

# Paleontological museums and geoethics

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## ABSTRACT

*Paleontological museums should adopt a code of ethics in order to carry out restorations and to set-up exhibits without any falsification. Indeed, alterations can often be voluntary because an exhibit needs to be 'beautiful', 'realistic' or 'charming' for the public. Therefore, the reconstructed parts are painted and then 'soiled' artfully to look more realistic. An incomplete skeleton might be completed by reconstructing the missing bones, or by adding casts of other bones. Sometimes skeletons are 'created', by assembling together bones from several specimens of the same species. Therefore, the museum staff should also inform visitors if a specimen has undergone such tampering, because otherwise each visitor is convinced that they have seen a 'true' fossil. So all museum staff should be trained not only in the techniques of museums, but also in the ethics of restoration and installation.*

## 1. Introduction

Science museums are the places that are responsible for the preservation and dissemination of culture. Therefore, we expect that what they propose is 'scientifically true'. Unfortunately, this is not always respected. It happens indeed that material on display is actually an artifact, while any notification of such for visitors is missing. An alteration is sometimes 'desired' because the exhibit needs to be beautiful and charming for the public. This philosophy is probably inherited from former 'museums', in which only weird findings were considered for display. These museums were much more 'rooms of wonders', or 'Wunderkammer' in German, where from the 16th to the 18th century, wealthy collectors displayed their curiosities to surprise their guests.

A striking example is the archeological site (archeological sites are to be considered in all respects as open-air museums) of Knossos (Isle of Crete, Greece). During the systematic excavation of the site from 1900 to 1931, the British archeologist Sir Arthur J. Evans brought to light many of the archeological remains visible today. The monuments were restored in questionable ways. Some rooms of the palace were colorfully rebuilt. Even the famous paintings of the Minotaur and the Dolphins

were almost completely re-depicted. This method of restoration has been much criticized, and visitors should be told to carefully read a well-written guide to be sure of the truth.

Unfortunately, it is not unusual to find 'disciples' of Evans in some modern paleontological museums.

## 2. The paleontological museums

Fossils are stored in paleontological museums. By their intrinsic nature, fossils are usually not intact, as they are the remains of organisms that lived thousands or hundreds of millions of years ago. Fossils are often broken, fractured, or distorted. At present, we see how much restoring is important and necessary as a practice to preserve fossil material. Unfortunately, during the restoration process, fossils can be altered in more or less severe ways, and this falsification is often voluntary.

## 3. Restoration

Restoration is the practice whereby a damaged object is 'restored' to its original aspect. Moreover, the recovery operation is not always easy. Sometimes, and quite rarely indeed, fossils are found intact, whereas more often fossil material is found damaged, and it requires long and painstaking work of restoration. Basically, we can recognize two types of restoration, one addressed to mere conservation, and one targeted at the display of the material.

### 3.1. Conservative restoration

This type of restoration is performed when a finding is not going to be displayed. In this case, the intervention is aimed only at maintaining the artifact in its optimal condition. So the restorer acts in order to stick together fragments, and eventually to assemble the battered parts. This is therefore like minimally invasive surgery, because there is no need to reconstruct the missing parts. The adhesives used to glue and to impregnate must be reversible.

### 3.2. Exhibition restoration

In this case, with appropriate mastics, the restorer reconstructs the missing parts of the fossil to reproduce the exhibit as it would be if it was intact. It is good practice not to hold the true parts, and to it is recommended to use adhesives that are reversible. The reconstructed parts can be colored so as to make them easily recognizable. This is an invasive intervention, however, which can alter the original appearance of the exhibit. It is important to have deep knowledge of the fossil taxon when it is treated, so as not to falsify it.

### 3.3. Remarks

Unfortunately, it is clear that restoration of material can lead to misrepresentation. In some cases, ignoring the concept itself of fossils and science, an exhibit might be restored to look as if it is intact, so as if is 'new'. Indeed, the reconstructed parts can painted and then 'soiled' artfully, to look more realistic, such that at first sight they are indistinguishable from the real parts (Figure 1). Only a careful examination will allow the restoration to be detected. Unfortunately, until recently, many restored fossils were altered, and new restorations are now necessary to 'correct' such false fossils.

For mounted skeletons, the falsification of fossils might also occur in the skeleton assembling and mounting. The mounting of a skeleton can be a hard task. The bones are often fragmented or deformed, or even missing. It is therefore mandatory that the assembling must be well designed. For example, if the bones are deformed, the skeleton might slope to one side. So, when the restorer starts facing skeleton mounting, he must consider in which way the bones might be deformed, to find the right balance. In some cases, inexperienced technicians have filed down the bones to have a perfect skeleton.

Many museums have skeletons that were installed following the example of the infamous Dr. Victor von Frankenstein. In this way, an incomplete skeleton can be completed by reconstructing the missing bones (and in



**Figure 1.** Detail of a deer horn on which sand was glued to increase the realism (Paleontological Museum of Rome University).

some cases by inventing new bones), or by adding casts of other bones (sometimes from other species), or with bones belonging to specimens of the same species. For these reasons, although some fossils are 'falsely real', they are actually counterfeit or chimeras. The intent of those who counterfeit is commendable on the one hand, because they aim to give the viewer an idea of the 'real' animal. At the same time, it is evident that the visitor is pushed into believe that what he is seeing is a true and actual fossil.

Another problem is with the 'compiled' skeletons. These skeletons are 'created' by assembling together bones from several specimens. From one point of view, these are true 'monsters', worthy of the best of Dr. Frankenstein [Mateus et al. 2008]. This mode of operation is generally adopted when a lot of bones that are supposed to belong to a single species are found together. In this case, the bones are all measured. Then, using biometric methods, i.e. using bones that appear dimensionally compatible with each other, several entire skeletons can be assembled. Scholars consider this as a reliable method from a scientific point of view. However, it is clear that any skeleton compiled in this way is effectively a 'puzzle' made of several individuals (Figure 2). The visitors are thus unaware that they are only observing a working hypothesis.

Another problem is the posture of the skeleton. This can vary greatly depending on whether we imagine the animal as standing, as stationary, or is moving. Today, curators really like to show the dynamism of certain animals, so we can see skeletons that stand on one leg only, or that are about to prey on another skeleton. The intention is noble, but even in these cases, reconstructions of behaviors might be arbitrary, or at least scientifically questionable.

## 4. Falsification and scientific theories

Sometime museums suffer from obsolete scientific theories. Scientific theories can change according to new studies and/or new finds. For instance, in several natural history museums of paleontology, skeletons of bipedal dinosaurs (e.g., Theropoda) are mounted in a way similar to the tripodal posture of kangaroos (i.e. two legs plus the tail in contact with the ground). This means that those skeletons were mounted with the pelvis and tail in a sub-vertical position. Today it is thought that bipedal dinosaurs hold the pelvis and tail sub-parallel to the ground.

The craziest thing is that to maintain the 'tripod' theory, bones have been filed down. Of note, in the famous original mounting of an *Iguanodon* at the Royal Institute of Natural Sciences in Brussels, several caudal vertebrae were modified to obtain a tail that rested on the ground. Original shapes have thus been filed down to agree with the old and compelling theory of tripod-standing dinosaurs.



**Figure 2.** Composite skeleton of a dwarf elephant (*Elephas falconeri*) (Paleontological Museum of Rome University).

It is evident that in these cases it is not correct to speak of deception. Indeed, these skeletons were mounted when that theory was in vogue and was considered to be correct. Nonetheless, filing down bones is certainly a hoax.

Nowadays, the tripod posture can be considered somehow scenic, and the skeleton is significantly higher than it would be if correctly mounted. So it might be preferred to maintain the skeleton just as it is, in the wrong tripod posture. At the same time, it should also be said that any adjustment to the mounting of such an exhibit has significant cost, and this might be why many museums prefer to avoid such extra costs. Again, however, it would be appropriate to specify in the captions that the tripod position is no longer accepted by the scientific community.

### 5. Desire for success

In a few disgraceful cases, the insane search for fame, glory and cash has led some private institutions to display material of uncertain origins, if not totally fake. In July 1997, a farmer from Xiasanjazi (in the Liaoning province of China) who was also a fossil hunter and seller, came out with a fossilized skeleton of a bird, preserved on a slab of shale. This skeleton was datable to the Early Cretaceous, and was identified as a primitive bird. An American museum bought the piece and made it available for study by experts. With its particular characteristics (both reptile and bird), the fossil turned out to be, at least the experts said, the missing link between dinosaurs and birds. It was named as *Archaeoraptor liaoningensis*. The National Geographic magazine sensed the importance of this scientific discovery and funded research and published sci-

entific results from the study of this extraordinary fossil. The criticism of the scientific community, which highlighting some inconsistencies, destroyed the article in a few weeks. Indeed, all of the unavowed doubts at the time of the discovery eventually became certainties, and *Archaeoraptor* was declared a resounding fake. In December 1998, the counter-mould of the tail of a dromosaurid dinosaur (the cast of which was glued to the bird skeleton by the Chinese farmer) was recovered from a fossil-bearing locality in China. In this way, Rowe et al. [2001] were able to officially confirm that *Archaeoraptor* was a name given to a false fossil. Later, computer tomography analysis revealed further forgery of the 'original' *Archaeoraptor* specimen [Simons 2000].

#### 5.1. Remarks

This case is the one that a scientist would never like to comment on, because it overshadows the scientific community due to the disarming superficiality of the researchers who were charged with the study of the fake Chinese fossil. Indeed, more than pointing out the superficiality of some of the analyses, and that they did not take sufficient account of the criticism, the most worrying aspect is that the scholars were biased by their conviction of having a missing link in their hands, instead of aseptically investigating the specimen. Such cultural bias is one of the worst faults that a scientist can have. Cultural bias can lead to deliberately falsifying plain facts, because it starts from an incorrect assumption. It is important here to remember that also racism stems from a cultural bias [Gould 1983].

## 6. Conclusions

What we have seen so far comes mainly from the questionable philosophy that a displayed exhibit must be beautiful, even it means sacrificing some science, forgetting in this way that a fossil, for its inherent nature, is imperfect. Among other things, these ‘monsters’ are often accepted passively by the scientific community, because they are considered scientifically reliable. From an ethical point of view, this way of working is questionable, because the viewer is often not informed. If the paleontological museums, and also for the Knossos ruins, inform visitors about the process of restoration that any ancient remains have gone through, there would be no objections. The visitor should be informed that the finding has been restored, and the visitor is happy anyway. The best thing would be a conservative restoration, possibly revealed by a distinguishing color of the exposed material. At most, we can propose the separate reconstruction of how the fossil would have been if found intact. The important thing is to always inform the visitor of the type of restoration that has been done.

Finally, it is necessary to train the staff of museums, and not just the technicians, but also the scientists. This should not only include the techniques of fossil preparation, mounting and display, but also the ethics of restoration and installation.

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