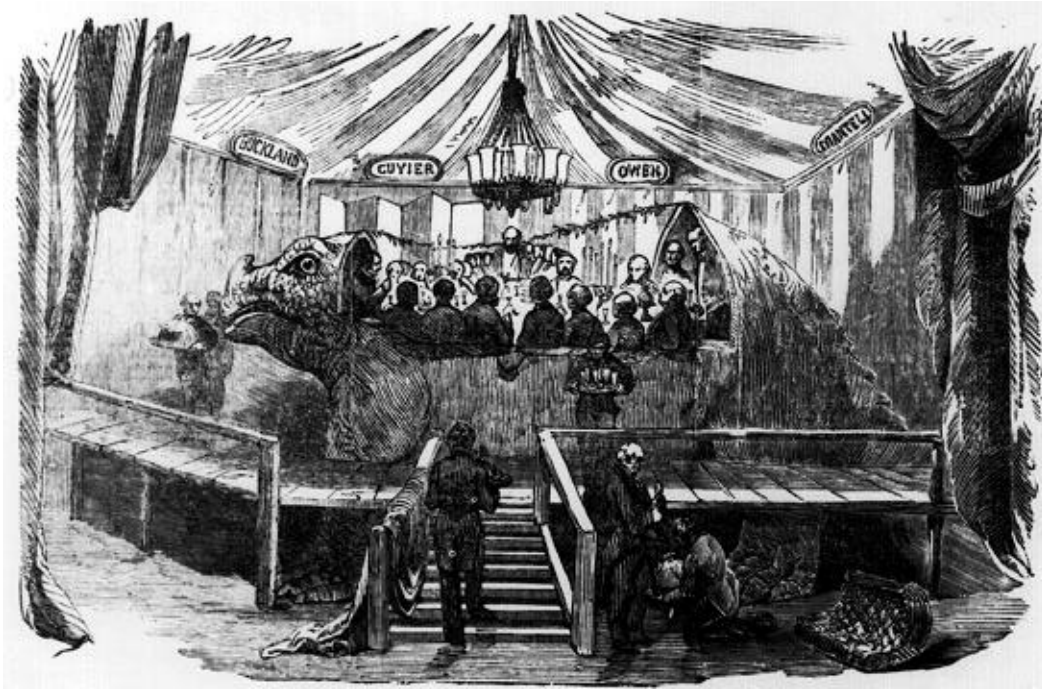
[Figures 1 and 2] at the Sydenham Crystal Palace gardens, installed on islands in an artificial lake, formed a hugely popular attraction. Opened by Queen Victoria to an audience of 40,000, the exhibit was drawing trainloads of spectators within a few months. These enormous markers pointed to a mythic nature; though their originals were absent, invisible, non-existent--in fact never-existent--the markers naturalized a historically constituted order.

Owen's guidebook to the exhibits, available to visitors for threepence, served as an additional term in this signifying system. In a semiotic regression, the guidebook--a marker directing tourists to the sight-worthiness of the Crystal Palace attraction--helped to authenticate the dinosaur exhibits, which themselves marked an absent "nature." The exhibits were massive, distant, frightening in the

controlled way that a roller coaster at an amusement park is frightening: offering no real danger, just a tantalizing thrill. The printed book that guided tourists through the exhibit functioned as a marker for these markers; where the exhibits' surprising surfaces prevented the distant viewer from penetrating their mysteries, the guidebook--ostensibly only a retrospective description of an antecedent reality--in fact offered authenticating depth, featuring diagrams of the skeletal structures of the creatures and positioning within these illustrations the fossil origins of the reconstructions [Figure 3].



These illustrations remind us of a crucial aspect of the reconstructions: befitting the original Crystal Palace exhibition's emphasis on products of industry, they were entirely manufactured, not, in a strict sense, re-constructions but constructions of Owen, Hawkins, and others. One thirty-five foot iguanodon was fashioned from four thick iron columns, 600 bricks, 650 drain tiles, 900 plain tiles, thirty-eight casks of cement, ninety-eight casks of broken stone, and one hundred feet of iron hooping.[25] There was no fossil trace on view anywhere in the exhibit. The guidebook illustration suggests that the fossil was imbedded in the interior of the construction, but in fact the massive object was hollow



inside, suitable for dinner parties [Figure 4]. [26] How in the face of this evidentiary void was the authenticity of the reconstructions to be established? The problem helps explain the guidebook's obsession with origins. In offering signs of the extinct past, Owen continually gestures toward source and origin, the supposed signified behind the signifier. The pamphlet opens,

before entering upon a description of the restorations of the Extinct Animals, placed upon the Geological Islands in the great Lake, a brief account may be premised of the principles and procedures adopted in carrying out this attempt to present a view of part of the animal creation of former periods in the earth's history. [27]

Before the beginning of the tour, then, are inserted the specialized theory and practices that generate and authorize the exhibits. The authority of science is summoned to authenticate the constructions, and in the naturalizing process science itself is reciprocally endorsed. Moreover, the guidebook follows a revealing pattern in introducing each of the exhibits: first comes a detailed account of the origin of the fossil upon which the constructed dinosaur is based, complete with the name of its discoverer and the place it

was found, as well as any later accidents which befell it, followed by its present location in a museum or other collection. This written account invariably includes another gesture toward origins: it gives the etymology, in ancient Greek, of the recently coined name of the extinct species.[28] Within this collection of references to origins of different kinds--what one might call the rhetoric of authentication--Owen's quotations of *Paradise Lost*, the major English poem of primordial origins, find a place. Gillian Beer has argued that Milton's poem, one of Darwin's favorite books and common cultural currency among the Victorian educated classes, provided Darwin with an imaginative resource to conceive, stabilize, and naturalize his evolutionary arguments within a reassuring symbolic context of continuity and tradition.[29] Judging from the poem's appearance in Owen's pamphlet, such deployment of Milton's text and its associations was not unprecedented.

Constructing the New Museum

The Crystal Palace dinosaur exhibit was not the last of Owen's efforts to offer the public such prospects of restored nature. A few years later, he participated directly in the design of the British Museum of Natural History in South Kensington, a project which he proposed to his friend, Prime Minister William Gladstone. During most of his curatorial career, Owen's collection was housed in the inadequate, cramped space of the British Museum. Public debate on the creation of a new museum, purpose-built for natural history displays, extended over several years; Owen entered the discussion with a pamphlet entitled *On the Extent and Aims of a National Museum of Natural History*, written in 1862 to promote the project. In this proposal, Owen declares that in an ideal world, perfect knowledge of nature would be acquired by direct, unmediated experience:

even such as was the Paradise in which Adam, as sung by our great poet,
Beheld each bird and beast
Approaching two and two; these cowering low
With blandishment, each bird stooped on his wing.
He named them as they passed and understood
Their nature; with such knowledge God endued
His sudden apprehension.[30]

But Milton's account of Adam's understanding of nature applies only before the Fall. Owen's postlapsarian world becomes "a grand Natural Museum" solely "to the loving eyes of the geological, botanical, and zoological observer";[31] recalling Emerson's desiring consumer of natural history exhibits, the gap in understanding must be filled by desire, produced by a scientific approach to Nature. Owen continues:

Under other and harder conditions we strive to regain that knowledge, needing, and urgently seeking for, every collateral aid in the struggle to acquire that most precious commodity--the truth as it is in Nature, and as manifested by the works of God.[32]

The chief collateral aid Owen advocates is a national museum of natural history. The material world, restored by scientific understanding, would reveal the wisdom and purposes of God. In Owen's view, therefore, a natural history museum should display and make evident the divine rationality of creation. Very often, the objects for which Owen wants adequate display room are huge: whales, elephants, rhinoceri, dinosaurs. As he argues for increased space for his collection--45,000 square meters, or five acres, would just about suffice--his interest as the likely director of this grand institution may seem obvious; he protests, however, that "the larger the Museum, the greater the cares of the Curator." [33] Instead, he continually emphasizes the need to appeal to a wide, popular audience through the sheer size of the exhibits: to shift initial affective responses of awe and wonder to appreciation; to replace the naive sensibility with a cultivated one that would resemble Adam's original understanding of all creation. In this effort, he ventures, the dinosaur exhibits are irreplaceable:

It is the common experience of officers of National Museums that no specimens of Natural History so much excite the interest and wonder of the public, so sensibly gratify their curiosity, are the subjects of such prolonged and profound contemplation, as these reconstructed skeletons of large extinct animals. [34]

Fortunately, such important exhibits are also economical:

A fossil bone and a coloured plaster-cast of it are not distinguishable at first sight, scarcely by sight at all. The artificial junction of a series of casts of the bones of an unique fossil skeleton, produces a result equivalent, for all the purposes of public exhibition, to the articulated skeleton itself. Thus every capital in Europe, the Public Museum of each civilised community, may show to the people the proportion of the creatures of former worlds that science has so restored. [35]

Fossil dinosaur exhibits, in short, are a curator's dream. Unlike such rareties of nature as gemstones, they can be mechanically reproduced from a single fossil and still retain the trace of the original that seems to authenticate them. The potentially unlimited possibility for multiplication of these signs allows Owen to imagine, with an entrepreneurial air, reciprocal interchange of extinct animals such as his own reconstructions, resulting in "co-adjusted frameworks" among international museum partners. Given the wealth of his own collection, supplied by generous grants from Parliament, [36] Britain's position as a potential trading partner could be a strong selling point in a bid for an enormous museum.

But the goal of such a museum, Owen insists, is not to gratify vulgar tastes for size and strangeness but to inculcate "an appreciation of the perfect fitness of the thing to its function" through setting forth "the extent and variety of the Creative Power, with the sole rational aim of imparting and diffusing that knowledge which begets the right spirit in which all Nature should be viewed." [37] Later in his proposal, Owen expands upon this theme: "The most elaborate and beautiful of created things--those manifesting life--have much to teach, much that comes home to the business of man, and to the highest element of his moral nature." [38] Owen believes that "contemplating the extent, variety,

beauty, and perfection of Creative Power" in a museum which completely epitomizes Nature will have a "humanizing and ameliorating effect" upon "the people of a busy and populous nation." [39]

This result can best be achieved through an ongoing educational effort on the part of the museum curators, in designing exhibits, lecturing to the public, and the like. Central to Owen's goal is the spatial organization and architecture of the museum itself: he proposes a central rotunda of glass and iron that would

serve for the reception of an Elementary Collection illustrating the characters of the Provinces, Classes, Orders, and Genera of the Animal Kingdom, and also for the Collections of the Natural History of the British Isles. An Exhibition-room of a circular form is that which admits of the most effective and economic supervision; and the series of specimens there proposed to be displayed are of a nature that would be most profitably shown to, and studied by, the wage-classes after the hours of work. [40]

The classes upon whom the museum's panopticon-like ameliorating effect might be most valuable are here explicitly named. But Owen hopes that the proposed museum will serve others as well:

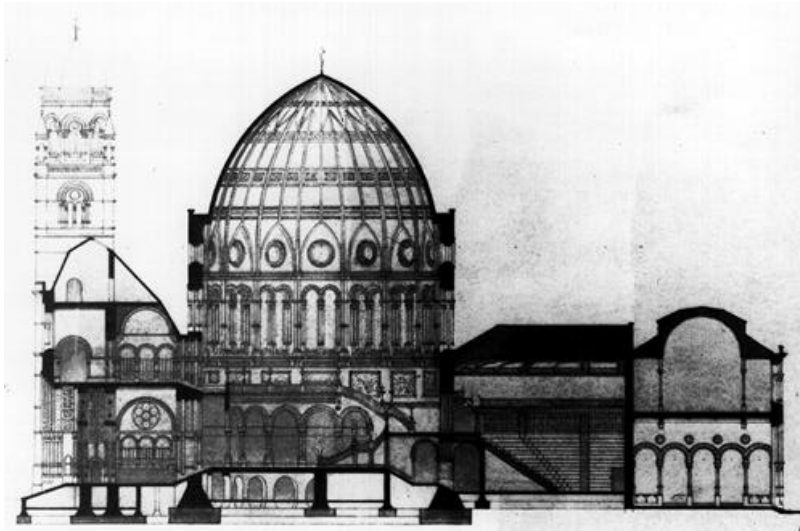
the local collector of birds, bird-eggs, shell, insects, fossils, &c.,--the intelligent wageman, tradesman, or professional man, whose tastes may lead him to devote his modicum of leisure to the pursuit of a particular branch of Natural History,-- expects or hopes to find, and ought to find, the help and information for which he visits the galleries of a Public Museum. [41]

A national museum, then, would serve as a meeting point for a range of social classes, from low to high bourgeois. In focusing on the natural history of Britain, it would promote national awareness and pride. The representation of Great Britain to itself--with an insistence on its power and wealth--emerges as a resounding note in Owen's pamphlet:

The greatest commercial and colonizing empire of the world can take her own befitting course for ennobling herself with that material symbol of advance in the march of civilisation which a Public Museum of Natural History embodies, and for effecting which her resources and command of the world give her peculiar advantages and facilities. [42]

"Resources and command of the world," commerce and colonization: the register of discourse in which natural history was embedded from the beginning of the nineteenth century is here explicitly named. For the British, as for the French and Dutch, the period between 1780 and 1830 saw massive expansion both of empire and of museum collections. Contemporaries were quite clear about the importance of colonial and military conquests for their collections. The size of a nation's museum was an index to its colonial power. The political might and extent of the nation empowered the eye that ranged over the framed view of nature.

Owen was eventually awarded his museum, though the realized edifice differed somewhat from his plan. In the envisioned design for the building, intended as a sanctuary "revealing the advances of the science,"[43] Owen and architect Francis Fowke used



Romanesque elements to suggest a huge domed cathedral [Figure 5],[44] a place to worship God through nature. When various constraints forced the abandonment of Owen's beloved rotunda, in its place

Alfred

Waterhouse, who took over as architect after Fowkes died in 1868, designed a rectangular cathedral nave along the lines of German Romanesque churches, with triforia above and arcades below, opening into a series of side chapels designed to enshrine the Elementary Collection. Overhead Waterhouse replaced the Romanesque vault with a roof of glass and iron, unmistakably recalling the architecture of a Victorian railway terminal.

To reach the upper galleries from either side, Waterhouse inserted a spectacular bridge, reminiscent of one of the great



railway trestles of the British Industrial Revolution. [Figures 6 and 7] The building thus synthesized the major European public architectural modes, both sacred and secular, to celebrate the march of national progress.



The outside of the building contributed to the educational function of the collections it housed. Covered entirely in ornamented terra cotta [Figure 8], the facade's rich decoration featured, in place of gothic gargoyles, models of monkeys, dodoes, and extinct animals such as gryphonesque saber-toothed tigers and sphinx-like pterodactyls. Avoiding any suggestion of Lamarckian transmutation, all were arranged in carefully separated niches rising up the walls of the museum, starting with marine life at the bottom and reaching to the parapet crowning the main entrance, over which were originally intended to stand statues of Adam and Eve. Perhaps as a corrective to Owenite feminism, Eve was eventually dropped from the design. Adam remained alone atop creation.

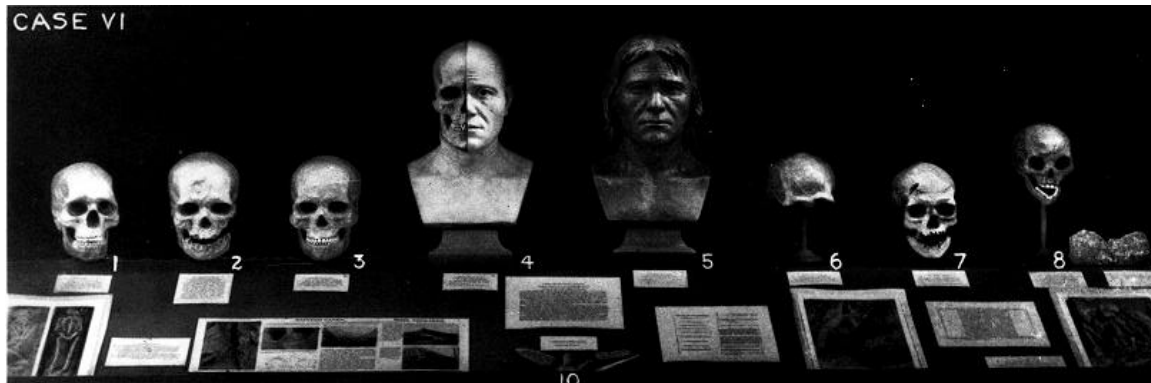


Our purpose in examining the relationship between important points in the history of evolutionary theories and the museums in which these theories were constructed has been to interrogate the claim we started with, Witteborg's notion of the natural history museum as a site of authentic representation of nature. For our final example, we shall turn to Witteborg's own institution, the American Museum of Natural History in New York City. The exhibits in this museum were constructed by paleontologists, taxidermists, and artists who accepted evolution--though not Lamarckian or Darwinian evolution. The people who built this museum had a different set of motivations for their work.

Cro-Magnon and the Modern Threat

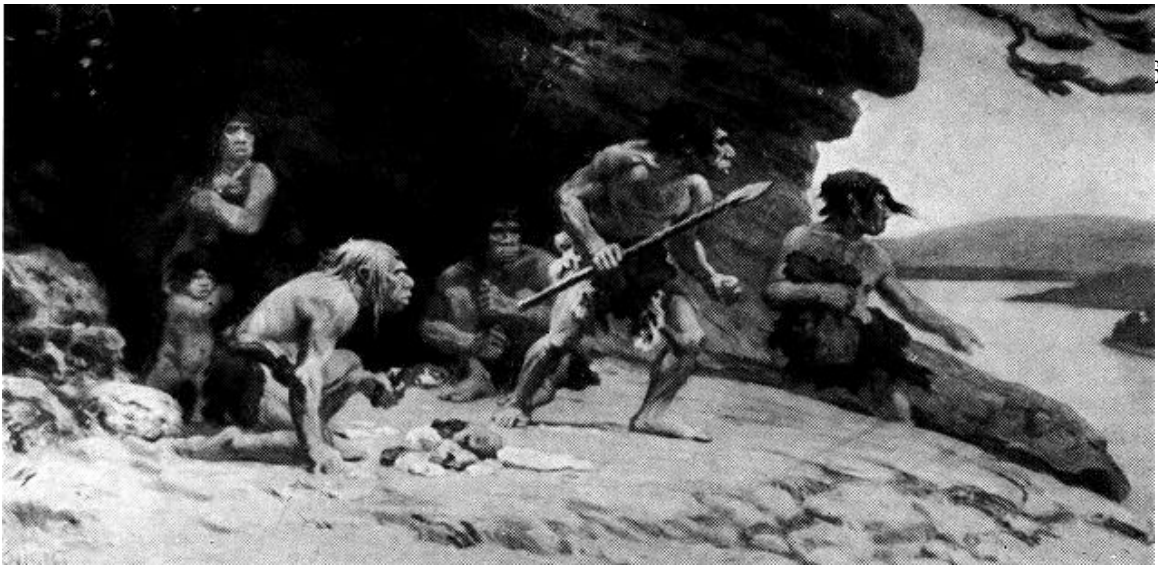
Donna Haraway and Ronald Rainger have provided detailed studies of some aspects of the construction of the American Museum and the interests it was intended to serve.[45] The founders of the museum, which was incorporated in 1868, included the father of Theodore Roosevelt, Henry Fairfield Osborn, J. P. Morgan, William K. Vanderbilt, Madison Grant, and John D. Rockefeller III: all philanthropists and supporters of science in the Progressive era, conservationists, and proponents of "the rational management of capitalist society." [46] The function of the museum they endowed was, not surprisingly, to educate. Its educational message was literally inscribed in the museum's monument to Theodore Roosevelt, the president of the most powerful nation of the industrial age, a man who had found himself as a youth and constantly renewed himself as an adult through combat with nature. Roosevelt's conservationism issued in part from his concern

over the potential for decadence in modern urban civilization. His museum-monument, though in the middle of the largest city in America, edged Central Park, a modern Garden of Eden constructed to restore health to degenerate city dwellers and to infuse manly vigor into pallid metropolitan youth.[47]



Visitors to the museum were guided, by person or pamphlet, through a series of exhibits leading up an evolutionary chain, culminating in the Hall of the Age of Man. The Hall of the Age of Man was designed by Henry Fairfield Osborn, the president of the museum from 1908 to 1933. His guidebook to the Hall emphasizes that most of the exhibits, like Owen's dinosaurs, are reconstructions. Again scientific knowledge, which allows the interpretation of such mysterious fragments, is resoundingly endorsed while social interests are silently promoted. The exhibit was governed by Osborn's view that anthropoid evolution had nothing to do with human evolution. The lines linking different specimens reflected Osborn's interpretation that descent from a common ancestor had yielded separate lineages for Pithecanthropus, Piltown, Neanderthal, Cro-Magnon, and modern man. A highlight of the Hall's display cases were busts of the different paleolithic races of man [Figure 9]. Osborn believed these various races had been unmistakably human, showing no affinity to the apes--though they had been quite distinct from each other. On the basis of Osborn's views, J. Howard McGregor, Osborn's former student and colleague at Columbia University, reconstructed Neanderthal as a heavy-browed, dull-witted looking creature that stood in marked contrast to the intelligent, high-browed restoration of Cro-Magnon.

These restorations were accompanied by three murals, painted by Charles R. Knight under Osborn's direction, representing distinct stages of human cultural evolution. The first was entitled "The Neanderthal Flint Workers" [Figure 10]. The painting portrayed the members of a Neanderthal family in what Osborn defined as a typical setting. In addition to a mother and child, the painting showed three generations of males engaged in crude flint-making activities. The family is posed in front of a cave; in line with Osborn's demands there is no evidence of human-built shelters or other structures that might suggest an advanced stage of cultural evolution. Following Osborn's instructions, Knight presented the Neanderthal family "to show the characters of the race which differed widely from any existing or modern human type." [48] The painting emphasized what became the classical view of the Neanderthal: a slouching, stocky, unintelligent race with brutish physical features.



In contrast, the mural illustrating Cro-Magnon [Figure 11] showed a group of upright, delicately featured people engaged in comparatively refined activities. In an amusing bit



of self-referentiality, Knight depicted the central Cro-Magnon as an artist, drawing on nature for inspiration as well as food, using natural materials for personal adornment (he wears an animal-tooth necklace) as well as for artistic expression (his palette is an animal's shoulder blade). Evidence of intellectual advancement abounds: some figures hold lamps placed in hollowed stones (which, dramatically, provide the only source of light in the painting) while another grinds pigment for the cave murals. The Cro-Magnon group is clearly culturally superior to the Neanderthals.

The last mural of the series, entitled "Neolithic Stag Hunters"[Figure 12], depicted a northern European tribe, with exceptionally muscular bodies, after a successful hunt. The leader exults over a fallen deer, while his blond son holds a wolf dog on a leash. In the guidebook, Osborn wrote of the Neolithic race:

This race was courageous, warlike, hearty, but of a lower intelligence and less artistic skill than the Cro-Magnons; in a rigorous northern climate, it was chiefly concerned with the struggle for existence, in which the qualities of endurance, tribal loyalty, and the rudiments of family life were being cultivated.[49]



The mural features robust natural man in combat with the elements of nature. In books such as *Men of the Old Stone Age*, Osborn praised the intellect, talent, and strength of earlier races, in particular the Cro-Magnon and the Nordic race of Neolithic times, which resulted from their closeness to nature. In the foreword of his 1924 annual report, entitled "The American Museum and Education," Osborn explicitly locates unparalleled educational value in such direct experience of nature:

The cave boy certainly had advantages which our boys have ceased to enjoy; he was surrounded on all sides by vibrant nature, full of inspiring and wonderful phenomena, which filled him with reverence and awe if not with superstition. . . . In the growth of our large cities, in the press, and in the minds of teachers who depend upon the press, civilization has reared a Frankenstein which shuts out the direct vision and inspiration of nature and banishes the struggle for existence.[50]

In fact, contact with nature which in turn inspires its representation, present in the details of the Cro-Magnon mural, was a major motif throughout the entire museum. The museum itself, in Osborn's vision, was to serve as the missing link in the educational experience of modern city youth: "The great function of the American Museum is . . . to restore the vision and inspiration of Nature, as well as the compelling force of the struggle for existence in education."[51]

Taken together, in their insistence on the inspiring qualities of nature and the improving stresses of the struggle for existence, Knight's Cro-Magnon and Neolithic murals represent the ideal effect Osborn hopes his museum will have on its schoolboy visitors. But even though they embodied human strength and nobility in direct confrontation with nature, the Neolithic hunters nevertheless represented a decline from the more intelligent, highly cultured Cro-Magnon artists, whom Osborn elsewhere terms "the Paleolithic Greeks." [52] A lesson too could be learned from this representation of an early stage of human civilization: decline from a high state was always possible. In various dioramas and informational exhibits in the Hall of Mammals, the museum space just before the Hall of the Age of Man, the message reverberated: Osborn showed the extinction of impressive animals such as the titanotherium and the Irish elk as a result of over-

specialization.[53] Osborn's published writing provides a gloss on these ominous signs of the spectre of decline. He frequently urges the analogy between prehistory and history, as in the concluding passage of his *Men of the Old Stone Age*:

The rise and fall of cultures and of industries, which is at this very day the outstanding feature of the history of western Europe, was fully typified in the very ancient contests with stone weapons which were waged along the borders of the Somme, the Marne, the Seine, and the Danube. No doubt, each invasion, each conquest, each substitution of an industry or a culture had within it the impelling contest of the spirit and will of man, the intelligence directing various industrial and warlike implements, the superiority either of force or of mind.[54]

The ringing oppositions--rise and fall, spirit and will, force and mind--belong to a different order of prose than a paleontologist's dispassionate discussions of fossil evidence. This rhetorical turn appears in Osborn's work when the past is being naturalized in the service of present interests. It is characteristic of his prefaces, written in 1916 and 1917, to *The Passing of the Great Race*, a study by his friend, Madison Grant, chair of the New York Zoological Society as well as founder and trustee of the American Museum. Osborn summons the crisis rhetoric of the world war to endorse Grant's research:

European history has been written in terms of nationality and of language, but never before in terms of race; yet race has played a far larger part than either language or nationality in moulding the destinies of men. . . the Anglo-Saxon branch of the Nordic race is again showing itself to be that upon which the nation must chiefly depend for leadership, for courage . . . for self-sacrifice and devotion to an ideal. . . in no other human stock which has come to this country is there displayed the unanimity of heart, mind and action which is now being displayed by the descendants of the blue-eyed, fair-haired peoples of the north of Europe. . . we shall save democracy only when democracy discovers its own aristocracy as in the days when our Republic was founded.[55]

The theme of Grant's work, to which Osborn here lends his powerful support, is that the "insidious victories arising from the crossing of two diverse races" have had more permanent results than all the "spectacular conquests and invasions of history." [56] America's own inherently superior Nordic peoples must protect themselves against the dilution of their hereditary qualities by a melting pot ideology. Grant offers the Cro-Magnons as an object lesson of "the replacement of a very superior race by an inferior one" and warns:

There is great danger of a similar replacement of a higher by a lower type here in America unless the native American [sic] uses his superior intelligence to protect himself and his children from competition with intrusive peoples drained from the lowest races of eastern Europe and western Asia.[57]

Osborn shared Grant's view that the Cro-Magnons were a notably pure and superior race who conquered rather than interbred with the declining and inferior Neanderthals.[58] The markers of his Hall of the Age of Man portrayed the need for preserving natural and racial purity, jeopardized by war and immigration. Immediate action was required to halt the rapid acceleration toward decline, racial suicide, and extinction.

What kind of action might counter this degeneration? On one level, the museum itself provided an educational site to promote Osborn's program. But, ironically, Osborn believed in fundamental limitations in this process:

In the United States we are slowly waking to the consciousness that education and environment do not fundamentally alter racial values. We are engaged in a serious struggle to maintain our historic republican institutions through barring the entrance of those who are unfit to share the duties and responsibilities of our well-founded government. The true spirit of American democracy that all men are born with equal rights and duties has been confused with the political sophistry that all men are born with equal character and ability to govern themselves and others, and with the educational sophistry that education and environment will offset the handicap of heredity.[59]

With these words, Osborn opened the Second International Eugenics Congress, over which he presided, in 1921. Specially financed by J. P. Morgan, the opening of the Hall of the Age of Man coincided with that congress; the exhibit was specially adapted to emphasize eugenical issues, and on the floor below the Hall of the Age of Man the temporary exhibits of the Congress itself were displayed. With this conjunction, the museum became the site of a powerful constellation of interests bent on exercising social control in order to preserve the national human resources that had made America great: its priceless gene pool.

Conclusion

Since their appearance in the nineteenth century, natural history museums have provided icons for meditating on nature as well as laboratories and factories for producing nature. They have functioned as cathedrals for worshipping divine purposes and as sites for shaping society. In examining these moments in the history of museum-making, we have intended to question the notion of a natural history museum as a site for the "authentic" representation of nature. We have advanced a different argument: museums provide semiotic markers of nature whose authenticity is guaranteed by having the historical processes which produce them naturalized. Our examples of Owen and Osborn could be enlarged with a treatment of, among others, Cuvier and his Paris Museum. Emerson, the Romantic idealist who enjoyed both the Jardin des Plantes on an early tour of Europe and Owen's public lectures on physiology during a later return visit, was fond of the observation that "from whatever side we look at Nature we seem to be exploring the figure of a disguised man." [60] We agree completely.

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ENDNOTES

[1].See Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts*, Princeton: Princeton University Press, 1986 (revised, originally published in 1979). Martin J.S. Rudwick, *The Great Devonian Controversy: The Shaping of Scientific Knowledge among Gentlemanly Specialists*, Chicago: University of Chicago Press, 1985. Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*, Princeton: Princeton University Press, 1985.

[2].In addition to the works cited above, see Timothy Lenoir, "Models and Instruments in the Development of Electrophysiology, 1845-1912," *Historical Studies in the Physical and Biological Sciences*, 17(1), 1986, pp. 1-54. M. Norton Wise, "Mediating Machines," *Science in Context*, 2(1), 1988, pp. 77-114. Simon Schaffer, "Glass Works: Newton's Prisms and the Uses of Experiment," in David Gooding, Trevor Pinch, and Simon Schaffer, eds., *The Uses of Experiment* (Cambridge: Cambridge University Press, 1989) pp. 67-104. Crosbie Smith and M. Norton Wise, *Energy and Empire: A Biographical Study of Lord Kelvin* (Cambridge: Cambridge University Press, 1989). David Gooding, *The Making of Meaning* (Dordrecht: Martinus Nijhoff, 1989).

[3].Trevor Pinch, "Towards an Analysis of Scientific Observation: The Externality and Evidential Significance of Observation Reports in Physics," *Social Studies of Science*, 15 (1), 1985, pp. 3-35. Harry Collins, *Changing Order*, (London and Beverly Hills: Sage, 1985).

[4].Michael Lynch, *Art and Artefact in Laboratory Science: A Study of Shop Work and Shop Talk in a Research Laboratory* (London: Routledge & Kegan Paul, 1985). Andy Pickering, "Living in the Material World," in *The Uses of Experiment*, pp. 275-298. Timothy Lenoir, "Practical Reason and the Construction of Knowledge: The Lifeworld of Haber-Bosch," in Ernan McMullin, ed., *The Social Dimension of Science* (South Bend, Indiana: University of Notre Dame Press, 1992). Andrew Warwick, "Cambridge Mathematics and Cavendish Physics: Cunningham, Campbell and Einstein's Relativity 1905-1911," Part I: The Uses of Theory, Part II: Comparing Traditions in Cambridge Physics, *Studies in History and Philosophy of Science*, 23 (1992), pp. 626-656; 24 (1993), pp. 1-25.

[5].Simon Schaffer, "'Late Victorian metrology and its instrumentation: A Manufactory of Ohms,'" in Robert Bud and Susan E. Cozzens (eds.), *Invisible Connections: Instruments, Institutions, and Science* (Bellingham, Wash.: SPIE Optical Engineering Press, 1992), pp.23-56. In a similar vein, Joseph Rouse has explored standardization as a means for multiplying contexts. See Joseph Rouse, *Knowledge and Power: Toward a Political Philosophy of Science* (Ithaca: Cornell University Press, 1987) pp. 111-126.

[6].See: Madeleine Akrich and Bruno Latour, "A Summary of a Convenient Vocabulary for the Semiotics of Human and Nonhuman Assemblies," in Wiebe E. Bijker and John

Law, eds., *Shaping Technology/Building Society: Studies in Sociotechnical Change* (Cambridge, MA.: MIT Press, 1992), pp. 259-264. Also see Akrich, "The De-Description of Technical Objects," *ibid.*, pp. 205-224. Bruno Latour, *We Have Never Been Modern*, Cambridge, MA: Harvard University Press, 1993. Donna Haraway, "The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others," in Lawrence Grosberg, Cary Nelson, and Paula Treichler, eds., *Cultural Studies* (New York and London: Routledge, 1992), pp. 295-337. N. Katherine Hayles, "Constrained Constructivism: Locating Scientific Inquiry in the Theater of Representation," in George Levine, ed., *Realism and Representation: Essays on the Problem of Realism in Relation to Science, Literature, and Culture* (Madison: University of Wisconsin Press, 1993), pp. 27-43.

[7].See Timothy Lenoir, "Was the Last Turn the Right Turn? The Semiotic Turn and A.J. Greimas," *Configurations*, Vol.2 (1994): 119-136. The semiotics of Roland Barthes is the starting point for such studies. Examples in science studies include the work of Haraway. See sources cited in note 8 below.

[8].See Gillian Beer, *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot, and Nineteenth Century Fiction* (London: Routledge and Kegan Paul, 1983). Donna Haraway, *Primate Visions: Gender, Race, and Nature in the World of Modern Science* (New York: Routledge, Chapman & Hall, 1989). Donna Haraway, *Simians, Cyborgs and Women: The Reinvention of Nature* (New York: Routledge, Chapman & Hall, 1991). A particularly valuable collection of essays on this topic is George Levine, ed., *Realism and Representation: Essays on the Problem of Realism in Relation to Science, Literature, and Culture* (Madison: University of Wisconsin Press, 1993). See especially Gillian Beer, "Wave Theory and the Rise of Literary Modernism," *ibid.*, pp. 193-213; Simon Schaffer, "Augustan Realities: Nature's Representatives and Their Cultural Resources in the Early Eighteenth Century," *ibid.*, pp. 279-320; and Ludmilla Jordanova, "Museums: Representing the Real?" *ibid.*, pp. 255-274.

[9].Lothar P. Witteborg, "Design Standards in Museum Exhibits," *Curator* 1 (1958): 29.

[10].Most work in museum studies tends either toward silence or naivete on these questions. Recent and welcome exceptions are essays by Ludmilla Jordanova and Stephen Bann in Peter Vergo, ed., *The New Museology* (London : Reaktion Books, 1989).

[11].Joel Porte, ed., *Emerson in His Journals* (Cambridge, Ma.; Havard University Press, 1982), 110-11.

[12].Patricia Parker has suggestively discussed "rhetorics of property" in seventeenth century writing, which she argues were intimately connected with the european approach to the New World. Emerson's journal entry provides a later, and interestingly inverted, example of the trope Parker describes as viewing the New World prior to conquering or colonizing it: Emerson comes from the New World, one site of appropriation for the creators of natural history exhibits, to the European centers of natural history in order to

learn how to "see" nature. See Patricia Parker, *Literary Fat Ladies: Rhetoric, Gender, Property* (London ; New York : Methuen, 1987), ch. 7.

[13].Jonathan Culler, *Framing the Sign: Criticism and Its Institutions* (Norman, Oklahoma: University of Oklahoma Press, 1988), 153-167.

[14].Ibid., 164.

[15].Roland Barthes, *Mythologies* (New York, 1957), 116.

[16].Ibid., 129.

[17].Recent efforts in art history, paralleling ours here, to use semiotic models to capture the workings of political and social power often omitted from traditional discussions of museum images, are included in Norman Bryson, ed., *Calligram: Essays in New Art History from France* (Cambridge, 1988).

[18].see Adrian J. Desmond, "Designing the Dinosaur: Richard Owen's Response to Robert Edmond Grant," *Isis* 70 (1979): 224-234; Desmond, "Artisan Resistance and Evolution in Britain, 1819-1848," *Osiris*, 2nd Series, 3 (1987): 77-110; and Desmond, *The Politics of Evolution: Morphology, Medicine, and Reform in Radical London* (Chicago, 1989).

[19].See J. F. C. Harrison, *Quest for the New Moral World: Robert Owen and the Owenites in Britain and America* (New York, 1969).

[20].See for example, Jack Morrell and Arnold Thackray, *Gentlemen of Science: Early Years of the British Association for the Advancement of Science* (Oxford, 1981).

[21].Richard Owen, "Report on British Fossil Reptiles," *Report of the British Association for the Advancement of Science*, 1841 (London, 1842), 200.

[22].Ibid., 109.

[23].Ibid., 203-204.

[24].Desmond, "Richard Owen's Reaction to Transmutation in the 1830s," *British Journal for the History of Science* 18 (1985): 25-50, especially 45.

[25].Desmond, "Central Park's Fragile Dinosaurs," *Natural History* 83 (October 1974): 65.

[26].On December 31, 1853, Hawkins held such an event to inaugurate the exhibit; invitations read, "Mr. B. Waterhouse Hawkins solicits the honour of Professor -----'s company at dinner, in the iguanodon. . . ": See Ibid., 66.

[27].Richard Owen, *Geology and Inhabitants of the Ancient World* (London, 1854), 5.

[28].Ibid., 31.

[29].Gillian Beer, *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot, and Nineteenth Century Fiction* (London, 1983), ch. 1.

[30].Richard Owen, *On the Extent and Aims of a National Museum of Natural History* (London, 1862), 2-3.

[31].Ibid.

[32].Ibid.

[33].Ibid., 125.

[34].Ibid., 68.

[35].Ibid.

[36].Ibid., 69.

[37].Ibid., 10-11.

[38].Ibid., 113.

[39].Ibid.

[40].Ibid., 85.

[41].Ibid., 117.

[42].Ibid., 126.

[43].Ibid., 114.

[44].Mark Girouard, from whose history of the architecture of the museum this discussion is derived, notes the similarity of this design to Bramante's unexecuted but famous plan for the dome of St. Peter's Cathedral in Rome; see Girouard, *Alfred Waterhouse and the Natural History Museum* (New Haven, 1981), 26-27 et passim.

[45].Donna Haraway, *Primate Visions: Gender, Race, and Nature in the World of Modern Science* (New York, 1989), 26-58; Ronald Rainger, *An Agenda for Antiquity: Henry Fairfield Osborn and Vertebrate Paleontology at the American Museum of Natural History* (Tuscaloosa, Alabama, 1991).

[46].Haraway, *Primate Visions*, 56.

[47].Hawkins narrowly missed having his dinosaur reconstructions exported to this site: see Desmond, "Central Park's Fragile Dinosaurs," for details of the controversy.

[48].Osborn, *The Hall of the Age of Man*, 21.

[49].*Ibid.*, 31.

[50].Osborn, *The American Museum and Education* (New York, 1925), 4-5.

[51].*Ibid.*, 5. The American Museum extended such educational efforts beyond its walls: the same issue of *Natural History* which heralds the opening of the Hall of the Age of Man offers an article by Mrs. John I. Northrop, president of New York City's School Nature League, entitled "Nature and the City Child." Mrs. Northrop praises the American Museum's Department of Public Education for supplying travelling cases of specimens to schools. Implying that such specimens are the indispensable signifieds of what are otherwise mere words learned in natural history classes, she insists, "If we cannot take the children of New York City to the country, we must bring all the country that is transportable to the children." See *Natural History* 10 (May-June 1920): 265-276.

[52].Osborn, *Men of the Old Stone Age*, 317.

[53].Support for this account of titanotheres extinction is provided in Osborn's massive, two-volume monograph, *The Titanotheres of Ancient Wyoming, Dakota and Nebraska: Department of the Interior and U.S. Geological Survey Monograph 55, vol. 2* (Washington, 1929), 883-888.

[54].Osborn, *Men of the Old Stone Age*, 502.

[55].Osborn, prefaces to Madison Grant, *The Passing of the Great Race: or the Racial Basis of European History* (New York, 1918), VII-XIII.

[56].*Ibid.*, 261-262.

[57].*Ibid.*, 110.

[58]. Osborn, *Men of the Old Stone Age*, 272.

[59].Osborn, "Address of Welcome," *Eugenics, Genetics, and the Family: Scientific Papers of the Second International Congress of Eugenics* (Baltimore, 1923), 2. An account of the history of modern eugenics movements is available in Daniel J. Kevles, *In the Name of Eugenics: Genetics and the Uses of Human Heredity* (Berkeley, 1985).

[60].Ralph Waldo Emerson, *Natural History of the Intellect and Other Papers* (Boston, 1921), 23.