Mapping of Knowledge in the Natural History Museum: Richard Owen's Naturalistic Ideas and Spatial Layouts of the Natural History Museum in London

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Abstract. A museum is a public place where objects of significance are arranged and displayed for visitors. The arrangement of objects in a museum therefore serves as a crucial interface between the objects and visitors. But what are the principles or theories behind the arrangement of objects and how are they supported by the spatial layout and design? This study uses the Natural History Museum (NHM) in London as a case to investigate how the arrangement of objects and the spatial layout of displays were structured and designed with a specific kind of knowledge about nature that had both social implications and effects for the creator of this museum: Richard Owen. This study analyzes various plans of the NHM and argues that the effects of the designed interfaces between visitors and objects concern a classification of people and an alternative view of the theory of evolution. It is further argued in this study that the spatial layout of the NHM was structured following Owen's naturalistic theory and that this theory was related to the emergence of a particular 'subject position' in 19th century scientific circles.

Keywords: archetype, diversity, evolutionism, Natural History Museum, Richard Owen, spatial layout, space syntax.

INTRODUCTION

Richard Owen (1804~1892), the founder of the Natural History Museum in London (Fig. 1), was a very important figure in 19th century natural history. His intellectual connection with the famous French comparative anatomist Georges Cuvier, and his disagreements with contemporary natural theorists, such as Charles Darwin and Thomas Huxley, occurred in a very critical period of modern biological thought in Britain. Owen's naturalistic theory is traditionally regarded as conservative and reactionary compared to Darwin's theory of evolution. However, according to recent studies on Owen, mainly by Nicolaas Rupke (1994), the relationship between Owen's theory and Darwin's evolutionism is quite complicated and actually more closely related than has hitherto been recognized. Owen is considered, by Rupke and others, to have had his own theory of evolution, which was partly related to Darwin's.

In this paper, I explore several important naturalistic ideas of Owen's and analyze how the spatial layouts of the NHM are related to his ideas. Through spatial analysis, it is argued that Owen's ideas can be identified as a particular form of evolutionism. This paper is organized as follows: The first section 'A Review on the Studies of Knowledge and Space in the Natural History Museum' focuses on what this special knowledge was and how it is recognized in the different literature as being mapped into spatial layouts of the NHM. Based on a literature review, this paper suggests that it is necessary to further trace the naturalistic ideas of Owen and the relationships between his ideas and spatial layouts. The following sections therefore examine, in detail, how Owen's naturalistic ideas are related to the space at the NHM. The second section 'The Construction of Space in the NHM and the Idea of Diversity' examines how Owen's idea of 'diversity' was used to determine the size and form of the

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space and what the position of this idea is in his theory. The third section 'Archetype and the Spatial Structure of the NHM' analyzes how the NHM's spatial layout is a response to Owen's ideas on 'archetype' which is closely related to transcendentalism of the 19th century. The final section is 'The Subject Position and Ideological Constraints'. It concludes that the spatial designs of the NHM in the 19th century were a response to Owen's ideas of a 'transcendental archetype' which was an epistemological position very much related to the emergence of Owen and the metropolitan naturalists in the 19th century.

Hooper-Greenhill in her *Museums and the Shaping of Knowledge* (1992) analyzed how the transformation of knowledge is related to the emergence of a new 'subject position' in museums. Earlier in 1985 Laclau and Mouffe in their *Hegemony and Socialist Strategy* argued that the subject position is created by discourse, which is the discussive effect of creating social categories and boundaries. If Owen's naturalistic ideas and theory can be regarded as a discourse that created a subject position in scientific circles, then what is the role of space, particularly the spatial layout of the museum? This study uses 'space syntax' as the method for spatial analysis. Through the space syntax method and a literature review, I attempt to show how the spatial planning of the NHM can be related to specific knowledge and subject position. It is revealed in this study that museum space is not just a reflection of knowledge but also a resource that a subject in history draws on to articulate social relationships.

Fig. 1. The Natural History Museum in London in the late 1990s.

Section 1. A Review of Studies of Knowledge and Space in the NHM

Peponis and Hedin (1982), in their pioneering work *The Layout of Theories in the Natural History Museum*, proposed some suggestions which have had great influences on subsequent studies about the relationship between spatial layout and knowledge. They compared the Human Biology Hall with the Bird Gallery which were respectively built in 1980 and 1871 and suggested that the axial fragmentation of the Human Biology Hall was related to the epistemological rupture which had made the transmission of knowledge very different. According to them, acquiring knowledge is now more reliant on interpretation. Knowledge no longer rests on the surface of things, but is the invisible 'function' that needs to be explained. Nowadays, visitors to museums are barely able to 'acquire' knowledge from the museum; they can only be 'told' by a professional what knowledge is. In other words, visitors to museums have become passive, they are passive in producing knowledge since knowledge is no longer reliant on the surface of things.

Peponis and Hedin's idea about this change in knowledge is very powerful in viewing how knowledge has played a very essential role in shaping museum spaces. By using the method of space syntax, they successfully pointed out differences between the spatial layouts of these two galleries; and with the idea of the change of knowledge, they inspirationally explain the cause of the change in space. The very critical element of their argument about the cause of spatial change is based on their study of the history of naturalistic ideas. According to their study, Owen's natural theory is skeptical about the theory of evolution: "The scheme of nature advocated by Owen goes back to the theories of classification and taxonomy developed by Linnaeus around 1756" (Peponis and Hedin, 1982: 23). Compared with this old theory of classification, the modern biology that is represented by the layouts in the Human Biology Hall presents a very different kind of natural theory. It is the triumph of the theory of evolution: "Biology has moved from the surface of things towards less visible structures .... The fundamental change was the adoption of the idea that life had its own logic distinct from that of language and that to name things was not to know them" (*ibid.*: 23). The paradigm had shifted, which effectively changed spatial structures.

We can learn from Peponis and Hedin's study that the theory of evolution is a very critical point from which to judge the difference between Owen's ideas and those of modern biology that were championed by most biologists. Before Darwin's theory, it was argued that a table of similarities and differences was the main concern that naturalists such as Linnaeus and Owen recognized. To know a thing was to find for it a place in the table, and then give it a name, once and for all. After Darwin, however, the principles of classification changed. The similarities and differences of appearance were no longer sufficient, since there were too many possibilities. The invisible structures of function had replaced the old principle, and the idea of time was admitted into the new theory. "Rather than mirror the order of things, language attempted to formulate hypotheses. The laws of nature ceased to be visible in comparisons and became enunciated in propositions" (*ibid*.: 23). They recognized the theory of evolution as a dramatic change in relationships between language and knowledge. To give and learn a name is not really to know the thing, you have to know the thing through the proposition that needs language to provide more explanation and interpretation.

This change was recognized by Peponis and Hedin as a very important factor shaping differences between the layouts of the Bird Gallery and the Human Biology Hall in the NHM. In their article, they compared the two galleries using the space syntax method and argued that the spatial structures of the two galleries actually reflect the two different paradigms about nature. The layout of the Bird Gallery was highly 'asymmetric'[3] and without a 'ring'[4] ; it reflects a strong tendency to synchronize controls and keep the objects apart. In other words, what the layout tries to do is to spatialize the static table. The layout of the Human Biology Hall, on the other hand, is diffuse in terms of controls and is axially fragmented. The plan works 'sequentially'; space therefore acquires the structure of a proposition. Peponis and Hedin's argument about the relationships between Owen's naturalistic idea and the spatial layout has been very influential in the study of museum layouts and knowledge. Historians of scientific knowledge and science museums have also contributed to this issue from a more-historical perspective. There are several researchers who have been concerned with the shift in scientific knowledge. Among them, Forgan and Yanni's research on museums is typical.

Forgan's studies on museum spaces mostly regard relationships between the rupture of the pedagogical regime of scientific knowledge and museum spaces in the 1870s. According to her study, *The Architecture of Display* (Forgan, 1994), the transmission of scientific knowledge experienced a shift in the third quarter of the 19th century. Before the 1870s, the transmission of scientific knowledge was 'lecture-based'. The museum collections were used for illustration and demonstration. After the 1870s, scientific instruction abruptly became laboratory-based (*ibid*.: 151). This shift was a pedagogical transformation from a 'museological approach' to a 'laboratory-based approach' which is a regime essentially based on order, repetition, experiment, and control of the immediate physical environment. After this shift in museums, "the preciseness of connection between the display of material and the sort of knowledge acquired by the observer was no longer wholly clear" (*ibid*.: 153). Scientific knowledge was more reliant on 'interpretation', but the knowledge needed to interpret the display was often too complicated to be represented by the text alone. In such a circumstance, displays in museums were no longer able to inculcate 'precise' knowledge. Consequently the exhibition and study of collections in the museum were divided. 'Public displays' in museums, for Forgan, became the 'instruments of moral improvement' after the 1870s since it did not function to transmit 'real' knowledge to visitors.

Forgan's ideas about science museums in the 19th century clearly had an influence on Yanni's (1999) work: *Nature's Museums - Victorian Science and the Architecture of Display*. In Yanni's analysis of the spatial construction of the NHM, articulation by architects and curators was mainly focused on the principle of the division between 'scientific research' and 'public education'. In the camp of scientific research were Huxley and Darwin, who considered that a museum should be comprised of carefully selected educational exhibitions. In the camp of public education was the creator of the NHM, Richard Owen. He is considered by Yanni to have attempted to display every collection without selection through scientific theory: "In Owen's mind these collections should not be hidden away in drawers and boxes. Instead, the museum was meant to be

an architectural setting that celebrated the act of looking and the ambition of a visible imperial archive" (Yanni, 1999: 114).

Along this demarcation, Yanni considered the architect Robert Kerr, who failed in the architecture competition for the NHM, to be closer to Huxley's camp because he was more concerned with the 'meaning of scientific objects' (*ibid*.: 124). On the other hand, Francis Fowke and Alfred Waterhouse were described by her as professionals who respectively concentrated on technical details and emphasizing a church-like quality. These two architects were in alliance with Owen, while Fowke's plans were implicitly characterized as the "bazaar place of bewildering commodification" epitomized by the Crystal Palace; Waterhouse's plan was recognized by Yanni as "the depiction of the museum as public entertainment rather than scientific research" (*ibid*.: 128).

Yanni's narrative framework of the NHM is mainly constructed along the lines of demarcation of the pedagogical shift. 'Public education' in her hands moves a clearer connection with 'public entertainment' further forward than does Forgan. The NHM in the third quarter of the 19th century was, for Yanni, a place for public entertainment to copy the spatial form of the Crystal Palace. In this sense, Yanni notes: "While glass-ceilinged halls at first seemed to offer a direction for museum builders, when the form was co-opted by popular exhibitions, its usefulness for serious science waned .... The Natural History Museum in London therefore could not serve as a model for other museums" (*ibid*.: 4). The function of entertainment emerged with the development of a specific spatial type. 'Serious' knowledge was eclipsed by this function. However, several problems should be raised about her argument.

The first problem is in regard to Owen's ideas about nature and display. In her study, Yanni noted that the idea of 'diversity' was a very important one. On the one hand, it was interpreted as an attempt to display as many exhibits as possible; an idea which was connected to imperialism (*ibid*.: 114). On the other hand, it was a preoccupation of early Victorian science to show the diversity of 'Creation' (*ibid*.: 144-146). However, the position of the idea of 'diversity' in Owen's theories about nature was not really made very clear. Although Yanni said that "The architecture of the museums could not always act to legitimise one particular theory; in most cases, ideas about science or nature were in conflict, and the architecture therefore responded to that conflict" (*ibid*.: p.4), she did not focus on how these conflicts were concerned with museum space. In this respect, it is difficult to say that Owen's idea of 'diversity' was only the product of imperialism, natural theology, or even the idea of 'public entertainment'.

The second problem relates to the spatial layout of the NHM. Yanni's study notes that the NHM's space became a constraint for more 'cutting-edge science', and this limited the later development of the NHM. In her discussion of the expression of antiquated science in the museum's plan and ornamentation, quoting talks by Flower, Owen's successor, Yanni implies that the constraints came from Owen's master plan and the ornamentation on the facade of the building. Owen's master plan was considered to be intended to "display every specimen of the national collection", which for Flower was an 'absurdity'. The ornamentation and plan were considered to represent the division between biology and paleontology which for Yanni did not "reflect the philosophy behind contemporary biology and palaeontology" (*ibid*.: 145).

However, the way space can constrain the development of new representation is questionable. If the constraint was due to the fact that exhibition spaces were entitled 'biology' and 'paleontology', it is difficult to imagine how these spaces and the exhibits within them could not be reused, renamed, and rearranged to suit the new paradigm. If the constraint was caused by the ornamentation on the facade of this building, it is also doubtful whether the decorations were such a strong an influence on visitors' ideas about nature.

The importance of Yanni's study of the NHM partly lies in the fact that it could have an effect on contemporary museums. The idea of the division of 'research' and 'public education' which was inherited from Forgan's idea of the pedagogic shift can provide a perspective on museum activities in modern society. Yanni's work has contributed to the question of how today's museum arrived at its current situation through a historical approach. However, some questions remain that should be further studied. In the following sections, to answer the questions raised from the above literature review, this thesis aims to investigate how Richard Owen used museum spaces as a resource to embody his naturalistic ideas and by doing so, to uphold the new subject position - a class of metropolitan naturalists.

Section 2. Construction of Spaces in the NHM and the Idea of Diversity

The idea of constructing a new museum for collections of natural history in the British Museum was first raised in the mid-19th century. Overcrowding was, in a literal sense, the trigger for demanding a new building. According to Girouard's study, Richard Owen, by 1861 the superintendent of the Natural History Department, took William Ewart Gladstone on a tour of his department to show him that the space in the British Museum was not adequate for the collections. "The stores were crammed to bursting with inaccessible specimens, the galleries were overcrowded and badly lit. He left firmly convinced of two things: the Natural History Museum needed a new museum of their own; and Professor Owen was a brilliantly capable man, with whom he saw eye to eye on a great many subjects" (Girouard, 1981: 7).

Moves toward a new museum for natural history were not solely propelled by Richard Owen, however. In 1858, more than a hundred scientists and naturalists signed a memorial to the Chancellor of the Exchequer, Benjamin Disraeli, to complain about the inadequate situation for natural history at the British Museum (Yanni, 1981: 8; 1999: 112). What concerned these naturalists was also the incompatibility of the limited space and the growing number of collections. William Stearn considered that this problem was increased by the expansion of British imperialism which brought more and more natural history specimens into the country from the middle of the 19th century (Stearn, 1998: 27). The expansion of imperialism brought more collections, and the greater number of collections created the need for a new museum. The emergence of the NHM was similar in this sense to other national museums built in Britain in the second half of the 19th century.

The problem of 'overcrowding' in the British Museum, according to Rupke's study, in fact probably appeared a little bit earlier than the middle of the 19th century[5]. Years of suffering from the lack of sufficient space had become one of the reasons Owen intended to convince the government to build a new museum. For this purpose, Owen wrote a proposal for building the NHM: *On the Extent and Aims of A National Museum of Natural History*. This proposal could be regarded as the most important architectural text for the museum. *On the Extent and Aims* was a booklet published in 1862, which was an enlarged version of his talk to the Royal Institution in 1861. This booklet was a very obvious attempt to convince Parliament to grant funds for the new museum. In this booklet, also a proposal for the new museum, Owen showed the importance of a new museum by referring to the different functions of a museum in which 'diversity' was a very important medium for his museum-building ambitions.

In this proposal, Owen specifically discussed why this museum was needed, and what shape and size this museum should be. In the proposal he complained about the exhibition space in the British Museum which was devoted to the arrangement of exhibits for the class of Mammalia. Owen exemplified the problem of the British Museum by describing the giraffe exhibits and then began to criticize the shape of the exhibition space. He said:

> In this space, as is notorious, the specimens are packed as closely as they can be stored, often three, four, or five deep in the cases; or they crowd the floor like a herd of cattle; or they are attached to the wall, at heights inaccessible to the scientific observer.
>
> (Owen, 1862: 13)

The inadequate space for storage and display of the natural collections became ammunition for Owen. The spatial problems not only provided Owen with strong justification for building a new museum, but also became a problem the new museum had to overcome.

Regarding the size of the exhibition space for the new museum, Owen said that the exhibition space "is to be estimated - first, by the number of known species of the class" (*ibid.*: 12). He then stated four other principles. The last of these being the need for an "orderly series for a true idea of the group". The first principle already reveals that Owen tried to display the specimens according to the principle of the proportion of known species. The arrangement of specimens was to be such that "each class of animals should receive its due proportional amount of elucidation to the extent which the acquired specimens at the time may admit, and according to the degree in which the principle of variety is manifested in the class" (*ibid.*: 10).

To put it simply, exhibiting as many specimens as possible in order to make the diversity manifest

was what Owen sought from the display in this proposal. That is also the reason why Flower attacked him and argued that this museum therefore "cannot be taken structurally as a model museum" (Flower, 1898: 42). This principle dominated Owen's ideas about the size of the space for displaying different classes; for example, the space for one of the mammalian galleries was estimated according to the number of species of seals.

> The number of species of Seals registered in Zoological works is upwards of fifty; their diversity of form and structure has led to their partition into five well-marked families. Exercising a proper discretion in the selection of specimens for exhibition, they would range along about 100 feet of the Mammalian Gallery.
>
> (Owen, 1862: 38)

In Owen's description of the exhibition space for the different classes, all spaces appeared as oblong galleries. The Gallery for Seals would 'range along' about 100 feet of the Mammalian Gallery which was estimated totally as "400 feet in length, by 45 feet in breadth" (*ibid*.: 38-41); Geology and Palaeontology was "850 feet in length, by 45 feet in width" (*ibid*.: 64-66); and the Gallery of Mineralogy should be "on the ground-floor of a gallery of 270 feet in length, by 40 feet in breadth" (*ibid*.: 74-75). All spaces for the different classes of Mineralogy, Geology, and Palaeontology were designed by Owen as oblong shapes, 40~45 feet wide, with the length dependent on the number of species.

In *On the Extent and Aims*, it can be seen that Owen endeavored to link his idea of diversity to the different functions of the museum. The first function Owen's diversity could serve was entertainment. On page 14, Owen said that "a museum destined to gratify the curiosity of the people, and afford them subjects of rational contemplation, ought to exhibit the maximum of the characters afforded by the dimensions of certain species of a class which is peculiar for the vast bulk of such species" (Owen, 1862: 14). "The maximum of the characters" naturally referred to the diversity of species. This diversity for Owen was particularly attractive to visitors when it revealed the vast bulk of such species. Therefore, the whale, "the largest specimen that can be procured ought to be exhibited in a National Museum" (*ibid*.: 14).

Exhibiting the whale, with its requirement of space for display, could be a means to "dramatise the need of space" as Rupke (1994: 34) said. It is understandable that Owen, as the primary initiator of the museum, would like a large museum. Owen's subsequent discussions about exhibiting the whale went further, however, and connected this need for space to both the "power of the Creator" and the "responsibility of a great country".

Following Owen's idea about how the whale would appeal to visitors' curiosity, Owen continued by saying that "One specimen, at least, out of the number of genera and species of the whale-kind should be prepared as an example of the power of the Creator as manifested by the hugeness of the creature" (Owen, 1862: 14). To exhibit a whale in a national museum therefore in Owen's text was not only concerned with a method of attracting visitors, it was a way to manifest the power of God. According to Girouard (1981: 27), "like his friend Gladstone but unlike his rival and enemy Huxley, Owen believed that the material world revealed the wisdom and purposes of God, who had created it". Rupke (1994: 54) recognized that Gladstone had been Owen's most powerful political patron for many years. By 1862 when *On the Extent and Aims* was published, Gladstone was Chancellor of the Exchequer, and it can be imagined how Gladstone's ideas about nature were very important for Owen.

Besides manifesting the power of God, exhibiting the whale was also a resource of scientific study which a great country should protect:

> If the wealthiest maritime and commercial country should not think it worth while to preserve one specimen, or at least the skeleton, of the right whale, before the species becomes a mere matter of history, it will be amenable to the same reflection which is cast upon the Dutch, who, [were] intent only on killing the dodo -- without caring to preserve a single specimen in their museums for the behoof of natural science.
>
> (Owen, 1862: 18-19)

To build a national museum to house the whale therefore in Owen's text, became a responsibility of a great country. Discussing such a museum he writes:

> The hugest, strangest, rarest specimens of the highest class of animals can only be studied in the galleries of a national one. It is surely unworthy of a great country to profess to have its Museum of Zoology, and to publicly vote, year by year, the sums required for the purchase of specimens; and yet to postpone, year after year, the cost of the simple buildings requisite to render them available.
>
> (*ibid*.: 22-23)

The reason this study has dwelt upon the topic of the whale is to try to show Owen's narrative strategy in context. The exhibition of the whale was concerned with entertainment and curiosity, then the power of the Creator, then scientific research, and finally the responsibility of the country. There are many ways of developing interpretations of Owen's ideas about display by examining these different aspects, for example natural theology, public entertainment, and imperialism. However, such interpretations need to be placed in a broader context. I am concerned with how Owen connected these different issues through discussing the object of the whale, which was embedded in the idea of diversity. The word 'diversity' provided the most flexible meaning which allowed Owen to articulate different functions of the museum. Of course, through this articulation, Owen was able to legitimize the requirement of the huge space that the new museum needed.

If diversity was the principle for estimating the scale of the space, the whale without doubt had more efficiently increased the demand for space in the new museum. Furthermore, in Owen's discussion about the 'type-form', he used the idea of diversity to oppose the 'type-form' which might endanger the scale of the museum by decreasing the exhibition space needed.

When considering the principles on which to organize the exhibits in the exhibition space, after having proposed several principles of priority, Owen attacked 'some Naturalists' who urged that the type-form was the only example necessary in order to exhibit each genus or family. He said:

> .... some Naturalists urge that it is only necessary to exhibit the type-form of each genus or family. But they do not tell us what they mean by their 'type-form'. It is a metaphysical term, which implies that the Creative Force had guiding pattern for the construction of all the varying or divergent forms in each genus or family. The idea is devoid of proof; and those who are loudest in advocating the restriction of exhibited specimens to 'type', have contributed least to lighten the difficulties of the practical curator in making the selection.
>
> (*ibid*.: 24)

Although he did not name them in *On the Extent and Aims* , 'some naturalists' could very possibly have been Huxley or Darwin. As Yanni pointed out, Huxley and Darwin preferred exhibitions with selection. In this context, Owen's display had been characterized as being 'without selection' and therefore being closer to the position of 'public entertainment'. This study suggests that, 'diversity' was also a kind of selection although it did not appear as a theory in the texts of *On the Extent and Aims*. Diversity was at the very least certainly the principle used to select specimens according to the proportion of known species and, therefore, a strategy for Owen to seek more space. Under the circumstance, what 'some naturalists' had advocated as the 'type-form' naturally attracted Owen's attacks since it implied a more-restricted use of space. In arguing against the type-form, Owen proposed another principle for exhibiting specimens:

> It is easy for the Book-naturalist to rule that only the type-form of the genus need be exhibited in a Public Museum. But even were all agreed as to the type-rhinoceros, type-elephant, type-hippopotamus, or type-tapir, the practical zoologist would testify that it is easier to make the required observations and comparisons of the species on the skins of great Pachyderms when stuffed and set up, than to have to open the stiff folds of a flattened and close-packed hide, and haul the bulky and cumbrous mass about, to bring to view this or that particular character.
>
> (*ibid*.: 35)

While naturalists of the type-form preferred to reveal the inner structure of animals, Owen emphasized the outer forms of diverse species. He turned the difference between him and the type-form naturalists into a problem of the museum's educational function. He claimed that instead of transmitting the idea of types, a museum should be the place where naturalists ought to find the readiest means of comparing specimens. What should be provided for comparison should not

only regard the structure of organs, for example 'the molar teeth'; but also to the shape and size of the different parts of animals, for example "the proportion of height to breadth of body, the shape of the head, the relative size of the ears". The stuffed specimens, which represent the diversity of the natural world, therefore in Owen's argument became the 'scientific resources' for particular groups of people - the resource for the sportsman, student, and amateur; rather than the 'evidence' of science - the evidence that revealed the truth of time and things. Through the demarcation and emphasis on this scientific resource, Owen justified the idea of diversity by linking it to the educational function of the museum. In his confrontation with other naturalists, the idea of type-form was illustrated by Owen as an idea that was even contrary to the progress of scientific knowledge. He claimed: "To pare down the cost of a National Establishment of Zoology, by excluding the bulky specimens from the series, is to take away its peculiar and exclusive function as an instrument in the advancement of natural science" (*ibid.*: 29).

Beginning from the scarcity of space in the British Museum, Owen's proposal for a new museum in fact was a narrative strategy which had become very much attached to spatial issues. In his proposal, the idea of 'diversity' was very important in developing this strategy. The first function of the idea of 'diversity', as this study showed above, was as a strategy to gain a bigger museum space by referring to the 'proportion of species'. The second function of the idea of 'diversity', as the discussion about the whale shows, was to articulate ideas of the 'Creator' and 'a great country'. The third function of this idea was to defeat his academic opponents such as Huxley by linking it with the educational function of the museum. By doing these things, he was able to protect his spatial plan for the new museum and create an alliance with diverse groups of potential supporters in society.

According to Girouard's 1981 study, in the middle of the 19th century, "there was a group between the uninformed and the specialists which needed to be catered for". This group included "the local collector of birds, bird-eggs, shells, insects, fossils, etc. ... 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" (Girouard, 1981: 13). This group of people had a relatively good income compared to the working class; they were members of a middle class in the middle of the 19th century. Exhibitions in museums were particularly attractive to them, and a visit to exhibitions was part of their leisure activities. However, "an elementary display was not enough for people of this type", because many of them already had a certain degree of natural knowledge as collectors. On the other hand, "they were likely to lack the self-confidence or know-how to penetrate to the reserve collections". Therefore Girouard said that: "The more there was on display, the better they would be served" (*ibid.*: 13).

The idea of 'diversity' therefore is a statement. It was a strategy to collaborate with different forces to build a 'big museum', and exclude other ideas which jeopardized the spatial project. However, this does not suggest that the idea of diversity had no connection with Owen's theories about nature. How this idea was related to Owen's theories and therefore structurally embodied in the space of the NHM, and how this idea could be related to the emergence of a certain subject position, are examined below. The spatial analysis of the NHM in the next section therefore, rather than emphasizing the role architects played, is concerned with how Owen's naturalistic ideas referred to the history of life. The analysis focuses on how Owen's idea of time and species, a particular form of historicity, shaped the structure of the space.

Section 3. Archetypes and the Spatial Structure of the NHM

The most famous characteristic of the NHM's plan is probably the description of the 'comb-like' space. This term was first proposed in 1982 by Peponis and Hedin: "On the ground floor the building was basically organised as a comb-like plan with a hall at the centre of its major axis" (Peponis and Hedin, 1982: 21). Other scholars, for example, Markus and Yanni continued to use this term to describe the plan of the NHM.[6] By 'comb-like', they mean that the front galleries, which lie along the main street and form the facade of the building, were like the spine of a comb; the rear galleries were stretched vertically from the spine to form several different units of space as the teeth of a comb (Fig. 2). The advantage of this description is that, the spine of a comb very

vividly expresses the axial relationship between the two front galleries; and the teeth of the comb also precisely show the split relationship between the rare galleries.

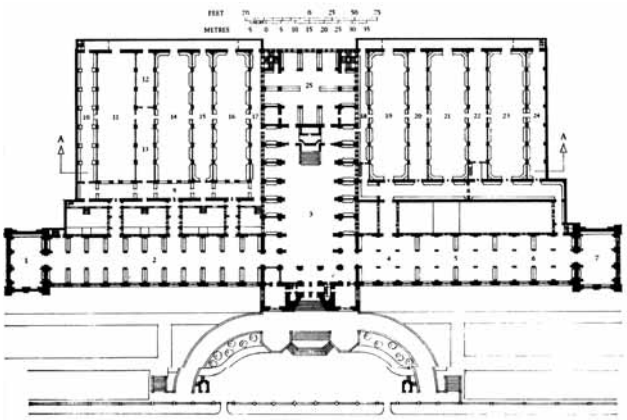


Fig. 2. Plan of the Natural History Museum in London (NHM) as it was built in 1881. From *Survey of London* 38: 211.

By using the idea of a comb-like space as a way of examining the different plans of the NHM, it is surprising to find how consistent the plan of Owen's manuscript in 1859 was to the final plan by Waterhouse in 1881. These plans include the manuscript of 1859 (Fig. 3), which was the first plan for the NHM; two different plans on different sites in 1862 (Figs. 4, 5), both proposed by Owen in his *On the Extent and Aims*; the plan designed by Waterhouse in 1868~1871 (Fig. 6); and the plan as it was finally built and opened to the public in 1881 (Fig. 2). The same characters are represented by the spine (i.e., the front galleries), the teeth (i.e., the rear galleries which were perpendicular to the spine), and the central hall which penetrates the spine and parallels the teeth in the central area. From the consistency of the comb-like space, it would be reasonable to infer that the first manuscript by Owen was very influential on subsequent designs. It is infrequent to find the design of a building survive with so few changes, especially a museum design which was conducted over more than 20 years. Therefore, the first manuscript provides very important material for research into the spatial structure. The following parts of this section focus on the structural dimensions of the comb-like space and their relations to Owen's famous idea of 'archetype'.

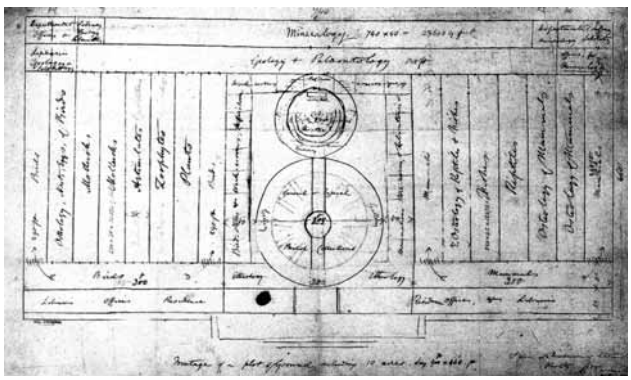


Fig. 3. Owen's sketch proposal for the plan of the NHM in 1859. From Mark Girouard, *Alfred Waterhouse and the Natural History Museum*, 1981: 10.

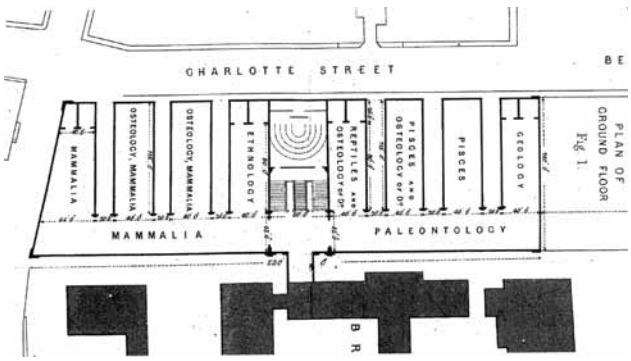


Fig. 4. Owen's proposal in 1862 for accommodating the Natural History collection by enlarging the British Museum. From Richard Owen, *On the Extent and Aims*.

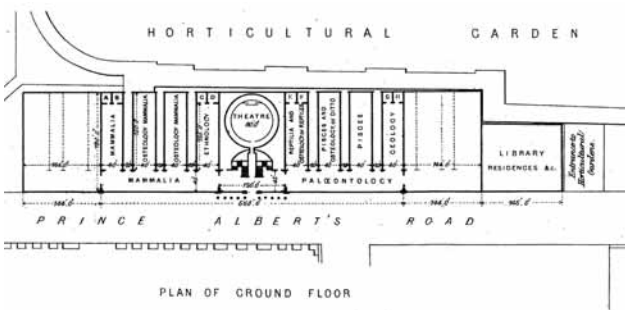


Fig. 5. Owen's proposal for the museum at the South Kensington site in 1862. From Richard Owen, *On the Extent and Aims.*

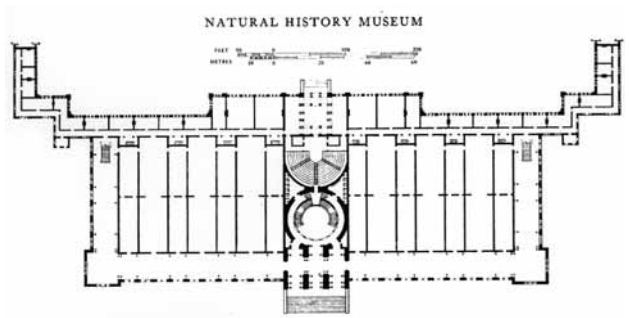


Fig. 6. Waterhouse's first design in 1868. From *Survey of London* 38: 207.

3-1. Ideas of time and objects in archetype and diversity

The idea of archetype, according to Desmond's study, can be traced in Owen's works as early as the 1840s. At that time, however, this term was not used by Owen. Desmond referred to the term 'Homology' in Owen's works of 1837 as the earliest reference to the idea of archetype, and he also suggested that it was developed at a time when Owen's anti-Lamarckian stance was at its height (Desmond, 1982: 214). The development of Owen's idea of archetype, from Desmond's point of view in *Archetypes and Ancestors*, was closely connected with Owen's opposition and antagonism to Lamarckian materialists in the first half of the 19th century.

When the term 'Archetype' appeared for the first time in Owen's writing in 1848: *On the Archetype and Homologies of the Vertebrate Skeleton*, it was not, however, so related to the debate about the causes of evolution and diversity of species. In that book, Owen used several illustrations (Fig. 7) to explain "the ideal pattern or archetype of the vertebrate endoskeleton, and of the modifications of it characteristic of the four great divisions of the vertebrate sub-kingdom, i.e. fishes, reptiles, birds, mammals, and of man" (Owen, 1848: 175). The archetype for him was an ideal model and pattern for comparing different vertebrate organisms and finding the unity hidden behind the diversity of the forms of these organisms. The four classes of vertebrates were illustrated as 'modifications' of the archetype, and the endoskeleton of man was illustrated for comparison with the archetype as well. Ideas about archetype, at this stage, relied more on empirical observations of structures of skeletons. Knowledge of the natural world, in other words, was produced through perception and analysis, i.e., observations of the skeleton and its elements, and the intellect, i.e., the capacity for abstraction. Archetype was more like the result of this process.

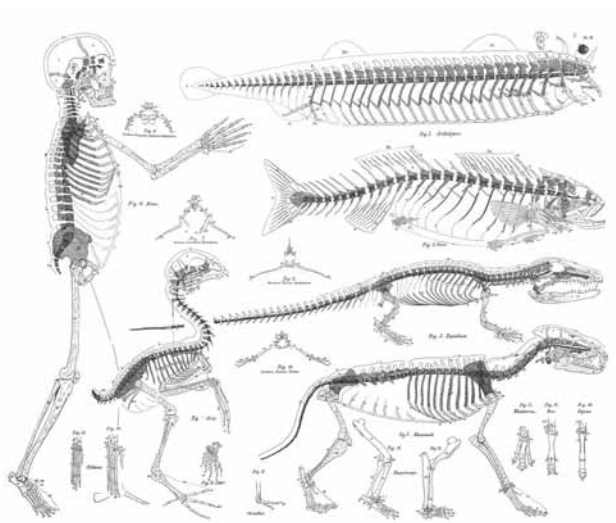


Fig. 7. Diagrams of the ideal pattern or archetype of the vertebrate endoskeleton. From Richard Owen, *On the Archetype and Homologies of the Vertebrate Skeleton*, 1848: plate II.

The model of abstraction for classification, however, in Owen's *On The Nature of Limbs* published in 1849, became a 'predetermined pattern' - the preexistent idea and knowledge which determined the structures of the skeleton of species and prior to the appearance of life[7]. 'Predetermined', implied that the idea of archetype transcended the empirical world in both time and of space. According to Rupke, "Owen based this belief that the archetype represented a pre-existent pattern on the fact that its possible modifications exceed the actual ones. Different and higher ones may exist on other planets or arise in future times" (Rupke, 1994: 198). The idea of archetype, therefore, was very related to 'transcendental morphology' in the 18th and 19th centuries, which was "the doctrine that organic diversity, as present in the myriad of different species, can be subsumed under one or a few ideal types which constitute the logic behind the morphological variety and thus its explanation, transcending the vision of the eye, and visible only to the eye of the mind" (*ibid.*: 108).

In this movement, one can see Owen turn the idea of archetype into a metaphysical entity. Archetype now became the explanation of the origin of the different kinds of life. This idea was no longer just a generalization of physical reality, but also a spiritual entity which was involved with the question of Creation. "Thus the archetype no longer reflected a material force, but became a divine forethought, a blueprint of design for the formation of animal life" (Rupke, 1994: 199).

According to Desmond's opinion, this was the product of a platonic idea which could be traced to Owen's earlier academic and political activities in the 1820s[8]. Desmond recognized Owen's archetype as a construct of Platonism which gave the archetype the status of a transcendental idea for the Divine Idea could move in and new political power could be promoted (see Desmond, 1989: 358-376). The idea of archetypal development implies a theological and static

system of time and things through which the social status quo was legitimized.[9] Desmond's view has had a great influence on studies of Owen and the NHM. Studies of the space of the NHM have frequently examined the idea of Creation in archetype as a representation of the struggles and antagonism between religion and science in the 19th century.

Relationships between Owen's archetype and Platonism encountered a serious challenge in Rupke's work in 1994. Even though Owen himself claimed that the archetype was a Platonic idea in his book *On the Nature of Limbs*, Rupke argued that the Platonization of Owen's archetype was only "a coat of Platonist fabric" to protect Owen's transcendental morphology[10] (see Rupke, 1994: 203-204). In contrast to the prevalent idea of Owen as a Platonist, Rupke recognized him as an Aristotelian from his idea of archetype.[11] From Rupke's point of view, what has been most critical of Owen's position as an Aristotelian rather than a Platonist is that the archetype represented the simplest rather than the most complete concept of a vertebrate.

From the illustration of archetype Owen had drawn in *On the Archetype* (Fig. 7), the archetype of the vertebrate looked indeed more like the simplest vertebrate: fish rather than mammal or man. Real vertebrates therefore are produced from the archetype by addition not subtraction. If the archetype was the origin of life, then there appeared the possibility of explaining how actual vertebrates were produced accordingly from the simplest class: fish, then reptiles, birds, and finally mammals. However, according to Rupke, what Owen emphasized in his idea of archetype was the process that moved from general to specific: the process of speciation and divergence.

How does the archetype produce diverse species? What is the cause of the diversity of species? These questions really inquire into the relationships between the sameness and difference of life. In fact, one decade before Owen's *On the Archetype*, he had already shown concern with these problems from the perspective of embryology. The archetype in the late 1840s was just an embodiment, a development of this 10 years' 'embryonal' stage. Owen's research on embryology had a great effect on his ideas about relationships among different classes and organic descent. It would be instructive to look at these ideas in more detail.

Embryology is the scientific study of the formation and development of embryos. It is mainly concerned with fission of a fertilized egg and the process of the differentiation and formation of an organic system in embryos. In the late 1830s, as a trained embryologist, Owen was involved in the development of embryological research. Richards' (1987) study, 'A question of property rights', provides a very clear treatment of Owen's ideas about embryological development, and also has a detailed study of the originality of his ideas.

According to Richards' study, Owen's ideas about embryological development can mainly be regarded as being concerned with two questions: relationships between different classes, and explaining the emergence of new species.

Owen's answer to the first question was, in fact, inherited from the German embryologist von Baer. In 1828, Von Baer had conceived that "ontogeny is essentially a process of divergent differentiation by which the embryo becomes increasingly specialised or individualised, and therefore diverges more and more from other animal forms (Richards, 1987: 133). The diversity of species for von Baer, therefore, is a divergent process beginning in the development of the embryo. At the same time, Von Baer recognized that "there were four basic types of organisation and the type is manifested in the very earliest stages. Hence the law of divergence is based not on a uniserial taxonomy, but on a multitypal or divergent one" (*ibid*.: 133).

Desmond (1989) in *The Politics of Evolution* noted Owen's embryological model and its metaphor. He said: "Owen now added von Baerian foundations, a foetal divergence reinforcing the image of a ramifying, preordained nature". With this embryological model, Owen was "generating an image of numerous lineages progressively specialising away from the more generalised archetypal antecedents". With this image, Desmond described this pattern using a 'tree' metaphor (Desmond, 1989: 371-372). The tree metaphor is useful in explaining Owen's idea about new species. According to Owen, the appearance of new species occurs because a 'monstrous' deviation occurred in the early stage of fetal development. Owen considered that deviation was mostly due to 'premature birth'. This emphasis on 'premature birth', according to Richards' explanation, was concerned with Owen's idea about the two antagonistic forces which control

the development of the embryo (Richards, 1987: 146-147). The new species was seen by Owen as the result of one of the forces: the organizing force.

The two antagonistic forces, according to Owen, were the two antithetical forces controlling the development of the organic body and of life on earth. According to Owen's *On the Archetype*, these two forces are the 'specific organising force' and the 'general polarising force'. In Owen's view, the 'organising force' is the one which "produces the diversity of form belonging to living bodies of the same material" (Owen, 1848: 172). It is the cause of organic diversity and the force diversifying the forms of life. This force, in this sense, is one which keeps trying all possibilities of forms of life. The other force, contrary to the organizing force, is the 'polarising force' to which "the similarity of forms, the repetition of parts, the signs of the unity of organisation may be ascribed" (*ibid.*). The principle of the polarizing force is the repetition of parts. It makes the archetype recognizable, and it is the force which constrains and arrests development of new species. Using an example proposed by Owen to explain the interaction between the two forces: the three toes of the Palaeotherium are considered to be a result of the polarizing force. The three toes were regarded as being produced according to the principle of repetition. Development of the toes of the Palaeotherium, however, was in antagonism with the organizing force in suppressing the 'irrelative repetition'. Therefore, the Palaeotherium 'evolved' and the one-toe modern horse was born.

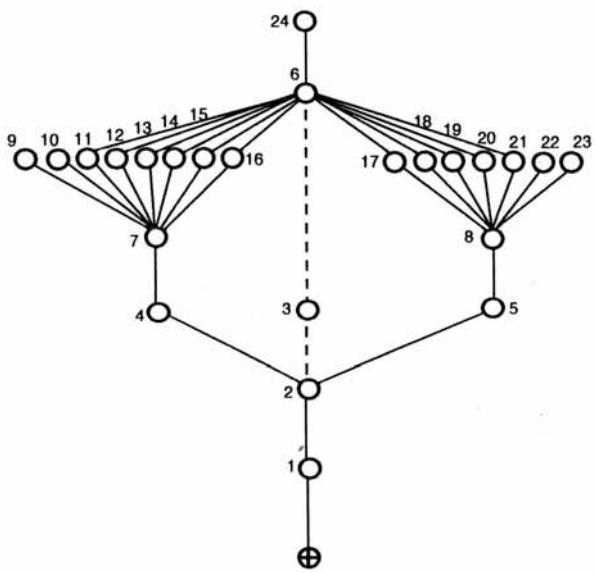
Obviously, the idea of the two antithetical forces expressed Owen's belief of the 'innate tendencies' as the driving force of organic evolution. The production of new species was explained by Owen as the result of an organizing force, and the purpose of the new species was to move toward perfection. The emergence of new species relied on the idea of 'monstrous birth'. 'Monstrous deviation' therefore was regarded as the mechanism of evolution without reference to the external environment. This for Owen is the innate momentum of the specific organizing force which drives the divergence of new species during embryological development, and it is the innate momentum of the polarizing force which is in antagonism with this development. While the former explains the difference, the latter reveals the sameness. The tension between the sameness and difference, which is related to the ideas of archetype and diversity, consequently, constituted Owen's theory of the history of life, which could be recognized as both dynamic and progressive.

As discussed above, Owen's naturalistic theory in fact deals with the problem of the history of life. The history of life was, furthermore, regarded as a progressive process. This idea of progression was represented in the archetypal development, from simple to complex; and was also represented in embryological development, towards perfection. In other words, Owen's idea of progress is one in which time is mediated by form. More-complicated and -differentiated forms of animals represented the more-advanced and progressive species. In this sense, the metaphor of Owen's embryological model is in fact the 'tree'. There is a trunk representing the progress of different classes, and there are branches that represent the divergence of species in each class. Within each class, there are also different trunks of progress and branches of divergences. Origin and divergence form the main theme of Owen's ideas about time. It is in this sense that new species are just like new sprouts on the metaphorical 'tree'. They come out from old branches which differ from each other, and they strive upward to develop by facing the sun.

3-2. The historicity[13] of spatial structures

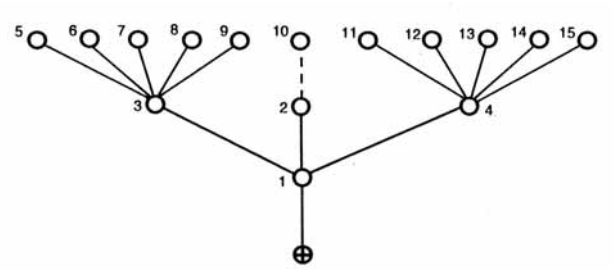
As discussed above, the historicity within which Owen developed his archetype was a specific one. This historicity concerned itself with the forms of organic life. The sense of time was revealed through the forms. In the following, this study attempts to examine how the spatial structures embodied Owen's ideas about time and things. It mainly uses the method of space syntax to analyze the spatial structures of the NHM. The techniques of analysis used here are mainly those of the 'justified permeability graph' and 'convaxial' analysis. According to Hillier and Hanson (1984), a 'justified permeability graph' (j-graph) is a justified spatial map in which spaces are represented by circles and permeabilities by lines, and all spaces of the same depth value are lined up horizontally with the lines representing direct permeabilities between the spaces drawn (see Fig. 8 for an example). A 'convaxial' analysis is related to some basic ideas of space syntax. When using the method of space syntax, space can be realized through a system constituted of two kinds of elements. The first of these is termed the 'axial

line'. It is drawn to indicate relations between all different spatial units in a spatial complex in terms of their visibility and accessibility. The spatial system can therefore be represented as an 'axial map' where the longest and fewest lines of sight and access are drawn through all spatial units. The second element used to constitute the spatial system is that of 'convex' space. The 'convex' is a spatial unit within which a 'diamond-shaped' space is encapsulated. The 'diamond-shaped' space refers to the physical environment that allows people in it to see and encounter each other simultaneously. The spatial system can therefore be represented as a 'convex break-up', where the largest and fewest convex spaces and linkages between them are drawn to cover all of the space. Moreover, each axis and convex are recognized as gaining their different properties through the organization of the entire spatial system. Among the different properties, as far as this paper is concerned, the degree of 'integration' is the most important property related to the movement of visitors. The degree of integration, put simply, theoretically indicates the relative intensity of usage in terms of movement. The 'convaxial' analysis is a calculation of the degree of integration of the convex spaces and axes within a spatial system. According to the different degrees of integration, convex spaces and axes in the spatial system are ranked as seven different bands that are respectively represented by different colors (see Fig. 12 for an example). The highly integrated spatial units and axes thus constitute the 'integration core' of the spatial system.



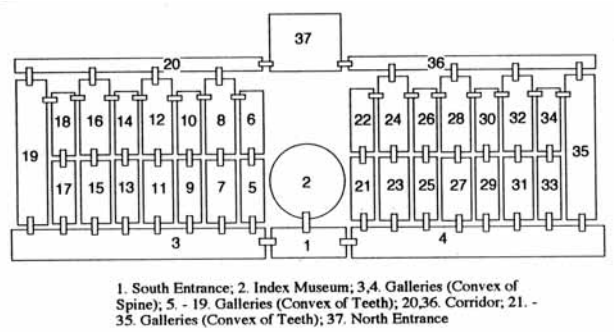
1. Entrance; 2. Index Museum; 3. Lecture Theatre; 4.5. Ethnology; 6.Geology and Palaeontology; 7. Birds; 8. Mammals; 9. Birds; !0. Osteology, Nests,Eggs,of Birds; 11.12. Mollusk; 13. Articulates; 14. Zoophytes; 15. Plants; 16. Birds; 17. Mammals; 18. Osteology of Reptiles and Fishes; 19. Fishes; 20. Reptiles; 21.22. Osteology of Mammals; 23. Mammals; 24. Mineralogy.

Fig. 8. Justified permeability graph of the manuscript by Owen in 1859.



1. Entrance; 2. Staircase; 3. Mammalia; 4. Palaeontology; 6. Mammalia; 7.8. Osteology Mammalia; 9. Ethnology; 10. Lecture Thretre; 11. Reptilia and Osteology of Reptiles; 12. Pisces and Osteology of Ditto; 13. Pisces; 14. Geology.

Fig. 9. Justified permeability graph of the plan in *On the Extent and Aims* in 1862.



1. South Entrance; 2. Index Museum; 3,4. Galleries (Convex of Spine); 5. - 19. Galleries (Convex of Teeth); 20,36. Corridor; 21. - 35. Galleries (Convex of Teeth); 37. North Entrance

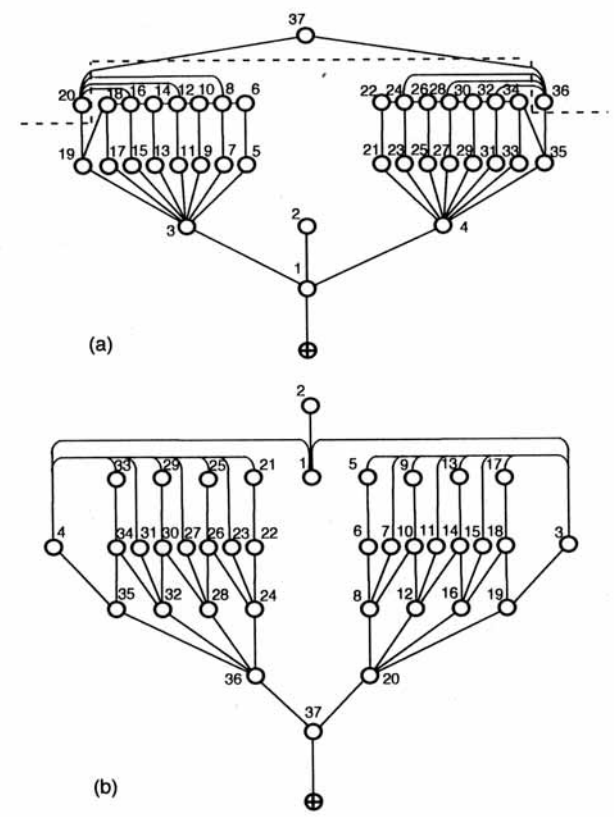


Fig. 10. Justified permeability graph of the plan by Waterhouse in 1868. (a) From the south entrance; (b) from the north entrance.

This study focuses on the properties of permeability and integration of spatial structures, and their relationships to the historicity, namely the discontinuity of classes, the progressive, and the divergence of species. This study draws on cases which include a manuscript by Owen drawn in 1859, the plan in *On the Extent* published in 1862, the plan by Waterhouse in 1868, and the final plan of the NHM in 1881. These respectively appear as Figs. 2, 3, 5, and 6. A further analysis is conducted below based on these materials. Following an analysis of permeability, Fig. 8 shows the justified permeability graph (j-graph) of the manuscript in 1859; Fig. 9 shows the j-graph of the plan in On the Extent in 1862; Fig. 10 shows the j-graph of the plan by Waterhouse in 1868; and Fig. 11 shows the j-graph of the final plan in 1881. Their convaxial diagrams are respectively shown as Figs. 12, 13, 14, and 15.

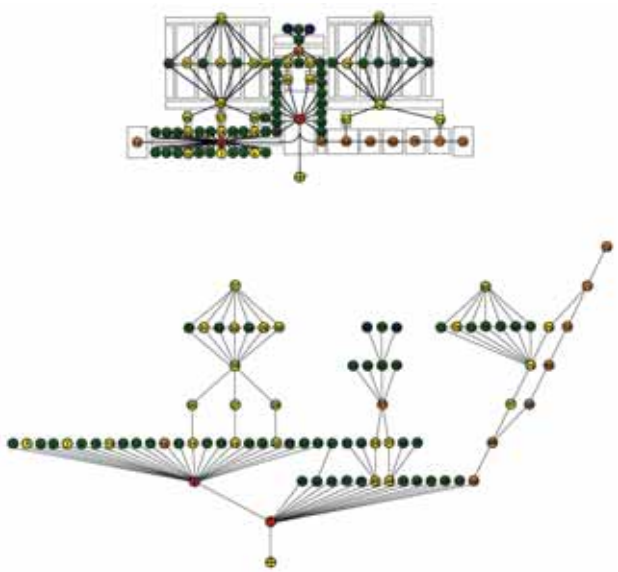


Figure 11(a): Justified permeability graph of the final plan in 1881.

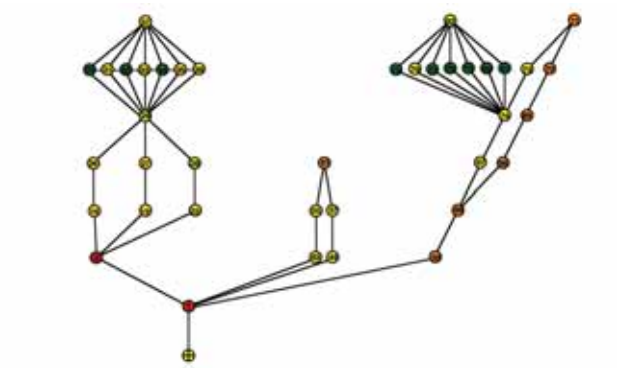


Figure 11(b): Distributed (ring) sub-system of justified permeability graph of the final plan in 1881.

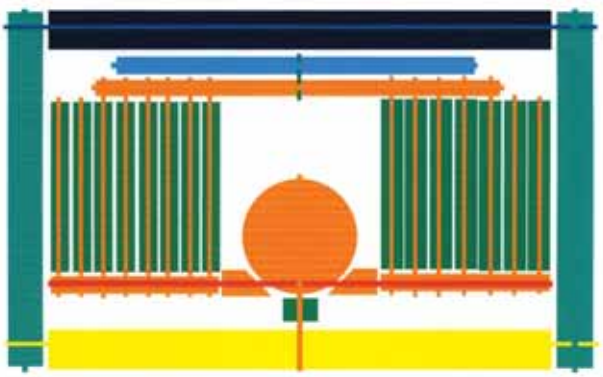


Fig. 12. Convaxial diagram of the manuscript by Owen in 1859.

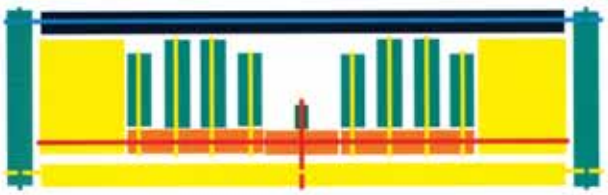


Fig. 13. Convaxial diagram of the plan in *On the Extent and Aims* in 1862.

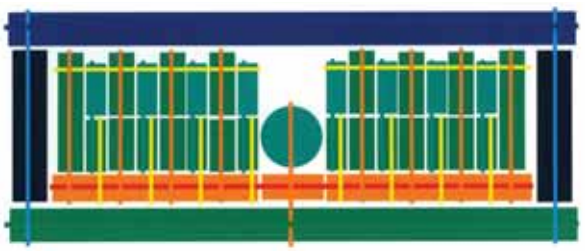


Figure 14(a): Convaxial diagram of the plan by Waterhouse in 1868 (with two entrances).

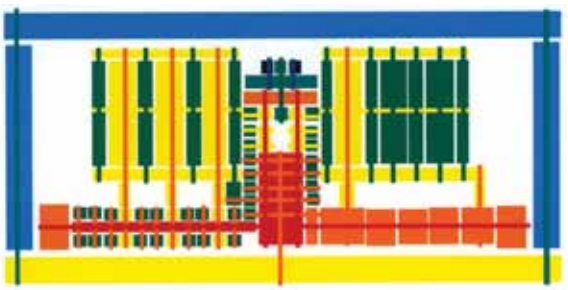


Figure 14(b): Convaxial diagram of the plan by Waterhouse in 1868 (with south entrance).

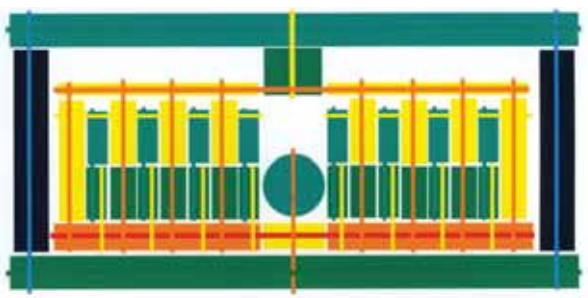


Fig. 15. Convaxial diagram of the final plan in 1881.

3-2.1. Discontinuities in spatial structures

Figure 8 shows the j-graph of the manuscript of 1859, the earliest plan of the NHM. The characteristic of this j-graph is very much determined by the relationships between the spine and the teeth of the comb-like space. The convex units 7 and 8, which form the spines of the comb (convex of the spine), respectively connect with the bush-like spatial system units 9 to 16 and units 17 to 23 which are the teeth of the comb (convex of the teeth). Part of the convex units of the teeth, through convex unit 6, also form ringy routes with units 7 and 8.

Therefore, two kinds of systems appear in the local complex of this comb-like space. One is the 'bush-system', for example units 7 to 9 and 10. The other one is the 'ring-system', for example units 7 to 11, 12, 13, 14, 15, and 16. The combination of these two systems characterized the local relationships between different galleries in the manuscript. The 'bushy' and 'ringy' systems refer to different spatial relationships. Relationships between the convex of the teeth, however, do have something in common.

Relationships between the convex of the teeth, according to the j-graph, are always mediated by other spatial units. For example, from convex 16 of 'Birds' to convex 13 of 'Articulates', a visitor has to pass through convexes 6 or 7. From convex 23 of 'Mammals' to convex 20 of 'Reptiles', a visitor has to pass through convexes 6 or 8. Regardless of whether the convex of the teeth is on a ring or on a bush, they all have to pass through the space of the spine or convex 6 to connect with each other. In other words, relationships between the convex parts of the teeth are always interrupted by other spaces. Each convex of a tooth is at least two steps away from another in terms of distance in the j-graph, and therefore gains a strength of discontinuity with regard to each other.

The representation of the convex of teeth, as shown in Fig. 8, is mainly concerned with the different classes of vertebrates and invertebrates. Through the spatial structure of the local complex, the representation of each class is maintained as a strong category which is disconnected from other categories.

In terms of the relationships between the spine and teeth, according to Fig. 8, the spatial structure of the local complex is quite a 'synchronized system'. In convex 8, visitors can obtain an overview of the classification from convexes 17 to 23. The same situation exists between convex 7 and convexes 9 to 16. Convexes 7 and 8 are, according to the convaxial diagram of Fig. 13, integrated into the strongest axis of the spatial system as a whole. In this sense, the spatial system of the manuscript plan exerts as strong a power on the classification of knowledge as does the synchronous library.[14]

The spatial structure of the plan in *On the Extent and Aims*, basically differs little from that of the manuscript. The discontinuity between the convex of the teeth, and the integration of the root of the local complex is the same as that of the plan of 1859. However, there is a development which greatly differs from later plans of the NHM.

Comparing Figs. 8 and 9, the major difference between them is that the rings in Fig. 8 are not included in Fig. 9. Although the convex of the teeth remains segregated and maintains strong categories, the local complex has become a wholly bush-like system. The disappearance of the rings is obviously related to the disappearance of the convexes on the north side of the NHM. However, in subsequent plans of 1868 and 1881 by Waterhouse, the north side of the plan has several galleries. Furthermore, relationships among the convexes of the teeth also changed.

The planned site for the NHM in 1868, according to the *Survey of London*, was to the south of the Horticultural Society's Garden. During the early 1860s, Prince Albert had hoped that the garden would be an inner court surrounded by public buildings which were intended for the development of science and art.[15] Between 1867 and 1870, the Albert Hall was built on the north side of this garden, and two galleries were built on the eastern and western sides. The NHM, at the end of the 1860s, was supposed to connect these buildings from the southern side of the garden (see *Survey of London*, 1975: 64-66). The north opening of Waterhouse's plan in 1868 reflected the conditions of this site. However, the north entrance had a very different characteristic compared to the south entrance.

Figure 10 shows the j-graph of the plan in 1868. Figure 10a is the j-graph counted from the south entrance, and 10b is counted from the north entrance. According to Figs. 10a and 14a, the local complex is still dominated by the convex of the spine. Two convexes of the spine are aligned with the entrance and are penetrated by a strong axis at the bottom of the j-graph. For visitors from the

south entrance, the spatial system is therefore still a strong classification machine which to some degree embodies the library system.

For visitors from the north entrance, the spatial system has a relative asymmetry (Fig. 10b). Compared with Fig. 10a, the local complexes are deeper. The roots of the local complexes lose their control value since part of the convexes in the complexes diverge into deeper places. The spatial system for visitors from the north entrance hence loses its strength as a library system.

A strong library system, as discussed in the footnotes, is very reliant on permeability or visibility to form an 'index room' mechanism. The index room mechanism of the plan in 1868, according to its j-graph and convaxial diagram, is formed by the alliance of the convex of the spine. Before visitors tour the galleries, those from the south entrance have no choice but to enter the index room complex. On the other hand, for visitors from the north, the index room is in the most distant, deepest place. The spatial system for them has weak control roots and deeper local complexes. Classification is not immediately evident at the roots of the j-graph. The spatial system for visitors from the north is more like a 'searching system'. It provides a system of hierarchical divergence similar to the arrangement of book shelves in a library.

Taking a library as a simile, the south entrance in the plan of 1868 is just like the front entrance of a library. Visitors coming from the front entrance are assumed to know nothing about the library. So there is an index room near the entrance. Every area of 'book shelves' is supposed to connect to the index room in an efficient way. The north entrance of the museum, however, works quite differently. It is, to continue the simile, just like the back door of a library. It is especially designed for visitors who regularly use the library and are familiar with the area of the book shelves. The back door is designed for specialists; it leads visitors directly to the book areas without passing through the index room. In this sense, visitors are therefore differentiated into two kinds of social groups.

According to Fig. 6 showing Waterhouse's plan in 1868, the north entrance is very close to the departmental offices and workshops. It is therefore reasonable to presume that the north entrance was designed to particularly be used by specialists. The project of the Horticultural Society's garden claimed to promote science and art but was obviously promoting these to two different kinds of people: the public, the receivers of knowledge; and those who were specialists, the producers of knowledge. The north entrance, as part of an integration project with the Horticultural Society's garden, in fact clearly shows the differentiation of museum visitors in the 1860s.

Since the north entrance was designed for specialists, it was possibly designed to be closed to the public, or at least to control public access. The departmental offices and workshops, actually formed a sort of 'backstage' area of the museum and the backstage was under constant control. This opinion is even more convincing if one notices that there were two axes designed to penetrate the galleries of the teeth (the convex of the teeth). The axes closely parallel the corridors of the backstage area. From the point of view of movement, these axes are unnecessary if the corridors of the backstage area could be used by visitors. The axes were therefore designed to replace the function of the corridors for the public.

The linking of the convex of the teeth also changed the global structure of the space. Compared with previous plans, the plan of 1868 is a more-distributed system ; except in the index museum, all convexes are on the rings. However, according to Fig. 10a, if the convex spaces are removed from the backstage area, the distributed system becomes locally non-distributed. After removing the rear area, the local complex is much more dominated by the convexes of the spine. The two local complexes at either side can only be linked by the south entrance. There is no ring to connect the two local complexes as there is in the 1859 manuscript.

The two ringy, local systems therefore have non-distributed relationships with the south entrance. In other words, for the public who use the south entrance, the two local systems are strongly categorized as in the library system. Furthermore, connecting the local ringy systems in non-distributed relationships not only occurred in the 1868 plan. It was actually also used for the final plan in 1881. According to Fig. 11b, which shows the distributed subsystem of the j-graph, it is clear that these local ringy systems are connected by the entrance hall in non-distributed relationships. The tree-like, non-distributed relationships make the local complexes at either side more strongly categorized in relation to each other. The east and west sides of the NHM therefore, respectively, reinforce their power of categorization by their non-distributed

relationships.

The spatial translation of the strongly categorized library system is that there is a non-distributed relationship between a strong 'index room' and the 'bookshelf' areas. Each area of bookshelves gains a strength of category through its isolation from the others, and only by passing through the index room can a visitor reach other book areas. In terms of this spatial logic, the structure of the final plan in 1881 was in fact quite similar to Owen's 1859 manuscript. While the manuscript embodied discontinuity through a strong categorization of each gallery in the local complex, the final plan used the same spatial logic to embody the discontinuity between the west and east complexes. The main difference between these two plans in terms of this spatial logic is that the discontinuity occurred within the local complex in 1859; in 1881, it occurred in the global structure instead.

With the emergence of the axis within the local complex from 1868, the power of category of each convex in the complex was weakened by the axial connection. In terms of representation, this means that the discontinuity between classes was weakened as well. However, according to Girouard's study, the openings for these two axes were actually walled in when the museum was opened to the public in the 1880s (Girouard, 1981: 51). The abandonment of these two axes meant that the classes remained strongly categorized and discontinuous. Furthermore, while the classes maintained the power of category through local discontinuities, a global discontinuity also emerged. From 1868, the discontinuity was further referred to by the relationships between the two local complexes: the west and east side galleries. This spatial discontinuity was, in fact, used to embody the discontinuity of species.

According to Girouard's study in 1981, the ornamentation on the facade of the NHM was divided into two main classes. The west half was decorated with representations of living species, the east half had extinct ones (Girouard, 1981: 57). With the material supplied by Owen, the architect Waterhouse designed these decorations and used the terracotta on the facade to represent the idea of a separation between living and extinct species. The idea of this separation, according to the final plan in 1881 (Fig. 2), was also represented by the arrangement of the plan. In the west side galleries there were the exhibitions of Birds, Fishes, Reptiles, etc. On the east side, there were mainly the paleontology and the fossils of animals. According to Yanni's quote from Flower, this separation is the "ancient division between biology and palaeontology". Therefore she considered that this separation "did not accurately reflect the philosophy behind contemporary biology and palaeontology" (Yanni, 1999: 145).

What Yanni noted about the differences between contemporary biology and natural history, regarding the idea of extinct species, concerns ideas of evolutionism. While the ancient division between biology and paleontology was drawn between beings which live now and those which lived in the past, modern biology thinks that there might be relations and continuity between 'extinct' and 'living' species. In some cases for modern biologists, extinct species were simply the ancestors of modern species. Modern species have 'evolved' from some of the extinct species. The separation of these two categories, for modern biologists, was therefore an ancient idea that marked a discontinuity of species.

Regarding this separation, what this study suggests is that the discontinuity of species was embodied by the global structure of the spatial layout. This idea was mapped into the spatial layout through the non-distributed relationships between the west and east galleries. Visitors to the museum are 'interrupted' by the central hall when they tour the entire museum. With this interruption, galleries of either side gain the power of category. They are independent and segregated from each other. The idea of a separation between extinct and living animals in natural history was manifested in the structure itself.

For Flower and other intellectuals who endeavored to represent a centralized idea using the museum as a whole, the spatial structure of the NHM was a strong constraint. For example, for an evolutionist who would like to organize the entire museum in a strong single sequence in order to represent the continuity of species, signs directing visitors' movements would be required, and visitors' movements would still be interrupted by the entrance hall. That is possibly why Flower said that "it cannot be taken structurally as a model museum" (Flower, 1898: 42). The idea of discontinuity was deeply embedded in the space of the NHM. It was locally and globally embodied in the spatial structure, where visitors were differentiated and their movements regulated.

3-2.2. Progression in the spatial structure

As I discussed above, Owen's transcendentalist idea is closer to Aristotelianism than to Platonism. That is to say, the idea of progress for Owen was represented in development from simple to complex rather than the reverse. Nevertheless, in terms of spatial mapping, what is important is the sequence between the different classes. Regardless of whether the starting point is simple or complex, the idea of progress should be able to be represented as long as the sequence is maintained.[17]

If there is such a sequence from complex to simple, the central index museum which was near the south entrance might have played an important role. According to several studies, the index museum intended to exhibit 'selected typical specimens' of Britain, and give visitors an 'introductory guide to each branch of natural knowledge' (Girouard, 1981: 12; Stern, 1998: 31, 37; Yanni, 1999: 115). This study now focuses on whether there was such a sequence starting from the central Index Museum.

According to Fig. 8, which is the j-graph of the manuscript, the galleries of the teeth are at the same depth in terms of permeability. That is to say, their relationships are not asymmetrical. This can be identified by their depths. Their non-distributed relationships to the convex of the spine give them a stronger strength of category than sequence. If instead the plan is analyzed by measuring the distance between the galleries and the Ethnology room, there is little evidence of a sequence. According to the manuscript (Fig. 3), from Ethnology to the left there were Birds, Plants, Zoophytes, Articulates, Mollusks, and Birds. From Ethnology to the right, there were Mammals, Reptiles, and Fishes, and Fishes, Reptiles, and Mammals. Basically, on the left side, the progression was from Humans to Birds, Plants, Invertebrates, and then to Birds again. On the right side, it was from Humans to Mammals, Fishes, Reptiles, and then to Mammals again.

According to Owen's ideas about embryological development, as discussed above, an increasing degree of complexity among the different classes of vertebrates should be: Fishes, Reptiles, Birds, and Mammals. Invertebrates should be about the same degree of complexity as the Fishes or Reptiles. According to this principle, it is difficult to see how the galleries were arranged in sequence from complex to simple.

The arrangement of the galleries perpendicular to the facade (the convex of the teeth) seems, therefore, more concerned with the idea of discontinuity than with the idea of progression. In fact, in Owen's subsequent plans, locations of exhibits of different classes were once even arranged by the principle of lighting. According to *On the Extent and Aims*, due to reasons of 'economy' Owen was forced to change the plan into a 'two-storied' building in 1862. In the two-storied building there was no choice but to divide the galleries perpendicular to the facade into those with side-lights on the ground floor and those with sky-lights on the first floor. The collections were therefore divided into two kinds by Owen: those that "would be seen with least disadvantage by side-lights" including Mammalia, Reptilia, Pisces, Osteology, Ethnology, Geology and Palaeontology; and "ones which ought to be displayed in sky-lit galleries", including Aves, Mollusca, Articulata, Radiata, Plant, and Mineralia (see Owen, 1862: 78-80).

To offer this example is to try and indicate that, for Owen, the collections in the galleries seemed to some degree to be flexible and interchangeable as long as they were grouped into different classes, or into extinct and living form in the complex of convexes. What was important for the galleries perpendicular to the facade was the principle of discontinuity that was locally and globally embodied by the spatial structures. The idea of progression seemingly had no role in terms of the arrangement of the galleries.

However if we look at the manuscript plan and examine its j-graph and convaxial diagram, there was another area in which the idea of progression could be represented by the arrangement of space. This is in the galleries parallel to the main road (the convex of the spine) rather than in the galleries perpendicular to it.

According to Figs. 8 and 12, a strong axis passed through the convex at the root of the j-graph. This means that the axial composition of these convexes was constantly experienced by the visitors. By 'constantly experienced', this study means that the axiality of these convexes was mostly detected by visitors through their movements. This axiality, as can be seen from the j-graph, was constructed by connections between the convexes of the Index Museum, Ethnology, Mammals, and Birds.

For visitors to this 'planned' museum, the strong integration of this axis would constantly bring them back to the axis. Furthermore, due to its position at the root of the j-graph, visitors

would experience this axis first. Before they could begin a tour of other galleries, they had to experience the sequence of these convexes. The sequence was either from the Index Museum to the left to Ethnology and then to Birds; or from the Index Museum to the right to Ethnology and then to Mammals. This experience was a sequence from typical collections to complex ones and then to less-complex ones - although it did not represent all the spectra of classes in a single sequence. It would be expected that visitors would bear this experience in mind every time they passed through or crossed this axis in the museum.

However what was more important in Owen's idea of progress was the process of divergence. In the following, this study continues to analyze how the exhibition space within the galleries responded to this question.

3-2.3. Divergence in the spatial structures of the displays

In Girouard's study of the galleries of the NHM designed by Waterhouse, he noted that there were some arrangements which coincided with Huxley's rather than Owen's ideas. He found that the narrow galleries (the narrow galleries of the teeth) were particularly designed to be reserved for students (see Fig. 16 for the cross-section of the galleries of the teeth). 'Reserve galleries were divided from public ones by arches filled with display cases, which the public were to look into from one side and students have access to from the other' (Girouard, 1981: 49).

Fig. 16. Cross-section of the galleries in the NHM, designed by Alfred Waterhouse in 1871 (From Girouard, 1981: 29).

Yanni further compared this plan to Huxley's 'ideal museum' which was exemplified by Huxley's proposal for the Museum of Manchester. She said that "In Huxley's ideal museum, a member of the public would have entered the building directly into a long gallery with natural historical exhibitions on either side, all behind glass. Carefully chosen type specimens .... were to be the only items on display" (Yanni, 1999: 129). For specialists who were naturalists and students, the ideal museum had another 'hidden space'. "Naturalists and students using his ideal museum could move about behind the glass, sharing space with the specimens" (ibid.) The cross-section and elevation of an interior wall for the Museum of Manchester clearly demonstrate the spatial idea of this ideal museum (Figs. 17, 18).

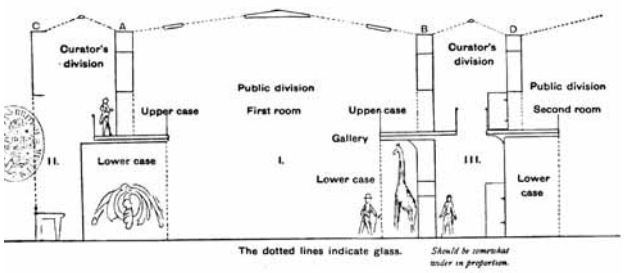


Fig. 17. Cross-section of the interior wall of the galleries in the ideal museum, proposed by Huxley for the Museum of Manchester (from Yanni, 1999: 130).

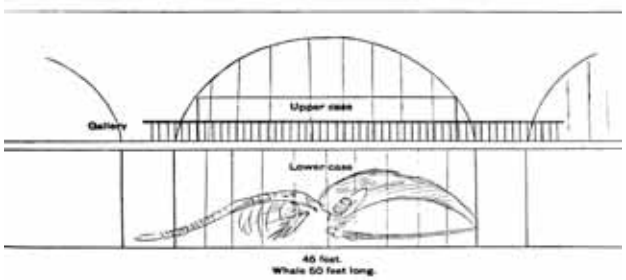


Fig. 18. Elevation of the interior wall of galleries in the ideal museum, proposed by Huxley for the Museum of Manchester (from Yanni, 1999: 131).

The spatial function of the narrow galleries, according to Girouard's and Yanni's studies, is mostly focused on separating and differentiating visitors to the museum. Specialists and the public are channeled into different circulations which embodied the social relationships between them. In addition to this point of view, this study suggests that the spatial layout of displays was also concerned with a different recognition of time and things.

As Yanni previously pointed out in her study, Huxley preferred "carefully chosen type specimens which is enough to illustrate all the most important truths of Natural History" (Yanni, 1999: 129). The 'type specimens' Huxley referred to greatly differed from what Owen meant by archetype. For Huxley, as an evolutionist in the second half of the 19th century, the differing types of organisms would have indicated their responses

to the external environment over the continual progressive process of time. According to Owen's idea of archetype, the diverse forms of organisms were just the results of divergence at the stage of embryological development which bore no relationship to the external environment. The difference between their ideas about the forms of organisms, of course, affected their respective ideas about how to display specimens.

The advantage of the ideal museum for Huxley can, therefore, be very easily observed by examining the relationships between the spatial form of the galleries and his idea of evolution. In the galleries, all collections could only be exhibited in a sequential way. Both sides of the galleries were fitted with uninterrupted glass cases with the public on one side of these cases, and specialists on the other. The uninterrupted cases on either side visually and permeably organized visitors' perceptions about the relationships between specimens which were all connected in a single, sequential way. Therefore, for an evolutionist like Huxley in the 1850s, the spatial form would be ideal for illustrating how species succeed each other in a great temporal flow.

Although initially designed to allow the separation of visitors, the galleries of the NHM greatly differed from Huxley's ideal museum in terms of their spatial layouts of displays. According to Girouard's study, many changes were made after the museum opened to the public. The use of narrow galleries was one such change. After opening, most of the narrow galleries remained open to the public rather than being reserved for students (Girouard, 1981: 50-51). According to photographs taken at the end of the 19th century, the spatial layouts of displays in the NHM were discovered to greatly differ from Huxley's. These pictures were taken in one of the narrow galleries (Fig. 19), one of the wide galleries (Fig. 20), and one of the galleries parallel to the front facade (Fig. 21). The most important feature of these pictures, which differed from the ideal museum, was that all of the exhibits in the galleries were in the central area. These exhibits were arranged in 'island-type' displays along the central axis of the galleries. Parts of these exhibits were put on bases, while others were put in free-standing display cases.

The central exhibits to some degree randomized visitors' visibility and movements compared to Huxley's ideal museum. Connections between collections were not developed in a single direction. Connections between the central exhibits and exhibits in side cases were added to the relationships between specimens. In this spatial pattern, relationships between the collections in the side cases were constantly interrupted by visitors' movements toward and viewing of the central exhibits. Through the

Fig. 19. One of the narrow galleries of the NHM with its original fittings (from Girouard, 1981: 49).

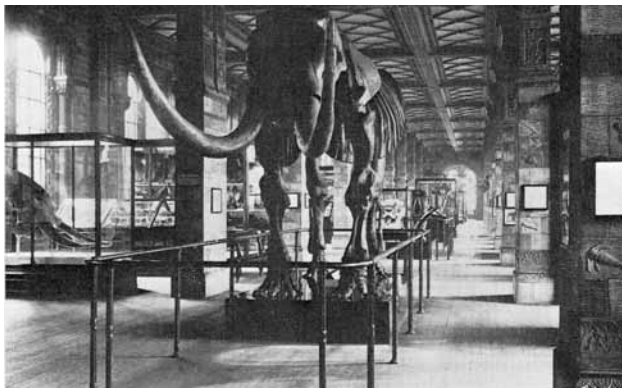


Fig. 20. One of the wide galleries (Osteological gallery) in 1893 (from Stern, 1998: plate 18).

Fig. 21. One of the galleries parallel to the front facade (Geological gallery) (from Stern, 1998: plate 17).

central exhibits, visitors' perceptions of the relationships between specimens were weaker in the long axis, and stronger in the axis perpendicular to the long axis. This change in perception was, of course, correlated to the 'random effect' caused by the central exhibits.

Therefore, compared to Huxley's ideal museum, the spatial type of the 'central-island' exhibit can be understood as a way of reinforcing the short axial relationships in a long gallery. These short axial relationships were very helpful in constructing a 'representational convex' in which some exhibits were centralized, while other exhibits in side cases could be referred to by the central ones. In other words, this spatial type was more capable of building synchronic relationships among a group of exhibits than was the ideal museum capable of building diachronic relationships. Visitors in this spatial pattern, by their continuous movements between central exhibits and side cases, could more easily experience the relatedness within a group of specimens than differences between specimens featured by single sequential arrangements. 'From difference to sameness' can be used to describe the different principles of display between Huxley's ideal museum and Owen's galleries in the NHM.

Exhibits in the galleries, whether in Huxley's galleries or Owen's, 'differed' from each other. Most of them were chosen to represent a typical form of their species. However through the different spatial patterns of display, differences from each other could be emphasized as in the ideal museum, or emphasis could be placed on their sameness as in galleries of the NHM. Representing diversity, for Owen, also meant representing the unity in diversity. The more diverse specimens were that were represented, the more persuasive was the idea of unity. The progressive idea for him was presented in a process of departure from unity, a divergent process from simple to complex. Spatial pattern displays in the NHM, from this point of view, could therefore be considered to be concerned with Owen's ideas about divergence and progressive development. The free-standing display cases in the center of the galleries were, in this sense, promoting this theory rather than undermining it.

The desire to represent specimens as fully as possible was therefore not just concerned with 'public entertainment'. It could also have to do with Owen's transcendental ideas about type and form which were a particular form of historicity. The main reason for Owen's opposition to Huxley's idea about display, i.e., carefully chosen type specimens illustrating all the most important truths of Natural History, might not have been caused by the problem of the 'carefully chosen type specimens' which was seen as contrary to Owen's idea. Rather, the problem might be about what, indeed, is the truth of natural history. In this sense, the antagonism between them could be seen as being embodied in the spatial form of the NHM. The spatial form was, at the same time, both the result and the medium of the struggle.

Section 4. Conclusions: The New Subject Position and Ideological Constraints

By the late 1860s after Darwin's evolutionism had been gaining acceptance for a decade, Owen's idea of the transcendental archetype was under severe attack. The new era for modern biology was beginning to unveil itself. Among the criticisms of the transcendental archetype was a review by Lewes in 1867, which is typical in reflecting opinions from the camp of more-modern science. For Lewes, the main problem of the concept of the archetype was that it became a plan that determines phenomena, rather than summarizes them. He said:

> The genesis of the fallacy is this: having followed the successive stages of an evolution (say the history of an embryo), and having recognised how each part was related to the whole, we form an abstract conception of that whole, by a process of mental shorthand, immensely useful. This abstract is thus a Plan of the phenomena, which serves to keep the relations of the phenomena distinctly before the mind. But by an unfortunate infirmity the mind tends to 'realise its abstractions,' and to give objective existence to what are only subjective artifices. Thus the 'plan', an abstract expression of the result, is converted into a 'purpose' which existed before the relations were established, and which arranged the results, as an architect arranges bricks and mortar according to an ideal scheme. All that Science discovers in the investigation of Nature's processes is a 'nexus formativus' - the law of causation. By a well-known informity we transform this into a 'nisus formativus', and the law becomes a plan.

> (G. H. Lewes, 1867: 108-109, quoted by Rupke, 1994: 209).

In Comteans's opinion, the archetype was transformed into a '*nisus formativus*' in Owen's hand. It was no longer an objective method to summarize phenomena, but a metaphysical approach to embody the evolution of life with a form of teleology. After it was 'transcendentalized', at least for a period of time for Owen, the archetype is the external entity which exists outside of life itself and predetermines the forms of organisms. This paper has analyzed how the designs of the spatial layouts of the NHM were a response to this idea of a transcendental archetype. The purpose of this transcendental construction, however, was not just an understanding of life, but was also concerned with the society in which the knowledge operated. Transcendentalism, in Owen's context, was in fact playing a very subtle role in terms of its social networks. This point of view is clearly revealed by a study of Desmond's and Rupke's opinions on Owen's transcendentalism.

Owen's transcendentalism, in Desmond's opinion (Desmond, 1989), was closely concerned with political ideology. Owen was recognized as being in the same group as the middle classes who were triumphant by the middle of the 19th century. His epistemological position was shaped by this ideological position. Through transcendentalism, Owen served to reinforce middle-class ideology, and oppose both the royal Whigs who were fading away and the radicals that were emerging.

Desmond's view was mainly established on the argument that Owen's transcendentalism was a kind of natural theology which was mediated by the Platonic idea of an archetype. However, Rupke's study in 1994 proposed a different explanation. According to his view, transcendentalism mainly functioned to serve Owen's need for the support of the 'upwardly mobile class of metropolitan naturalists'.

In Rupke's opinion, the Platonic idea was just a screen. It served to 'defuse the threat that Owen and the Goethe-inspired Germanisers of the metropolis represented to Oxbridge', and to respond to the 'non-functionists'[20] by intending to 'reintegrate morphology into a traditional, teleological epistemology' (Rupke, 1994: 204).

Why did Owen have to respond to Oxbridge and the non-functionists? This was related to his different supporters in scientific circles. According to Rupke, there were two different kinds of supporters required for Owen's institutional ambitions. One was the Oxbridge patronage. They were his trustee-patrons, and Cuvierian functionism was their epistemology. The other was his metropolitan peers who were emergent in the metropolitan scientific culture at the beginning of the 19th century. Most of these were non-functionists and had been Owen's colleagues in institutions which fundamentally differed in purpose from the Oxbridge colleges. Transcendentalism, in Rupke's opinion, was developed by Owen and his colleagues in London in order to construct a metropolitan cultural identity separate from the dominant Oxbridge tradition (see Rupke 1994: 59-69).

Although Owen's Oxbridge friends promoted him, according to Rupke, he never truly became one of them. Owen needed the Oxbridge patronage to support his museum plans and research, but Owen's own social background and his own ultimate purposes differed from those of his patrons. It was this difference, that "led him to adopt a scientific epistemology that went beyond the functionalism of natural theology" (Rupke, 1994: 60-61).

The scientific epistemology Rupke referred to was based on transcendentalism. In his opinion, transcendentalism was a reaction to the functionism to which the Oxbridge patrons subscribed. He said:

> Whereas Cuvierian functionism only fitted the career ambitions and conditions of Oxbridge's clergymen-naturalists, idealism was tailor-made for those of Owen and his metropolitan confreres. It was metaphysical, yet secular, just as Owen was .... The design argument[21] favoured the status quo of the privileged classes; by contrast, transcendentalism pegged the notion of design at an abstract level by applying it to an ultimate, future goal of the history of life. This suited the upwardly mobile class of metropolitan naturalists to whose ambitions of social self-advancement the status quo was a constraint.
>
> (Rupke, 1994: 64).

Quite contrary to Desmond's opinion, transcendentalism according to Rupke's study was a progressive idea. It was progressive not only because it was the epistemology intended to reintegrate the scientists in London against the natural theology of Oxbridge, but also because it

implied a dynamic process from simple to complex. Epistemology for Rupke was shaped by the antagonism between scientists. The production of Owen's transcendentalism was more related to epistemological effects on scientific communities, rather than political ideology.

In Rupke's opinion, transcendentalism had an effectiveness in the epistemological struggle. It moved Oxbridge's 'design argument' onto an abstract level by appealing to the law rather than God. This law was still 'strategically' attached to God because of the ideological constraints imposed by the Oxbridge patronage, but it was 'progressive' in its emphasis on the process from the simple to the complex. It is in this sense, Rupke considered, that Owen was an early evolutionist. By transcendentalism, the 'class' of metropolitan naturalists who believed in social self-advancement were able to separate themselves from Oxbridge patrons and emerge as a new 'subject position' in contemporary British society. In this version, Owen's archetype was being emphasized as representing the divergence process of species. This process moved from simple to complex through the medium of transcendental ideas. For Rupke, therefore, Owen's idea of the life of organisms was not so static as to promote God and the interests connected to it. On the contrary, it was dynamic in time and aimed to relieve the constraints of the status quo.

It is from this perspective that Owen's archetype could be claimed to be a crucial, early idea in modern Biology. Owen's idea of the archetype is a construction of transcendentalism. The historicity of the archetype was presented by the discontinuity of species, and the progressive and divergence processes of development. The study of the space of the NHM shows that the spatial layouts of the museum were responses to Owen's ideas of a transcendental archetype that constituted a particular form of historicity. From this perspective, the NHM was therefore not wholly a product of the Creationists. Owen's idea about the life of organisms might not appear the same as Darwin's, but it could be seen as an alternative view of evolution. The distance between the idea of an archetype and the idea of an ancestor of life is perhaps not so great as we thought, and the construction of the NHM can therefore be identified as a very early establishment of the modern museum. This study shows how the spatial layout of the NHM was mapped by knowledge which was related to the emergence of Owen and the metropolitan naturalists. It was within these social networks that Owen was struggling to build his theory about the history of life. The spatialization of knowledge is therefore not just concerned with the reflection of knowledge, but is also an epistemological strategy for dealing with and creating social relationships.

NOTES

[1]In this study, the 'subject position' refers to Hooper-Greenhill's theoretical ideas in *Museum and the Shaping of Knowledge*. A subject is an individual agent who in particular social circumstances, is able to adopt a legitimized position in relation to others and act in legitimized ways. The emergence of the 19th century museum created and legitimized a particular kind of curator, with particular relations to knowledge and to society. In this way the curator is a subject constituted by specific social and epistemological conditions. Through this subject position, knowledge is reorganized and exhibited to reflect the social and epistemological nexus within which this role is defined.

[2]Space syntax is the spatial theory developed by Bill Hillier and his colleagues at University College, London. An important concern of this theory is the nature of movement patterns and how these are affected by the design of spatial layouts. *The Social Logic of Space* could be regarded as the original pioneer work of this theory, which Hillier co-authored with Julienne Hanson in 1984. In this book, they develop space syntax methods and argue that societies are made up of spatial forms in which people's relationships are arranged through different patterns of movement and encounters (Hillier and Hanson, 1984: 26-27, 224, 234-236).

[3]'Asymmetry' and 'symmetry' are terms of space syntax to describe relations between spaces. According to Peponis and Hedin (1982), if a space controls access to another space, while not being controlled by it, a relation of 'asymmetry' between spaces is defined.

[4]A ring is a series of spaces connected in sequence so that one can return to any starting point without having to backtrack on one's steps.

[5]Rupke (1994) describes how the problem appeared in the 1840s: "Even before the completion of the British Museum building in 1845, overcrowding and neglect were the order of the day".

[6]See Yanni' *Nature's Museums*, 1999: 132; and Markus' *Buildings and Power*, 1993: 197.

[7]According to Owen's *On the Nature of Limbs*, the general vertebrate design (the archetype) represented a "predetermined pattern, answering to the idea of the Archetypal World in the Platonic cosmogony". R. Owen, *On the Nature of Limbs*, 1849: 2. Quoted by Desmond (1989: 364) and Rupke (1994: 198).

[8]The interpretation of the archetype as a Platonic idea was put forward by Owen himself in 1849 *On the Nature of Limbs*. Desmond considered that the idea of an archetype was really a Platonic idea which was developed by some members in the conservative Royal College of Surgeons to defuse the threat from democracy in the first quarter of 19th century. He said: "Science at the College of Surgeons played a far more traditional role; it was at once conservative, religious, and supportive of the existing power structure. ... Following the older baronets in the 1820s came the younger disciples of the poet and philosopher Samuel Taylor Coleridge, the recondite Joseph Henry Green and his industrious protégé Richard Owen. To meet the democratic threat, they promoted an idealist biology based on German Naturphilosophie. Theirs was a science of Platonic 'archetype', ideal forms existing only in the Divine mind" (Desmond, 1989: 13; 1982: 42-43).

[9]Desmond considered the archetypal development as static in terms of evolution. For example in *Archetypes and Ancestors* he said: "Although the Ideal Form was fleshed-out in increasingly specialised guises according to the 'predetermining Will', the Archetypal pattern remained static" (Desmond, 1982: 44).

[10]According to Rupke (1994: 107-108), transcendental morphology was related to Romantic philosophy which was regarded as a reaction to Enlightenment's rationalism. The Romantic philosophy emphasis is on 'unity in variety'; it had a great influence on Romantic naturalists' ideas of 'morphological types' which were established according to the relatedness of organic forms. This produced what has been called 'transcendental morphology', that is, "the doctrine that organic diversity, as present in the myriad of different species, can be subsumed under one or a few ideal types which constitute the logic behind the morphological variety and thus its explanation, transcending the vision of the eye, and visible only to the eye of mind".

[11]Rupke (1994: 197) asked: "Was Owen's archetype a Platonic idea? The answer is a definite 'no'. Whereas a Platonic idea is the highest, most perfect reality, the vertebrate archetype represented the opposite, namely the simplest and least perfected conception of a vertebrate. In one sense, Owen's archetype was all potentiality, and as such his position was more Aristotelian than Platonist".

[12]Richards (1987: 142) shows that Owen's explanation about embryological development is "remarkably similar to that of von Baer". According to Lecture on Invertebrates, Owen explained the embryonic forms that "all animals resemble one another at the earliest period of their development, but development is a progress from the general to the special, and each animal, while it approximates the forms of lower animals in its early stages, must complete its development by diverging to its own special form, and this precludes resemblance to lower forms in the later stages of development".

[13]In this study 'historicity' refers to the intersection of teleology (the concept and study of progress and purpose) and temporality (the concept of time). Varying conceptualizations of historicity emphasize linear progress or the repetition or modulation of past events. In this sense, historicity can have many different forms. See Wikipedia for more definitions of this term.

[14]The library system here refers to Forgan's (1994: 148) idea about the 'library type'. In *The Architecture of Display* she considered that there are two types of spatial layouts of museums: "One was the library type, where the taxonomies were wrapped around a central open space, so often top-lit, where the visitor might browse and wander between sections. The other type was more rigid, with the taxonomies ranged along an axis in equal-sized bays with controlled circulation". This study further suggests that they are the two different ways of controlling a body which manifests this classification. The first emphasizes the control of visibility by space, which is what Forgan calls the library type. The second one is the control of permeability, or the 'axial type' Forgan has referred to. These two ways are both spatial methods of forming the mechanism of the 'index room'.

[15]The Horticultural Society's garden was in the northern area of the contemporary NHM. It was a part of the museums area of South Kensington in the 1860s. Most of the South Kensington properties in the 1860s belonged to the

Commissioners for the Exhibition of 1851. Prince Albert was the President of the Commissioners. According to the *Survey of London*, this area was bought with a surplus from the 1851 Exhibition and funds voted on by Parliament. The purpose of this area was to provide "a site for institutions that would further the general aims of the Exhibition and extend the influence of Science and Art upon Productive Industry" (*Survey of London*, 1975: 49). When the garden was opened in 1861 the Prince looked forward to the time when it would "at no distant day form the inner court of a vast quadrangle of public buildings, buildings where science and art may find space for development" (*Survey of London*, 1975: 60).

[16]'Distributed' and 'non-distributed' are technical terms used by space syntax to describe the relations between spatial unites in a spatial complex. A non-distributed relation is one which is controlled by a single space, as for example when a courtyard or a corridor provides the only access to a group of rooms off it, while a distributed relation is one in which access can be gained by more than one route (see Hillier and Hanson, 1984: 11-14, 147-175). When the terms are used to describe a spatial system, it can be inferred that a ringy system would be a distributed system since it have many alternative routes. A non-distributed system on the contrary has relative little ring and the j-graph would be tree-like.

[17]There is an analysis by Yanni (1999: 115) of Owen's manuscript which is concerned with the progressive idea and the sequence in Owen's plan. In her study she noted that from the rooms of ethnology which were around the index museum, "continuing to the left or right, the collections were laid out in galleries perpendicular to the facade, with mammals closest to the centre, and less complex organisms toward the edges". In other words, Yanni suggested that the distance between the ethnology and the other classes could be measured as the process from the complex to the simple.

[18]Transcendentalism is a belief in the existence of things that transcend sense-experience. For example, Ideas of Plato and God, which are not in space and time and not encountered in the world of senses, are transcendent (see Honderich, 1995: 878).

[19]When Rupke analyzed Owen's social networks of London's clubs, two circles appeared as very important - one is the 'Oxford circle' and the other is the 'Cambridge network'. Rupke (1994: 58) further said that: "It was at the level of scientific societies that Owen's respective Oxford and Cambridge support merged into a unified Oxbridge patronage in particular in London's Geological Society and in the peripatetic British Association for the Advancement of Science".

[20]According to Rupke (1994: 61), two or three decades before Darwin's *Origin of Species* was published, a generation of London naturalists had already abandoned the functionalist epistemology and adopted a different kind of scientific explanation which was imported from the Continent. This position of 'non-functionalists' gave metropolitan science its own philosophical mooring. "It may seem contradictory, but Owen was the leading proponent of the non-functionalist, non-Oxbridge, metropolitan form of scientific explanation".

[21]The design argument is a form of natural theology. It mainly served to train future clergy among Oxbridge patrons by justifying nature as designed by God. According to Rupke (1994: 60), "the demonstration of design and of perfect adaptation in nature benefited the landed gentry and nobility, whose sons were sent to Oxbridge. The reason for this was that the design argument tended to legitimise the social status quo and therefore the privileges of the ruling classes, because it portrayed the world as a perfectly functioning whole, designed by the Creator". The Cuvierian functionalist approach to the study of nature, according to Rupke, "provided the perfect means of making natural history part of the tradition of natural theology" (*ibid.*).

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自然史博物館中知識的鋪陳：
理查・歐文的自然思想與倫敦自然史博物館的空間佈局

黃旭

國立自然科學博物館展示組

博物館是一種公共場所，藉由公開展示，將具有意義的物件提供大眾觀賞；安排物件，因此形塑著博物館中物件和觀眾間的界面。但物件的安排，它背後的理論或原則是什麼呢？空間的設計及佈局，又是如何支持著這些理論或原則呢？本文以倫敦自然史博物館爲例，調查物件的安排及展示空間的佈局，如何被一種特別的自然史知識所設計和結構，這種知識對博物館的創始人理查・歐文而言，並且具有一定的社會意涵及作用。本文透過自然史博物館建築空間的分析，認爲觀眾和物件之間的界面，關係到民眾的分類、及一種替代性的演化理論；本文進一步認爲，倫敦自然史博物館的空間佈局爲歐文的自然史理論所結構，並且這個理論與19世紀科學社群中「主體位置」的浮現相關。

關鍵詞：原型，多樣性，演化論，自然史博物館，理查・歐文，空間佈局，空間型構。