Hist. Sci., xlviii (2010)

SERIALITY IN THE MAKING: THE OSBORN-KNIGHT RESTORATIONS OF EVOLUTIONARY HISTORY

Marianne Sommer
University of Zurich

The author and illustrator, Charles R. Knight (1874–1953), has like no other artist shaped the scientific, artistic and popular images of prehistoric animals and men. Again and again, he visualized and performed the story of "life's pageant through the ages" by means of a series of images. The most impressive was undertaken in the second half of the 1920s for the Chicago Field Museum, for which Knight produced a series of 28 murals for a new gallery showing the fossils of extinct vertebrates. These murals were to be a splendid display of the history of life on earth, from its beginnings, through the age of amphibians, reptiles and mammals, up to the age of man (although no humans were depicted). However, this commission piqued the feelings of Henry Fairfield Osborn (1857–1935), who as curator of vertebrate palaeontology (1891) and later president (1908) of the American Museum of Natural History in New York (hereafter AMNH) had revolutionized the way in which fossil vertebrates were displayed. It was Osborn who had made it possible for locals and visitors alike to be stunned by the dynamic mounts of the skeletons of fossil reptiles and mammals. And it was Osborn who had combined science and art to bring to life the long-gone creatures in their behaviour and ecology. No doubt Osborn regarded Knight — the genius of palaeontological reconstruction — as to no small degree his creation. After all, it was due to Osborn that Knight had opened up the field of 'palaeoart' in the mid-1890s, painting fossil animals as realistically as living animals could be caught on photographs. It was through Knight's work at the AMNH that the artist achieved worldwide fame. In fact, Osborn considered his share in Knight's paintings to be considerable, so considerable that he spoke of the images as Osborn-Knight restorations.

Osborn's layout of the epochs in the history of life at the AMNH was not as compactly serial as Knight's mural project for the Field Museum. Rather, the development of vertebrate life was stretched out through entire halls: the ages of reptiles, mammals and man. Within each hall, the visitor encountered static scenes of life in the respective age as well as visualizations of development. There were other structuring devices at work than chronological order, as for example the reconstruction of scenes from particularly rich sites; the exhibits also reflected Osborn's interests, such as the evolution of the proboscidea and titanotheres. Nonetheless, seriality was incorporated in the design of the halls, and it also ordered the work processes that led to their profuse decoration. Osborn firmly subscribed to his New-York élite's credo of efficiency, and wanted to make the process of bringing evolutionary history before the eyes of the museum visitors as rational as possible.[1] This included the collection

of data on the former lifeworlds; their processing at the museum; and the nationwide, and even worldwide, distribution of the final visual and verbal reconstructions. Where Knight's murals were concerned, Osborn established a serial workflow. Most of all, the definition of a series of working steps aimed to ensure that the paintings transmitted what for Osborn was the educational message of evolutionary history.

Osborn saw his attempt to have prehistoric animals mounted and painted in a lifelike and active way as a contribution to the civic education of the industrial age's children. Although Osborn was hardly Darwinian in the current sense, he regarded himself as a progeny of the tradition of naturalists that he believed to be embodied in the great Victorian. In his view, the centrepiece of that tradition was the emphatic and direct study of nature.[2] One of the functions of the AMNH was to allow such an experience also to the asphalt-dwellers of New York City and of other industrial and urban areas: "The best training for citizenship, in the highly artificial environment which surrounds the mind and spirit of the boy and girl in our times, is to show Nature in all her beauty and attractiveness, in all her moral lessons and inspirations, as well as in her stern moods of command."[3] For Osborn, Nature 'herself' was characterized by a combination of beauty and stern command, or law. By inference, it was through the union of art and science that the moral authority of nature could best be conveyed.

The central role Knight played in the fulfilment of Osborn's vision for the museum was given by this understanding of nature: "We are realizing that nature is more than truth; it is beauty as well.... To express beauty we need to have the artist and the sculptor to help us."[4] Knight's reconstructions of evolutionary history, which communicated facts through emphatic aesthetic feeling, were paramount to Osborn's educational programme; the more so because Osborn regarded the visual sense as fundamental in humans. Seeing was not only believing, it was experiencing: "And the best way to learn one of these laws [of nature] is to see it in operation; this is far better than to read about it, for what is seen becomes part of oneself."[5] For Osborn, the teaching of evolutionary history was particularly apt to demonstrate the most important law of nature: progress through a strenuous life in close contact with nature. Knight staged the struggle for survival with irresistible dramaturgy, dynamics and authenticity. But a closer look at the cooperation of 'science' and 'art' in these projects reveals that neither the series of work steps codified in contracts to steer production, nor the message communicated through the serial exhibit of the final murals, could be entirely controlled.

"THE OSBORN-KNIGHT RESTORATION"

Osborn made no secret of the efforts involved in searching for traces of long-gone creatures and in the excavation, transportation, analysis, preparation and restoration of fragments to create displays of entire animals or life scenes. On the contrary, he considered disclosure of behind-the-scenes work as increasing the final product's authenticity. It also increased its instructiveness, provided that the work process was strenuous and efficient. Osborn therefore measured his success in terms of the speed with which the labour-intensive procedure could be achieved. This may be illustrated

for one particular trophy, the *Baluchitherium* (giant Miocene rhinoceros), remains of which were brought back from the Central Asiatic Expeditions over which Osborn presided. The example can stand in for his entire programme:

> The exhumation and transportation of this skull [*Baluchitherium*] is a little romance in itself. It presents us with a concrete example of how long it takes to bring a wonderful new fact of nature from the other side of the globe and put it within the reach and understanding of the vision and mind of the people in the city of New York. It took several days to work the skull out of the earth. It was transported across the desert of Mongolia and reached Peking on October 20, 1922. It reached the American Museum on December 19, 1922 — a red-letter day in the Department of Vertebrate Palaeontology, which received it. The scientific preparation began immediately and continued unremittingly in the hands of two, three and sometimes four preparators, until its completion on April 6, 1923. It was then ready to be reproduced a thousand-fold in still photographs and by the moving-pictures of Mr. Shackelford, and thus distributed in this country and all over the world. The Baluchitherium was placed in a large case near the centre of the American Museum, with a map showing its long journey and a label giving its history, together with a complete restoration showing how it appeared in life. Within nine months of its discovery this animal was known to millions of people! This is not quite so rapid as Jules Verne's *Around the World in Eighty Days*, but the record is a good one when one considers the very difficult scientific problems involved, the years of experience and training necessary rightly to interpret this animal, and the faultless restoration of this skull, which arrived at the Museum in three hundred and sixty pieces of fossil bone.[6]

With its exact dates and reference to Jules Verne's — albeit fictional — record of travelling around the world, the passage conveys a feeling of urgency. It also conveys a sense of control. Osborn's museum was an efficient centre of calculation where traces of lost worlds were collected and processed, from whence the resulting reconstructions of ancient creatures were immediately fed into a multi-media distribution network of exhibits, popular books, journals, magazines, newspapers, lectures and educational films.[7] In the example of the *Baluchitherium*, Knight's "complete restoration showing how it appeared in life" was part of a multi-layered exhibit of one kind of animal. His paintings, models and murals were integral also to larger projects such as a series of exhibits, or even an entire museum hall or series of halls. Their profuse reproduction and distribution certainly contributed to making the prehistoric animals known to millions of people in a minimum of time. Also in the case of the *Baluchitherium*, Osborn proved his cunning in dealing with the media. When the magazine *Asia* asked him for an article on the beast, he proposed that the museum take on half of the cost for the illustration, provided Knight's painting would become the possession of the museum and could thus be used in the *Baluchitherium* exhibit and in museum publications.[8]

But Osborn's casual reference to "a complete restoration showing how it appeared

in life" black-boxes a process that was tedious in itself, and that Osborn, too, tried to rationalize by defining a series of work steps. Knight had begun his work on smaller paintings such as the one of the *Baluchitherium* under Osborn's "scientific and artistic direction", and guided by the expertise of other scientists, with an *Elasmosaurus* painting of 1897. In the new century, fossil mammals and men became prominent subjects alongside the dinosaurs. However, the large murals were by far the most important and most difficult work that Knight did for the museum.[9] In this case, Osborn again considered the disclosure of the series of production steps as an important part of the public instruction that the restorations served. Osborn advised Knight:

> I shall be glad to have you prepare for Scribner's Magazine an article on the murals … I specially hope you will give the readers some idea of how these murals are prepared, how many trials are made for each. It would be amusing in this connection if you could make a series of very small reproductions showing the steps in preparation of these sketches. This would be worth while and would be a new contribution to this subject, because few people have any idea of the amount of time and pains taken to make them as nearly authentic as possible.[10]

Although Knight did not provide "a series of very small reproductions showing the steps in preparation of these sketches", he verbally explained the series of steps that had led to the murals in the Hall of the Age of Man. These were:

(1) The landscape illustrating a geological period was chosen and the most characteristic animals selected.

(2) The appearance of the animals (form, colour, typical attitudes) were discussed in detail, also taking into account the scale in the context of the entire hall.

(3) The artistic composition and colour scheme were negotiated on the basis of a series of charcoal sketches showing possible arrangements of the animal groups.

(4) A colour painting was produced that would serve as model for the mural. This step took up four-fifths of the entire time required for the restoration, because Knight had to do research on the geology, fauna and flora, and because he had to come up with a satisfactory colour scheme. This step was characterized by many abortive attempts.

(5) The larger panel was copied from the original colour painting.[11]

This is an abbreviated account of the general series in the production of a mural. Further steps could be included. A panel-project was discussed as part of its larger context, which could be facilitated by simple sketches and even a papier-maché model indicating the walls, windows and mural spaces in the hall.[12] Knight would receive briefs that indicated a list of animals Osborn wanted him to include; the scene to be represented; and the literature, experts and possibly additional material to be consulted.[13] Knight arrived at an image of a fossil animal in the way he drew living animals. He studied the anatomy on the basis of fossils and expertise, drew the skeleton, and applied the muscles (Figure 1).[14] Furthermore, in order to be able to draw an animal from all sides and perspectives, Knight often made small sculptures (Figure 2). This also allowed him to place the three-dimensional figure outside, in order to observe the casting of shadows. On the part of the museum, these models

FIG. 1. Sketch by Knight of *Triceratops*, courtesy Rhoda Kalt.

were later cast and sold.[15] Once the large painting had been copied from the smaller painting, it was placed on a panel and put in its place in the hall, so that Osborn could examine it again for final touches.[16] The paintings were photographed in colour before permanent installation in the halls, in order to be copyrighted and distributed pending Osborn's permission of reproduction.[17] In general, Osborn made sure that

FIG. 2. Knight modelling *Stegosaurus*, 1899, from *Autobiography of an artist* (Ann Arbor, 2005), 78, courtesy Rhoda Kalt.

the reconstructions were described in the museum's bulletin, *Natural history*, before being made accessible for other educational purposes.

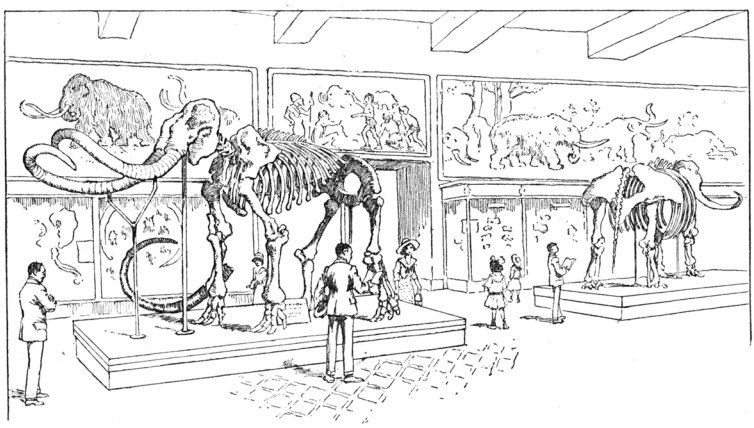
In order to channel an efficient workflow, and to ensure sufficient control over the process to make the restorations convey his particular vision, Osborn roughly defined the series of work steps in contracts that would become more refined over time. The terms and conditions included the final size and an acknowledgement that the subject matter and composition were to be determined in consultation with Osborn. The museum agreed to pay for expenses such as canvas, paint and transportation between studio and museum. The contract also specified the price of the finished work (between $4000 and $7000), and the mode of payment. Knight would be paid in monthly instalments and receive a certain part of the total sum once Osborn approved of the sketch (for example $3000). A part of the total sum (for example $400) could also be withheld until the finished work had been approved. From the 1920s, contracts stated that the museum had the right to buy the sketch on which a panel would be based (for example for $600), with the copyrights for the sketch and final work remaining with the museum. Knight was allowed to reproduce the images only under the condition that the museum had already published them, and that they accompanied articles he had himself authored. In the case of his death, the panel would be copied from the approved sketch by an artist of Knight's choice.[18]

Despite these provisions, Knight's representation of the production process in *Scribner's magazine* was streamlined and euphemized. Each step was accompanied by time- and nerve-consuming discussions concerning the practical aspects of the work, scientific and artistic issues, timing, payment and copyrights. This can be illustrated on the basis of the first panel produced for the Hall of the Age of Man, the wonderful 'Mammoth and Reindeer' scene that would be hung behind a mounted mammoth skeleton and joined by one of the human murals above the doorway (Figures 3(a) and 3(b)). Even a look at the production for this one example brings to light that the merging of science and art that was so central to Osborn's vision of the museum was difficult. Osborn had a hard time indeed maintaining control over the process that he wanted to end in a visualization of the severe conditions of prehistoric life.

It was in the year 1914 that Knight was commissioned for the 'Mammoth and Reindeer' panel.[19] There were immediately questions of accuracy. The museum director, Frederic A. Lucas, considered the mammoth in Knight's early sketch rather bobtailed.[20] Osborn took issue with the mammoth's head, especially the curvature of the tusk. Knight reacted sensitively to any criticism. He conceded that he had diverged somewhat from the model Osborn had had him prepare, and which Osborn had approved. But he considered this divergence justified in order "… to secure some particularly artistic effect and or to improve some point in the composition…". Knight made it very clear how he saw the relation of science and art in his restoration: "This decoration should of course, be primarily a work of art, in this way alone will it be of any value and interest. The scientific part should be unquestioningly kept subservient…."[21]

Osborn was not satisfied with the smaller painting. It was not so much that he did

FIG. 3(a). Photograph taken in the Hall of the Age of Man, with Mammoth skeleton and part of the 'Mammoth and Reindeer' mural as well as of the Cro-Magnon painting and showcase. Image no. 39130. Photograph by E. M. Fulda, American Museum of Natural History Library.



The sketch by W. M. Berger shows a section of the Pleistocene Hall with the actual skeletons of mammoths and mastodons; and above them a glimpse of two of the large murals in position on the wall.

FIG. 3(b). Sketch from W. M. Berger from Charles R. Knight, "Mural paintings of prehistoric men and animals", *Scribner's magazine*, lxxi (January–June 1922), 279–86, p. 279.

not agree with Knight on its character as a work of art. Rather, he thought it failed to express the vision of the Pleistocene he wanted to convey, and he was more than usually solicitous to avoid mistakes where the murals were concerned:

> The general effect does not seem to me to produce the robust character of these mammoths and the severe conditions of life characteristic of the Pleistocene. I quite agree with you that the primary purpose of these paintings is that they shall be works of art, but they should also express the great broad truths of Pleistocene life and environment and should convey to the visitors to this great hall this supreme impression.[22]

Once the sketch was finished, the question arose whether it would be better to proceed with the sketch for the second mural in order to compare the two, or whether Knight should copy the first painting to mural size. Even Jack Pierpont Morgan, the uncle Osborn turned to for the financing of the murals, was asked about his opinion in the matter.[23] Although Osborn favoured the first procedure, Morgan authorized the museum to go ahead with the full-sized panel. Nonetheless, Osborn solicited yet another opinion on the mammoth sketch, that of the taxidermist and diorama expert, Carl Akeley — in this case, for his expertise on elephants. Osborn himself still felt that the young mammoths looked too much like small adults, and that the atmosphere was not yet right, that it lacked the cold-weather feeling necessary to convey the harsh conditions of life.[24]

Osborn also advised that the reindeer were to be copied from the great expert on prehistoric art, the archaeologist Henri Breuil. Knight, he argued, should take Breuil's illustrations of the Font-de-Gaume murals as models with regard to colour patches as well as horn shape.[25] In fact, Osborn came up with the idea to enlarge photographs of the Palaeolithic cave drawings of reindeer to the full size of the mural (using the technique of architects and engineers for hyper-photographs), so that Knight would get the correct impression of the reindeer and mammoth. Obviously, Osborn considered the Stone Age drawings to be the true data on the animals.[26] Lucas could not agree. He thought that the Palaeolithic paintings were not anatomically correct, and that Knight should use the living North European reindeer as model (antlers and photographs).[27] True to his notion of the Cro-Magnon as in the perfect state of balance between nature and culture, science and art, Osborn insisted that except for the body proportions, the old painters should be trusted upon, and that Knight should be provided with illustrations of the Palaeolithic art from the museum library.[28] As a result, Lucas withdrew from any kind of responsibility regarding the accuracy of the outcome of the mural in order to avoid the turning of Osborn's "triple entente" into a "triple misunderstanding".[29]

There were also technical questions involved: "Where will this be painted? What kind of stretcher will you use for it? How is it to be put on the wall and what about assistance for handling the canvas and placing it on the wall?"[30] At the beginning of 1915, it had been decided that the canvas was eventually to be fastened by white lead, but Lucas still needed to know the size and quality of the canvas, and the position in

which it was to be while being worked upon.[31] The copying of the subject onto the large panel was quite an undertaking. The stretchers had to be very solid, with several crosspieces. Knight further gave instructions for stretcher and canvas to be somewhat longer than the actual wall panel, to allow for cutting the edges and joining them to the panel. The height was determined by the top of the new exhibition cases below and by the underside of the big girders above.[32] There were financial technicalities as well. Since Knight was asking for an advance of $500 for the painting, Osborn desired the future work of art to be insured, because in the case of Knight's failing to complete it, they would have had to account for Morgan's money.[33] Lucas was sceptical about the insurance complying to insure an "unpainted picture", but once again handed Osborn's request on to Knight, and the work was eventually also insured for the transports between his studio and the museum.[34]

Osborn had Knight's drawing of mural size put in its destined place in the Hall of the Age of Man and had a scaffold and platform built beneath it, so that Knight might study it *in situ* with respect to the perspective, the composition of the mammoth herd, the proportion of the big bull, and the proportion of the reindeer herd. Osborn was of the opinion that Knight needed to do this study in the museum rather than in the studio.[35] Knight protested that he could not work at the museum, or only for the very last finishes (such as making one or two of the mammoth heads slightly smaller), and wanted the canvas back in his studio. Even for the final touches, no scaffold would be needed, because Knight preferred to work with the canvas on the ground.[36] This was a quarrel that came up again and again when working on murals. Osborn even suggested having part of an exhibition hall screened off as a studio for Knight. Knight must have sensed an attempt to tighten control over his work and successfully refused to comply. Instead, the museum helped finance Knight's various studios.

Nor could Knight comply with Osborn's request to change the perspective in the drawing, which

> … would entirely change my idea of the whole composition. I did not intend having the large mammoth on a different plane from all the rest. It would give a very unballanced effect to the composition if we made them that way. Nor do I care to have the large one stick out in front of the others any more than it does at present.[37]

Osborn had taken issue with the inclusion of a bull in a herd that should be composed of females and young, and especially disliked the male animal's size. Knight explained that he had introduced a bull with raised trunk into the females-and-young herd composition to add to the group's grandeur and the scene's drama. He was therefore reluctant to change the proportions.

Knight was particularly upset that Osborn let other artists judge his painting, and most likely even more so, because they agreed with Osborn's criticism.[38] Osborn expressed his disappointment about Knight's obstinacy and inability to deal with well-intended suggestions for improvement. Knight's resistance to what he considered the friendliest of advice made him voice his discontent more pronounced:

> Mammoths twelve or thirteen feet high and Reindeer as large as the wapiti elk — may look beautifully in a state capitol building, but in a Museum our murals must also conform to the truth of nature because they bear the official stamp of approval of the Museum. Students and pupils should be able to take notes from them.[39]

Osborn felt that Knight's imagination led him away from the objects on which his restorations should be based. This was one reason why Knight should work at the museum, where he would be surrounded by the traces from the past.

As in their later disagreements, Knight's wife, Annie Hardcastle Knight, joined the correspondence in an attempt at arbitration.[40] Both Knight and Osborn also involved the palaeontologist William Diller Matthew, who was a central scientific advisor in Knight's work for the museum. Matthew was reluctant to give his opinion on what he considered a question of art rather than science. In Matthew's view, the perspective, or the relative size of the animals, did not really touch on anatomical veracity.[41] Knight made a similar point when he insisted on the difference between critique directed at the artistic aspects of his work, and one directed at its scientific accuracy. While he emphasized his willingness to listen to scientific expertise, he protested that where art was concerned, his opinion was to be trusted, and that he should be spared the criticism of "well meaning persons who know nothing whatever about the problems".[42]

It became clear that the contract worked not only to Osborn's advantage. According to the agreement, once Osborn had approved of the smaller painting, no further changes could be made to the larger picture within the limits of this contract, provided it was an exact copy. Since Knight thought that that was the case, he was disconcerted about renewed demands for changes, even if the large picture now in place in the museum hall was only a charcoal drawing. He assured Osborn that "… the mammoth will look much smaller when they are painted than they do now. They are already drawn smaller than those in the sketch. They will also be blacker, to agree with the real hair". However, he conceded that "I can make the mammoth with his trunk raised, and some of the others in the main group a trifle smaller, but I do not wish to make them much smaller, as this is quite at variance with my arrangement of the group". Knight also agreed to go over the charcoal drawing in the museum, but demanded that the canvas then be brought back to the studio.[43]

Even after Knight had made some changes to the drawing at the museum, Osborn was only partly satisfied. In his opinion, the bull in the distance on the bank of the stream was still too tall. He also took issue with the tusks of the females, which ought to be more slender and less curved. He approved of the inclusion of young bulls in the herd, but those he had marked with a check in the drawing had to be corrected to make their tusks extend out further before curving. Also the reindeer were still too large, and Osborn now suggested Knight go over the proportions of both *Rangifer tarandus* and *Elephas primigenius* with Matthew.[44] To this purpose, he had a mounted reindeer skeleton placed besides the mounted mammoth in the hall.

Osborn was exasperated and complained that "[t]his drawing has caused me so

much time and supervision that I think I shall call it the Osborn-Knight restoration without any injustice to Mr. Knight".[45] However, by June 1916 Osborn was satisfied enough to have the canvas sent back to Knight's studio.[46] While finishing the first mural with the help of an assistant artist of his choice, Knight was already working on the sketch for the second mural, for which Morgan had agreed to pay. When in September 1916 the first mural was finally on the wall, Osborn praised it as Knight's magnum opus, both artistically and scientifically. It was "… the best thing of the kind which is to be found in any museum in the world".[47] He described it as perfectly mural in spirit and in harmony with the room and the fossils. Although this praise was addressed to his patron Morgan, Osborn was sincere. He was pleased enough to try to get some more money for Knight. He wanted to make Morgan understand the hard work invested into the decoration and stressed the fact that "[Knight] is thoroughly run down physically and very much depressed mentally, after this exhausting piece of work during the hot months of summer".[48] This was a complaint of the kind Knight had repeatedly made to Osborn when confronted with criticism of his art. Osborn now tried the strategy on Morgan — in addition to praise. The strategy proved successful, and secured Knight an additional $1000.[49]

Even though Knight would still have to add a few atmospheric touches once the canvas was permanently fixed to the wall, Osborn saw his vision for the museum come true: "I believe that these murals, under the careful personal supervision which I shall give them, and with Knight's undoubted talent, are destined to endure and exert a great influence on all our visitors, young and old, for all time."[50] Osborn and Knight continued to cooperate on the decoration of the Hall of the Age of Man and the Hall of the Age of Mammals, even though this was accompanied by all kinds of disagreement and much bickering. However, although the two men also made plans for murals in the Hall of the Age of Reptiles, this project, which would have concluded Osborn's vision, did not materialize. This was to a large part due to the fact that their quarrels increased and eventually got out of control. Although Osborn made a last attempt at making peace and coming to an agreement with regard to the issues of copyright, ownership of sketches, and workmanship of the Titanothere mural before leaving the museum, Knight was never commissioned for the Hall of the Age of Reptiles.[51] As the example of the 'Mammoths and Reindeer' mural illustrates, Osborn had a clear idea of the message he wanted to convey and kept Knight on a short leash in order to realize his goal of showing nature's laws in operation. Even granted that Osborn was successful in steering the production of the murals by means of the regulation of the most important work steps, the question remains of whether his messages came across.

FROM SEQUENTIAL PRODUCTION TO SEQUENTIAL INTERPRETATION

Not only did Knight and Osborn establish a series of work steps each mural would go through; the murals themselves formed a series, intended to be seen from the perspective of the whole. Even if they were not decorated in order, the exhibition halls of fossil reptiles, of fossil mammals and of the age of man represented different

chapters in the history of the earth. In addition, some paintings were designed together as a kind of picture story. This is most obvious for the case of the three murals in the Hall of the Age of Man depicting Neanderthals, Cro-Magnons and Neolithic stag hunters, which was a particularly laborious project (Figures 4, 5 and 6).[52]

The very arrangement of the three images sounds like a simple story of progress, and Stephen Jay Gould has discussed how the evolutionary series has become a canonical icon constraining our thinking about evolution to such notions of progressive development.[53] However, Constance Areson Clark has shown that this constraint works more subtly. Images of evolution that circulated in Osborn's context could be equivocal. Even if biologists tried to visualize a more complex idea of the evolutionary process, the public was already so accustomed to the linear hierarchies 'from fish to man' that evolutionary diagrams tended to be read as conveying a goal-directed and hierarchical development.[54]

But what kind of story did Osborn want to convey with the Neanderthal-Cro-Magnon-Nordic series? In his *Men of the Old Stone Age, their environment, life and art* (1915), Osborn described the fossil remains found in Europe as those of peoples who had invaded the area in succession from the east. With regard to their phylogenetic relationship he stated that

> [w]e should regard as wholly unproved the notion that either of these Palaeolithic races of western Europe gave rise to others which succeeded them in geologic time.… We may therefore imagine that the family tree or lines of descent of the Old Stone Age consisted of a number of entirely separate branches.…[55]

Osborn visualized this theory in a "family tree", in which the 'branch' ending dead in the Neanderthals, and the one leading up to the equally dead-ending Cro-Magnons and the existing human "races", split deep down in the Eolithic.[56]

Surprisingly, however, it was not the strong and courageous "Nordic race" that Osborn estimated most highly. Even though they were superior to the "Mediterranean and Alpine races", they did not possess the Cro-Magnons' artistic mind. To

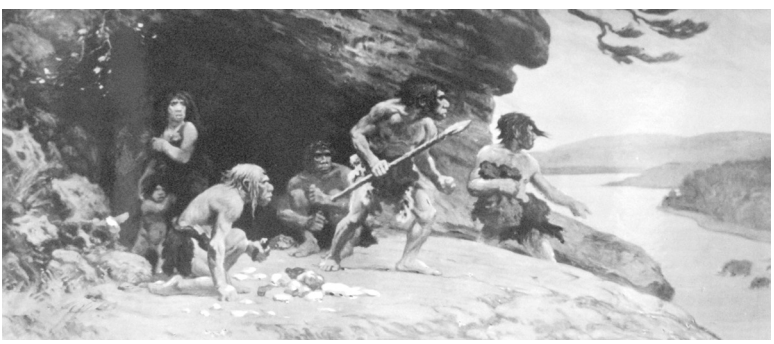


FIG. 4. Knight's Neanderthal mural for the Hall of the Age of Man. Image no. 39441A. Photograph by unknown photographer, American Museum of Natural History Library.

FIG. 5. Knight's Cro-Magnon mural for the Hall of the Age of Man. Image no. 322602. Photograph by unknown photographer, American Museum of Natural History Library.

FIG. 6. Knight's Neolithic stag hunters mural for the Hall of the Age of Man. Image no. 37952. Photo by Julius Kirschner, 1920, American Museum of Natural History Library.

Osborn, the Cro-Magnons represented the apex of all the extinct and living types. He described their art as superior to the Hellenic. In Osborn's philosophy, the Cro-Magnons had occupied just that perfect place between nature and culture where life was still inseparable from the forces of nature and the struggle against it, while the human body and mind had already reached the highest refinement. With their natural instincts intact, the Cro-Magnons had also known better than to spare the females of the local Neanderthals they killed when invading Europe, let alone accept them as mates.[57] The fate of the Cro-Magnons thus served as a thinly veiled warning against degeneration through an estrangement from the natural way of life and through miscegenation. Nonetheless, with the Cro-Magnons also began a process of degeneration. A decline in artistry suggested by the archaeological record was interpreted by Osborn as the effect of the Cro-Magnons' eventual estrangement from the natural

way of life through the abandonment of nomadism. Subsequently, miscegenation had contributed to the degenerative development of the "races".[58]

If anything, these conceptions about the extinct and living human types became more pronounced. In *Man rises to Parnassus: Critical epochs in the prehistory of man* (1927), Osborn expanded their independent evolutionary lines much farther back in time. Once separated, the lines showed no vertical connections, because Osborn considered miscegenation a relatively modern phenomenon, an effect of civilization. Just as the taxonomic and phylogenetic gap between apes and humans was considerably enlarged, Osborn argued that the types of living humans should be classified as different species or genera (*europaeus*, *asiaticus*, *afer*), with for example *Homo europaeus* (Caucasians) comprising what were in fact the species *nordicus*, *alpinus*, *mediterraneus*. Due to differential potentials of their "race plasms", and to the different environments and habitual behaviours that had characterized their evolutionary histories, 'the contemporary races' now found themselves at different stages on the 'racial lines' that ran in parallel towards the highest grade. Each stage was associated with a particular level in morphological, cultural and intellectual development.[59]

That the production of Knight's human mural series was very much part of such concerns, becomes evident from the exchanges between Osborn, Knight, Lucas and other scientists at the museum. The palaeontologist William King Gregory cautioned against rendering the Neanderthals too similar to white men. Osborn advised that the prehistoric humans were to be of a "wild aboriginal character". He suggested the "Italian laborer" as a model for Neanderthal skin colour, whereas in his estimate the central male figure in the Neolithic image had turned out too dark. Both Osborn and J. Howard McGregor considered Knight's Neanderthal woman too European looking. Osborn proposed Australian Aboriginal and Tierra del Fuegian women as models for the Neanderthal female; clearly, they had no waistline.[60] The racist undertones of the final murals led to their dismantling in 1966. That these disturbing meanings were most striking when the images were seen in series, because they juxtaposed prehistoric human types depicted with reference to early twentieth-century racial stereotypes, is suggested by the fact that the Cro-Magnon and Neanderthal paintings have recently been re-hung, but not as part of a series. They are now in isolation, decorating the staircases as part of the museum's history rather than as scientific instruction.[61]

Obviously, Osborn did not mean to convey a progressive line of descent with the Neanderthal-Cro-Magnon-Nordic series. But another kind of lineage seems to be implied. To Osborn, the central figure in Knight's Cro-Magnon image — 'the painter' — may well have represented the primal naturalist, in whom fact and reverence, science and art, were still united. As we have seen, Osborn advised that Knight paint his reindeer and mammoths from the Palaeolithic murals because he took them to be accurate renderings of nature. To the contrary, Knight seems to have had the primordial artist in mind when painting the dominant figure in the Cro-Magnon picture. As mentioned above, he insisted that what the Cro-Magnons had produced was more art than science.[62] Thus, when in 1927 Knight had the chance to visit archaeological sites in France and Spain with his then employer Henry Field of the Field Museum

in Chicago, and was guided through the painted caves by Breuil, he experienced a familial connection to the early artists:

> Such excellent examples of the work of ancient artists are really an inspiration to those of us who essay to follow in their footsteps, and one feels a fraternal emotion in the presence not only of the art itself but of the meager remains of its possible producer.[63]

In the cave of Font-de-Gaume, Knight even had a vision. When the lights suddenly went out, he saw the very scene he had chosen as a motif for the Cro-Magnon mural taking place in the cave, with the exception that the Cro-Magnon artist 'in truth' was naked, just as Knight had intended to draw him, but had been prevented to do for reasons of propriety.[64]

Apart from sharing Osborn's particular esteem of the Cro-Magnons, Knight seems to have embraced his general interpretation of the Stone Age peoples and thus of the mural series as not representing a line of descent.[65] He certainly appropriated Osborn's conviction of the importance of struggle for progress, and shared Osborn's view of evolution as overall a progressive development towards humankind. This is evident in the books Knight wrote and illustrated after his work for the AMNH had ended. In these, the drama of eating and being eaten, of deadly combat, and of harsh circumstances are an integral part of the progress from lower to higher beings conveyed in series of images representing different epochs of earth history. In similarly vivid fashion, Knight re-enacted life's pageant through the ages in lantern-slide shows. Here, viewers could see the images in colour (as opposed to the black-and-white *Life through the ages* (1946)). The audience, including Knight's granddaughter, was captivated by the magic of deep time: "He began to speak. The audience laughed at his opening jokes. They watched, spell-bound, as pre-history passed before their eyes in the color slides of the paintings and murals. The prehistoric creatures loomed large upon the screen. They almost seemed to live and breathe."[66]

Knight himself was little short of appalled by many of the earlier, and in the logic of evolutionary progress more primitive, creatures. In *Life through the ages*, he illustrated and wrote the story of evolution from the Cambrian epoch to the times of the cave bear and Palaeolithic humans for a younger audience. The texts that accompany each image on the opposite page are structured by the notion of a progressive history; in fact, even of providence, because Knight tells of the unfolding of "Nature's great plan of evolution", in which "odd-looking", "queer", "awkward", "grotesque", "absurd", "bizarre", "ungainly", "grovelling", "primitive", "repellent", "sinister brutes", "stupid monsters", "woefully short on brain", "these little nonentities" are progressively replaced by "advanced", "progressive", "aristocratic", "lordly", "graceful", "proud", "grand", "beautiful", even "sublime", "magnificent beasts". Knight's disgust at the simple creatures of the sea and the early reptiles might have been motivated by aesthetic feeling as much as was his adoration of cats (of prey); but at its root was the disdain for anything that was not progressive and efficient. In his verbal and visual story, personified nature seems to follow divine intention

in securing efficiency and progress by means of a ruthless struggle for survival. As in the paintings for the AMNH, scenes of eating and being eaten and of the race of armament between species are prominent in Knight's books. Again, dinosaurs were the perfect material for a drama of "savage killers", "pouncing upon some hapless victim and biting and clawing it without mercy until it died".[67] The extinction of these monstrous killers that Knight described as a "very moronic family" was not meant to induce regret in the reader/viewer: "... Nature had apparently grown weary of the great scaly cold-blooded monsters. They had been in existence too long, for they were stupid, unadaptable and unprogressive. And so the world was to grow away from these slow-moving dunces...."[68]

Even when humans appeared, conditions had not substantially improved: "Life in those days was a strenuous affair."[69] As in the murals in the Hall of the Age of Man, it is especially the increase in brain size that marks human progress and sets humans apart from the rest of the animal world: "Gradually, by virtue of superior brain power, he gained ascendancy over all the creatures of the field."[70] And again as encoded in the Cro-Magnon mural, intelligence is not only manifest in the development of tools and weapons; human control over the animals is also dependent on the ability of man to manipulate the image of the creatures on the walls of his caves. As if to continue a long argument with the by then deceased Osborn, Knight emphasizes the importance of art that, from its beginnings in the Stone Age, had been far more than auxiliary to science.

Such a story of life's progress was easily absorbable for a general readership, and the book was a great success, so that Knight's publisher exclaimed that "*Life through the Ages* is extremely popular with librarians and students. I hear many excellent comments as I travel around visiting schools".[71] But also adults loved it. Yet again — as in the case of the story conveyed through the cases and murals in the Hall of the Age of Man — they may have taken away an unintended message, one not only of overall advancement through life's parade through the ages, but also one of a linear line of descent: "Thank you for ... your book of remarkably beautiful, accurate and dramatic drawings. I always get a tremendous thrill from your work — whether it's the caveman or the gorilla still lingering in me, I do not know."[72]

Knight's linear, progressive series of images and texts are broken, however: for even more than the palaeontologists, Knight had the present always in mind. He regarded any fossil animal through the lens of a present-day analogue, so used was he to draw from living models at the Central Park zoo. This back-and-forth technique confused his series of stages in the earth's history by implying a coexistence of the non-contemporaneous, in which some creatures died out, some stagnated, and others progressed. Throughout *Life through the ages*, Knight compared extinct creatures to living ones in the text, and in some of the images juxtaposed recent and extinct animals. He even interspersed the series through the ages with illustrations solely of modern animals. Just as the discussions among the museum staff about the appropriate living models for the human series in the Hall of the Age of Man betray racial views, Knight's own back-and-forth technique was not without rationalization

where humans were concerned. Around the time the Hall of the Age of Man series was produced, Knight responded to a letter to the editor of a newspaper, in which a reader had shown himself offended by Knight's 'restorations'; rather than inspiring awe through an illustration of "the long series of wonderful manifestations" in the history of the earth, the reader considered Knight's prehistoric humans as cause for contempt. Drawing on a familiar argument, Knight answered:

> If they think my restorations of prehistoric man are an insult they think it an insult to say that the restorations I make are our ancestors. A little study of the races of the world will divulge many types living on earth at present who are far more brutish in appearance and absolutely primitive in their habits of living, having the civilization of the Stone Age. It is rather a notion that civilized peoples represent all the peoples of the earth but that is a false idea.[73]

We may conclude that even though the line of reasoning evident in this quote is clearly a heritage from nineteenth-century evolutionism, the "Osborn-Knight restorations" were no longer intended to transport a straightforward line of development and descent. In Osborn's view, evolution proceeded along orthogenetic lines, but was highly polyphyletic. Phylogeny took the shape of a bush-like structure with many branches growing in parallel towards the sky, with some dying off in the process. As we have seen, this also applied to hominid evolution. No known fossils were placed on the line leading to modern humans. Instead, this void was filled with an imaginary Dawn Man that had anatomically been relatively modern at very distant times. Furthermore, as has been generally diagnosed for the turn-of-the-century American culture, a belief in inevitable progress had given way to a sensibility towards the instability of what Osborn and his peers considered as advances. Without effort and struggle, there would be no gain and progress.

But how to convey such a complex of diversification, linear trends, progress, stagnation, degeneration, acceleration and deceleration in a series of images? When accompanied by words, such as in one of Knight's lantern-slide lectures, the message could be brought home: "The Cro-Magnon type was as highly developed mentally as the modern man."[74] However, the central role Knight played in the fulfilment of Osborn's vision for the museum had also been due to the special kind of instruction that exhibition halls allowed and of which Osborn was so well aware. The exhibits had to stand for themselves, and had to appeal to the visual sense. As both men believed, the combination of beauty and art realized in the "Osborn-Knight restorations" maximized the truth content of the images. Nevertheless, the series of the Neanderthals, Cro-Magnons and Nordics for the Hall of the Age of Man were read as a story of descent and progress, despite the fact that Osborn had intended a non-linear narrative. Indeed, Osborn might have made use of the spatial as well as the visual dimension of the museum halls in conveying his story. After all, the three images were not exhibited as a series in the strict sense. If we go back to the arrangement of the Hall of the Age of Man — a section of which is visible in Figure 3 above — it becomes clear that the three human murals were placed above the entrances. At

times where there were a lot of visitors, streams of people would have entered the hall from beneath the three scenes, as though re-enacting the invasion of different human types into Europe during the Stone Age.

Was all this of no avail? While for Osborn seriality was a tool aimed at efficient production and creative education, it did not give him full control either in the making of the decorations, or over their interpretation. It might well be that the evolutionist script had been too deeply engrained in the visual cultural memory for a series of images to convey an as many-layered story of life's protracted pageant through the ages.[75] But Knight's paintings have been so influential, and through them Osborn's message of a strenuous life in deep time, that images of dinosaurs lazing around or engaging in social behaviour are hardly the first ones to appear in front of our inner eye. Gould caught the partly subliminal way in which Knight's reconstructions affect the ways in which dinosaurs, fossil mammals and prehistoric humans are imagined: "If one seeks the name of the person most responsible for our usual sense, our everyday 'feel,' of the nature, status, beauty, strangeness, and fascination of prehistoric life, only one person can possibly claim the title.... That person is not Darwin.... That man is Charles R. Knight."[76] Even though his anniversaries cause no worldwide hype, Knight's images have influenced conceptions of prehistoric animals and humans more than any others. Through their impact on palaeontologists and palaeoartists, they continue to shape scientific, artistic and popular imagination. And the original series can still be seen on museum walls.[77]

REFERENCES

1. Garland E. Allen has shown how notions of efficiency entwined the economic and the social spheres. The values of more effective production were associated with those of control and order. Economic control meant effective models of division of labour, input and output assessment of factories (including machines and humans), and the planned and controlled fragmentation of work processes. Social control meant supervised integration of the fragments of society into an efficiently functioning whole. Allen argues that the eugenic reform can also be seen as the attempt to apply business methods to evolution, to rationalize humankind's biological development (the Eugenics Record Office was involved in marriage counselling to create the fit and in social legislation and education aiming at decreasing the number of 'defectives produced'). Garland E. Allen, "The Eugenics Record Office at Cold Spring Harbor, 1910–1940: An essay in institutional history", *Osiris*, 2nd ser., ii (1986), 225–64. For a scientific biography that situates Osborn's life and work in the context of the progressivist educational and political goals of his urban élite circle, including their interrelated concerns for nature conversation, the fitness of the American population, and the 'back-to-nature' movement, see Ronald Rainger, *An agenda for antiquity. Henry Fairfield Osborn & vertebrate paleontology at the American Museum of Natural History, 1890–1935* (Tuscaloosa, 1991).
2. See particularly his biographies of "great naturalists", including Darwin's, in Henry Fairfield Osborn, *Impressions of great naturalists: Reminiscences of Darwin, Huxley, Balfour, Cope and others* (New York, 1924 (1913)).
3. Henry Fairfield Osborn, *Creative education in school, college, university, and museum: Personal observation and experience of the half-century 1877–1927* (New York, 1927), 252.
4. Osborn, *Creative education* (ref. 3), 236–7.

5. Osborn, *Creative education* (ref. 3), 269.
6. Henry Fairfield Osborn, "Giant beasts of three million years ago", in Roy Chapman Andrews (ed.), *On the trail of ancient man: A narrative of the field work of the Central Asiatic Expeditions* (New York, 1926), 193–5.
7. In particular, the photographic, filmic, graphic, and textual inscriptions may be seen as "immutable and combinable mobiles", while the museum functioned as a "center of calculation" also with respect to fossils (Bruno Latour, *Science in action: How to follow scientists and engineers through society* (Cambridge, 1987), 227–8, 232–47; see also Gregg Mitman, "Cinematic nature: Hollywood technology, popular culture, and the American Museum of Natural History", *Isis*, lxxxiv (1993), 637–61).
8. Osborn to Louis D. Froelick (editor of *ASIA*) (27 Mar. 1923), Froelick to Osborn (23 July 1923) (American Museum of Natural History, Special Collections, Manuscript and Personal Papers Collections K57: Knight, Charles Robert, 1874-1953, Manuscripts. Location: 6-26 B2 (hereafter AMNH, Knight), 1077.2).
9. See catalogue of Knight's paintings, models, and murals, 1894–1924, dated January 1924 (AMNH, Knight, Box 245, 1065).
10. Osborn to Knight (9 Aug. 1920), New York Public Library, Rare Books and Manuscripts Division, Charles R. Knight Papers (hereafter NYPL), Box 1, Folder 2.
11. Charles R. Knight, "Mural paintings of prehistoric men and animals", *Scribner's magazine*, lxxi (January–June 1922), 279–86, p. 279.
12. See for example the discussion of the panels for the Hall of the Age of Mammals (Osborn to Knight (16 July 1923), AMNH, Knight, Box 245, 1065); and George H. Sherwood (executive secretary) to James L. Clark (12 Nov. 1925) on the model of the Hall of the Age of Reptiles (AMNH, Knight, Box 728, 1262).
13. See for example Osborn to director Frederic A. Lucas (19 June 1923), AMNH, Knight, Box 245, 1065; Osborn to William Diller Matthew (24 Oct. 1924), AMNH, Knight, Box 245, 1065.
14. Knight would eventually describe his method for the case of living animals in Charles R. Knight, *Animal drawing: Anatomy and action for artists* (New York, 1947).
15. Knight to Osborn (15 May 1920), AMNH, Knight, Box 728, 1262.
16. Note from Osborn to Sherwood (18 June 1925), AMNH, Knight, Box 728, 1262.
17. See for example Osborn to Lucas (27 June 1918), AMNH, Knight, Box 90, 249; Osborn to Sherwood (3 July 1925), AMNH, Knight, Box 728, 1262.
18. See for example the contract for the Pampean mural, Hall of the Age of Man (Sherwood to Knight, 25 July 1918), AMNH, Knight, Box 90, 249; for the three human murals, Hall of the Age of Man (Lucas to Knight, 26 June 1919), AMNH, Knight, Box 90, 249; for the Blanco waterhole panel, Hall of the Age of Mammals (20 June 1923, Pliocene Panel A, signed by Knight 28 Nov. 1923, AMNH, Knight, Box 245, 1065); and for Pliocene Panel C (signed by Knight 19 Jan. 1925, AMNH, Knight, Box 728, 1262). Already the draft of the contract for the Rancho La Brea Panel A, The Tar Pool, for the Hall of the Age of Man, contained the clause that the copyright for the sketch would rest with the museum (Sherwood to Knight, 28 Jan. 1921, AMNH, Knight, Box 728, 1262). The final and signed contract carried the date of 10 February 1921 (Sherwood to Knight, AMNH, Knight, Box 90, 249).
19. Lucas to Osborn (19 Oct. 1914); for the letter stating the agreement, see Lucas to Knight (28 Oct. 1914); the agreement was signed by Lucas and Knight on 10 Nov. 1914, AMNH, Knight, Box 90, 249 (the correspondence and documents on which I base the description of the production of the fist mural are located in Box 90, and marked with the number 249; the folders are sorted by year).
20. Lucas to Knight (13 Jan. 1915).
21. Knight to Osborn (5 Feb. 1915).

22. Osborn to Knight (9 Feb. 1915).
23. Lucas to Morgan (15 May 1915).
24. Osborn to Lucas (20 May 1915).
25. Osborn to Lucas (20 May 1915).
26. Osborn to Lucas (26 May 1915).
27. Lucas to Osborn (26 May 1915).
28. Osborn to Lucas (27 May 1915, 21 Oct. 1915), Lucas to Osborn (27 May 1915), Lucas to Knight (22 Oct. 1915).
29. Lucas to Osborn (27 May 1915).
30. Lucas to Osborn (19 Oct. 1914), for the letter stating the agreement, see Lucas to Knight (28 Oct. 1914).
31. Lucas to Knight (13 Jan. 1915).
32. Knight to Lucas (1 Aug. 1915), Lucas to Knight (4 Aug. 1915, 11 Aug. 1915).
33. Osborn to Lucas (23 Oct. 1915).
34. Lucas to Knight (25 Oct. 1915), Osborn to Morgan (20 Dec. 1915), Lucas to Osborn (26 Feb. 1916), certificate of insurance dated 1 Feb. 1916.
35. Osborn to Knight (1 Feb. 1916).
36. Knight to Osborn (3 Feb. 1916).
37. Knight to Osborn (3 Feb. 1916), emphasis in the original.
38. Osborn to Knight (18 Feb. 1916).
39. Osborn to Knight (7 Feb. 1916), emphasis in the original.
40. Annie Hardcastle Knight to Osborn (? 1916; shortly after above letter).
41. Matthew to Osborn (?).
42. Knight to Osborn (19 Feb. 1916).
43. Knight to Osborn (19 Feb. 1916).
44. Osborn to Knight (2 May 1916).
45. Osborn to Lucas (2 May 1916).
46. Knight to Osborn (8 June 1916).
47. Osborn to Morgan (28 Sept. 1916).
48. Osborn to Morgan (28 Sept. 1916).
49. Assistant Secretary to Morgan (24 Nov. 1916).
50. Osborn to Morgan (28 Sept. 1916); see also Osborn to Knight (28 Sept. 1916).
51. These developments are well documented in the archives of the AMNH, but absent from the sparse secondary literature on Knight. However, this is not the place for the development of this story either (for the most detailed treatment of Knight's art, see Sylvia Massey Czerkas and Donald F. Glut, *Dinosaurs, mammoths, and cavemen: The art of Charles R. Knight* (New York, 1982)).
52. AMNH, Knight, Box 90, 249.
53. Stephen Jay Gould, "Ladders and cones: Constraining evolution by canonical icons", in *Hidden histories of science*, ed. by Robert B. Silvers (New York, 1995), 38–67, in particular pp. 42–60.
54. Clark's analysis of the role of diagrammatic visualizations of evolution is situated in the anti-evolution campaign of the American 1920s. She points out that the ways in which these were understood by non-specialists might well have differed from at least the messages consciously intended by their expert producers. She also discusses Osborn's conspicuous public involvement in the debates surrounding the Scopes Trial of 1925. While the fact that the anti-evolution sentiment of the time clearly influenced Osborn's science and public engagement is not of concern here, Clark demonstrates that exactly that kind of misunderstanding also pertained to Osborn's Hall of the Age of Man, where visitors felt a simple progress was being communicated in a *scala naturae*

arrangement, for example in the cases with J. Howard McGregor's busts of *Pithecanthropus*, Piltdown Man, Heidelberg Man, Neanderthal, and Cro-Magnon (Constance Areson Clark, "Evolution for John Doe: Pictures, the public, and the Scopes Trial debate", *The journal of American history*, lxxxvii (2001), 1275–303; see also Constance Areson Clark, *God — or gorilla: Images of evolution in the Age of Jazz* (Baltimore, 2008)).

55. Henry Fairfield Osborn, *Men of the Old Stone Age, their environment, life and art* (New York, 1915), 489.
56. Osborn, *Men of the Old Stone Age* (ref. 55), 491.
57. Osborn, *Men of the Old Stone Age* (ref. 55), 272, 316.
58. Osborn, *Men of the Old Stone Age* (ref. 55), 450.
59. Henry Fairfield Osborn, *Man rises to Parnassus: Critical epochs in the prehistory of man* (Princeton, 1927), 155–87.
60. Osborn to McGregor (13 Dec. 1918), Gregory to Osborn (6 Jan. 1919), Osborn to Knight (6 Jan. 1919), Osborn to Lucas (6 Jan. 1919), Osborn to Mrs Knight (21 July 1919), Osborn to Knight (4 Jan. 1921), AMNH, Knight, Box 90, 249.
61. On the human murals see also Stephanie Moser, *Ancestral images: The iconography of human origins* (Ithaca NY, 1998), 156–60; on the racial aspects of the Hall of the Age of Man in general, see Charlotte M. Porter, "The rise to Parnassus: Henry Fairfield Osborn and the Hall of the Age of Man", *Museum studies journal*, i (1983), 26–34; Rainger, *An agenda for antiquity* (ref. 1), 169–77; Brian Regal, *Henry Fairfield Osborn: Race, and the search for the origins of man* (Aldershot, 2002), 151–4.
62. For an alternative interpretation, see Michele Bogart, who argues that "… the three murals were intended to show diachronic and paleontological developments as straightforward revelations of evolutionary progress, the advancement of human 'races' from the Neanderthal and the Neolithic" ("Lowbrow/highbrow: Charles R. Knight, art work, and the spectacle of prehistoric life", in *American Victorians and virgin nature*, ed. by T. J. Jackson Lears (Boston, 2002), 39–63, p. 47). In Bogart's view, Knight differed from Osborn's intention when he revealed his higher regard for the Cro-Magnons than for the other types. However, Osborn saw in the Cro-Magnons the most advanced human type ever in existence, with an art excelling that of the Greeks.
63. Charles R. Knight, *Autobiography of an artist*, ed. by Jim Ottaviani (Ann Arbor, 2005), 91.
64. The question of clothing was controversial. Many of the museum experts considered the clothes scientifically inaccurate (Lucas to Osborn (26 June 1914), AMNH, Knight, Box 90, 249). In fact, even Breuil had advised Osborn that most likely the Cro-Magnon people had not worn clothes (Breuil to Osborn (27 Jan. 1919), NYPL, Box 1, Folder 2). Nonetheless, Osborn insisted on clothing (Osborn to Knight (28 July 1919), AMNH, Knight, Box 90, 249).
65. The paintings are reproduced and described in Charles R. Knight, *Before the dawn of history* (New York, 1935), 112–19, see also 25–30; on the Neanderthals, the Cro-Magnons, and on Stone-Age art, see also *Prehistoric man: The great adventurer. The saga of man's beginnings in word and picture* (New York, 1949), 153–91.
66. Rhoda Kalt on lecture by Ch. Knight at Marine Biology Laboratory, Charles Knight: Unpublished Biography MS. Box 1 of 1, Kalt Donation 4/92, AMNH archives.
67. Charles R. Knight, *Life through the ages* (Bloomington, 2001 (1946)), 12.
68. Knight, *Life through the ages* (ref. 67), 20–21.
69. Knight, *Life through the ages* (ref. 67), 34.
70. Knight, *Life through the ages* (ref. 67), 34.
71. Helen Durney of Alfred A. Knopf to Knight, 9 May 1946, NYPL.
72. Cecil B. deMille to Knight, 22 July 1946, NYPL, Box 2, Folder 1.
73. Knight, 18 March 1922, NYPL.

74. Illustrated lecture before the Architectural League, called “Life through the ages” (1926, NYPL).
75. See Arthur MacGregor, “Exhibiting evolutionism”, *Journal of the history of collections*, xxi (2009), 77–94.
76. Stephen Jay Gould, “Foreword: Life through our ages”, in Charles R. Knight, *Life through the ages* (Bloomington, 2001 (1946)), pp. vii–x, p. viii.
77. Gould recognizes the influence of Knight’s images in his decision to become a palaeontologist (Gould, “Foreword” (ref. 76), p. vii). Many present-day palaeontologists and palaeoartists refer to Knight as the inspiration in the choice of their career, and in shaping the ways in which they imagine the lost worlds of dinosaurs and other fossil animals (see for example, Philip J. Currie, “Introduction”, in Charles R. Knight, *Life through the ages* (Bloomington, 2001 (1946)), pp. xi–xxii, especially p. xi; John Anthony Gurche, personal communication, 27 January 2009; appreciations in Charles R. Knight, *Autobiography of an artist*, ed. by Jim Ottaviani (Ann Arbor, 2005), 103–7; and in William Stout, *Charles R. Knight sketchbook*, ii (Pasadena, 2002), and iii (Pasadena, 2003)).