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The Godzilla Syndrome – Scientific Inaccuracies of Prehistoric Animals in the Movies

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ABSTRACT

The depictions of dinosaurs and other ancient animals in the movies have, almost without exception, sacrificed scientific accuracy in order to create exotic images of huge, terrifying creatures. The public's misconceptions of dinosaurs as blood-thirsty, ponderous beasts that co-existed with humans have been gradually changing over the years. Recent discoveries by paleontologists have made people, especially children, more aware of the facts. Students, in the courses "Adventures in Earth History" and "Principles of Paleontology," were assigned to review a video that depicted prehistoric animals with the idea of evaluating their scientific accuracy. The students' reviews demonstrated that they were able to detect fallacies regarding dinosaur ecology and behavior and arrive at conclusions based on scientific evidence. Class discussions ranged from dinosaur functional morphology and ichnology to an overview of dinosaur ecology. The assignment may be adapted for advanced courses, such as vertebrate paleontology, historical geology, or general biology classes.

Keywords: Geology – public affairs; paleontology – vertebrate; reviews – films.

Introduction

While teaching the subject of paleontology as part of historical geology or general biology, or as a separate course, we find that it is almost impossible to omit discussion of the most popular fossil group – the dinosaurs – a name first coined by Sir Richard Owen, the English anatomist. Students today, as in the past, are fascinated by these extinct creatures. From the elementary to graduate level, interest in dinosaurs has maintained momentum over the past ten years (Feeney, 1987; Durant and others, 1989; Gould, 1991; Weishampel and others, 1990) and has again peaked with the showing of the film *The Lost World* (1997). The American Museum of Natural History in New York recently opened a newly renovated dinosaur exhibit and has, over the years, presented numerous lectures, workshops, and exhibitions on the latest developments in dinosaur paleontology. The American Museum has even presented a program held in conjunction with the exhibition "The Dinosaurs of Jurassic Park" entitled "Fantasy Dinosaurs on Film" which included a lecture on film and special-effects techniques.

Almost since the creation of motion pictures, movie makers and audiences alike have had a fascination with dinosaurs and other prehistoric beasts. Many of today's paleontologists and biologists can trace their desire to work in the sciences back to afternoons spent wide-eyed in the theater as Godzilla, King Kong, or the Beast from 20,000 Fathoms terrorized the world. Because of the tremendous interest in dinosaur movies, and the power of film as a medium for spreading information, movies have been one of the major influences in the shaping of the public's knowledge and impression of prehistoric life. Unfortunately, the depictions of dinosaurs and other ancient animals in the movies have, almost without exception, sacrificed scientific accuracy in order to create lurid images of marauding monsters out to feast on human flesh. Bakker (1986) aptly noted that dinosaurs were often viewed as swamp-bound monsters of sluggish disposition, plodding with somnolent strides through the sodden terrain of the Mesozoic Era.

The Assignment

Students are assigned to either rent a video tape or view a film that depicts prehistoric animals. A list is handed out with suggested titles, and the students have the option of either selecting a title from the list or coming up with one on their own. In fact, there are so many films on tape today that students have little difficulty finding an appropriate movie. Often a student has an old favorite that is not on the suggested list, and, as long as the film meets the criterion for selection, it is approved.

The main criterion is that prehistoric animals appear in the movie. By this we do not mean that they make a cameo appearance but that they have a significant role in the movie. The dinosaurs do not have to be the "star" of the film but must be in it long enough so that their behavior can be analyzed in terms of scientific accuracy and, preferably, functional morphology.

Synopsis of Student Assignments

Based on student feedback, we have summarized below the reaction of students to the assignment. Although they have the option of selecting any "prehistoric animal," students invariably choose dinosaurs for analysis.

The first dinosaur on film was the animated star of *Gertie the Dinosaur*, made in 1909. Gertie was a loveable cartoonish *Diplodocus* who romped with a woolly

mammoth and her human companion, ate entire trees, and generally acted like a trained dog. While such caricatures are to be expected in animated films, several scientifically impossible constants of the dinosaur movie genre can already be seen in *Gertie the Dinosaur*. Firstly, the dinosaur's morphology is not reflective of the evidence in the geological record (in this case Gertie was not scaled to the animal's true size). Secondly, the animal is shown interacting with creatures that evolved long after dinosaurs had become extinct, and, thirdly, the natural behavior of the creature is ignored in favor of a more exciting depiction.

This trend can be seen in the first "serious" dinosaur movie, *The Lost World*, from 1925. In this film, live human actors were superimposed into scenes of clay-mation dinosaurs, creating a dramatic effect. When the *Apatosaurus* (= *Brontosaurus*) rampaged through the streets at the movie's climax, some audiences were so panicked that they fled the theater in terror, convinced that the dinosaurs were real. But, of course, they could not be; the movie-makers neatly ignored the fact that such creatures had been extinct for 65 million years. We should note that the idea of a refugium capable of sheltering dinosaurs until the present may be implausible, but it does not violate any known scientific facts or principles. Even more insulting to scientific fact was *King Kong*, released in 1933, a movie that featured dinosaurs roughly three times their true size, meat-eating apatosaurs, and a huge ape that could never have survived under Earth's air pressure and gravity.

By 1940 all attempts at scientific accuracy were gone, as *One Million Years B.C.* brought us mammoths, ankylosaurs, allosaurs, dimetrodons, stegosaurs, and humans all living and fighting together a mere million years ago! Audiences were asked to believe that an alligator with a plastic fin glued to its back and a normal tegu lizard were prehistoric beasts. By now many people were firmly convinced that humans and dinosaurs *had* lived at the same time, mostly because of what they saw in the movies. That same year, Disney released its famous *Fantasia*, whose animated dinosaur scenes depicted a wide variety of species that never co-existed, and produced the first example of another trend that would reappear throughout dinosaur movies: the three-fingered *Tyrannosaurus rex*. Disney, however, should be given credit here for hinting at the long span of geologic time only 15 years after the Scopes trial took place in Dayton, Tennessee. Interestingly, the anthropomorphism of dinosaurs and their depiction as social creatures in *Fantasia* is closer to our "modern" concept of dinosaur paleobiology than a more "scientific" view would have been, given the general conception of dinosaurs in 1940.

By the 1950s, movie makers no longer even bothered to consult scientists for their ideas of dinosaurs. *The Beast From 20,000 Fathoms* (1953) was pure fantasy: a gigantic dragon-like monster with poisonous blood given the pseudoscientific label "*Rhedosaurus*." Also, 20,000 fathoms is equivalent to 120,000 feet, about three and a half times the maximum depth of the ocean. Inspired by the movie's success, Japanese film-makers set out to reproduce it and, in the process

created the most widely recognized prehistoric monster ever: *Godzilla, King of the Monsters*. Lucas (1994) noted that since its first appearance in 1954, the Japanese behemoth has been the star of 16 more movies, ending with *Godzilla vs. Violante* (1989). This monstrosity was absurdly huge, breathed fire, and seemed to be a theropod of sorts; a cross between a *Tyrannosaurus* and a *Stegosaurus*. It viciously destroyed cities by the dozen with no clear motivation other than spite. Constant references to the extinction of the beast's species only two million years ago added to the silliness.

The fifties produced other scientific impossibilities to thrill audiences, such as the *Creature From the Black Lagoon* (1957), which hypothesized a Devonian missing link between fish and humans, suggesting that people evolved directly from fish with no intermediate species; *Rodan the Flying Monster* (1957), which depicted a pterosaur so large it could knock over buildings; and *The Giant Behemoth* (1959), a fictitious prehistoric reptile that was both electric and radioactive. In 1957 humans ventured to *The Land Unknown*, where they encountered a saber-toothed plesiosaur that swam by dog-paddling, and took a *Journey to the Center of the Earth* (1959), where they discovered dimetrodons the size of city buses and giant prehistoric chameleons.

The 1960s also produced its share of ludicrous "dinosaurs," starting in 1960 with a remake of *The Lost World* that slapped fake fins and horns on a skink and claimed it was *Tyrannosaurus*. That same year *Dinosaurus* once again presented cavemen and dinosaurs living side by side. Perhaps most ironic of all was 1961's *Mysterious Island*. This movie included a *Phororhacus* (a giant flightless bird) and a huge nautiloid, both of which *did* exist together at one point and which were accurately portrayed in the film. However, the producers decided that audiences would not understand the prehistoric origins of these obscure creatures and instead claimed that they were a mutated chicken and a giant octopus!

The 1966 remake of *One Million Years B.C.* re-hashed the old prehistoric man versus dinosaur bit and also demonstrated another trend as frequently abused as three-fingered tyrannosaurs: bat-winged pterosaurs. It also depicted an *Archelon* the size of a house and showed an *Apatosaurus* apparently living in the desert. The 1970 sequel *When Dinosaurs Ruled the Earth* brought audiences another made-up creature that followed its human mistress around like a pet. In 1975 humans visited *The Land That Time Forgot* and encountered silly looking puppet dinosaurs. A second venture into this lost land in 1977's *People That Time Forgot* yielded a pterodactyl that never flapped its wings and a scientist who claimed that something in the water was speeding up the process of evolution.

When people crash landed on the *Planet of the Dinosaurs* in 1980, they discovered that natural selection apparently creates scientifically inaccurate dinosaurs on every planet in the galaxy, while 1983's *Legend of Dinosaurs and Monster Birds* failed to produce a single dinosaur or bird, featuring a ridiculous *Plesiosaur* with a goofy grin and a big pterosaur instead.

Throughout nearly all of these films, and many others, dinosaurs are depicted as mindless, savage brutes that lust after human flesh. They were cold-blooded contemporaries of simple-minded cavemen, dragging their tails on the ground as they chased their human prey. It looked as if this erroneous trend would continue forever, until finally a movie appeared on the horizon that re-envisioned dinosaurs according to modern scientific theories and had the technology to create realistic, life-like dinosaurs. This movie was 1991's *Jurassic Park*. But, did it manage to free itself from the long-standing Hollywood tradition of subordinating science in favor of melodrama?

In short, no. While *Jurassic Park*'s *Tyrannosaurus*, velociraptors, *Triceratops*, and *Brachiosaurus* were all in the proper scale, with modern warm-blooded behaviors and rigid outstretching tails, the dilophosaurs were woefully short (one meter tall instead of ten), spat acidic poison, and had colorful fringes on their necks. Velociraptors were perhaps some of the most intelligent dinosaurs, but no one believes that they would have had an intelligence approaching that of a chimpanzee, as claimed by the movie. So, whereas *Jurassic Park* managed to dispel some myths, it merely replaced them with new ones.

The tendency to exaggerate the abilities of dinosaur protagonists did not disappear with the sequel, *The Lost World*. While the procomsognathuses, pteranodons, stegosaurs, and pachycephalosaurs that joined the dino cast were all beautifully rendered, the dinosaurs often behaved more intelligently than the human cast. The tyrannosaurs became fiercely devoted parents, affectionately raising their offspring and driving off intruders. The velociraptors became veritable gymnasts, apparently willing to climb to the top story of a building after prey. And the little procomsognathuses cooperated to bring down a much larger human, even though such a larger foe would surely have posed too large a target for creatures adapted to scavenging carrion and hunting small lizards and insects.

Note Added in Proof

The latest movie in the Godzilla series, "*Godzilla*," (1998), was a vast improvement over the earlier films in terms of a more realistic "monster" thanks to recent advances in computer technology. However, there were several notable scientific inaccuracies in the movie, such as the reference to Godzilla as being an amphibian but having dry, scaly skin and laying what appeared to be amniote eggs. Also, the newest Godzilla still breaths fire, is radioactive, and has babies that are born pregnant!

Discussion

Class discussion of the film reviews can range from an in-depth study of dinosaur functional morphology and dinosaur ichnology (Lockley, 1986) in a vertebrate paleontology course to a rather brief overview of basic dinosaur ecology (Bakker, 1971; Ostrom, 1984; Spotila and others, 1991) in a biology, historical geology or general paleontology course. Rossbach (1996) noted numerous points for discussion such as: 1) the license of artists to change current scientific thinking,

2) incorrect morphology depicted by the models (for example, *Tyrannosaurus* with three fingers per hand), 3) the idea that certain dinosaurs displayed maternal instincts (for example, nesting sites of the hadrosaur *Maiasaura*), and 4) the concept of dinosaur posture (tail dragging versus tail off the ground).

We have found that students enjoy this assignment because it makes use of the popular VCR, an instrument that our undergraduates are all too familiar with, often to the detriment of their studies. In addition, reviewing a film depicting dinosaurs can be combined with a trip to a natural history museum where some of the inaccuracies portrayed in the films can be corrected in an informative and interesting manner.

Conclusions

The public's misconceptions of dinosaurs as blood-thirsty, ponderous creatures that co-existed with humans has been gradually changing over the years. The recent discoveries by paleontologists have made people, especially children, more aware of the facts. We believe, however, that it is the adults who are often more misinformed about dinosaurs and, like bad tennis habits, have more difficulty losing ingrained misconceptions than do kids.

The topic of this paper can easily be used by educators, at various levels, to stimulate interest in the subject of paleobiology, although most of us seem to have an innate interest in dinosaurs. Everyone should read critically, but students should be particularly careful readers and viewers of all science information found in any popular medium, such as television, cartoons, and the movies.

This trend of ignoring scientific fact in the depiction of prehistoric animals will likely continue for as long as motion pictures are made. Until a paleontologist decides to turn in his dental tools in favor of a movie camera, the scientific community will just have to suffer through the exciting but absurd visions that Hollywood offers us.

An Annotated List of Dinosaur Movies Arranged Chronologically

- Gertie the Dinosaur* (1909): animated *Diplodocus*; first dinosaur in the movies.
- The Lost World* (1925): claymation *Apatosaurus* and *Tyrannosaurus rex*; first claymation dinosaurs.
- King Kong* (1933): claymation *Stegosaurus*, *Apatosaurus*, *Tyrannosaurus rex*; although dinosaurs are roughly three times normal size, and *Apatosaurus* eats men, still considered one of the finest dinosaur movies of all time.
- One Million Years B.C.* (1940): elephant-in-suit mammoth, man-in-suit *Allosaurus*, armadillo-in-suit *Ankylosaurus*, dwarf alligator-in-suit *Dimetrodon* versus tegu lizard *Stegosaurus*; although not scientifically exact, still a milestone with live action dinosaurs.
- Fantasia* (1940): animated mosasaurs, pteranodons, plesiosaurs, *Archelon*, *Dimetrodon*, *Triceratops*, *Anatosaurus*, *Apatosaurus*, *Stegosaurus*, *Protoceratops*, *Tyrannosaurus rex*, *Archaeopteryx*, *Ceratosaurus*, hadrosaurs, and *Corythosaurus*; first appearance of three-fingered *Tyrannosaurus rex* syndrome.
- The Beast From 20,000 Leagues* (1953): claymation "*Rheotosaurs*"; science ridiculous, monster imaginary; still,

- inspired many later-generation dinosaur buffs and was the direct inspiration for "Godzilla."
- Godzilla – King of the Monsters* (1954): model "living" trilobite, man-in-suit, clay model, mechanical model Godzilla; absurd creature is too large to exist, breathes fire and eats people who are smaller than the last joint on its pinky; still, the most popular of all cinema "dinosaurs."
- Creature From the Black Lagoon* (1954): man-in-suit gill man; scientifically preposterous fish-man is missing link from the Devonian Period.
- Rodan the Flying Monster* (1957): man-in-suit and puppet giant pterodactyl; gigantic monster probably could not fly if real; fought Godzilla on several occasions.
- The Land Unknown* (1957): full-size mechanical plesiosaur; sabre-toothed creature is ill-proportioned and swims with a peculiar paddling motion.
- The Giant Behemoth* (1959): claymation "Prehistoric Monster"; fictitious species; monster is electrical and radioactive!
- Journey to the Center of the Earth* (1959): rhinoceros iguana-in-suit *Dimetrodon*; huge creature is oversized; claimed not to swim but probably could in real life.
- Dinosaurus* (1960): claymation *Apatosaurus* versus claymation *Tyrannosaurus rex*; poor special effects with friendly neighborhood caveman thrown in for good measure.
- The Lost World* (1960): skink-in-suit *Tyrannosaurus rex* "firemonster" with other dressed-up lizards; *T. rex* has fin and horns!
- Mysterious Island* (1961): claymation *Phororhacus* and claymation giant nautiloid; scientifically accurate; unfortunately, audience believed creatures to be a mutated chicken and giant octopus.
- King Kong vs. Godzilla* (1963): "paleontologist" gives inane explanation of Godzilla's origin.
- One Million Years B.C.* (1966): claymation *Archelon*, *Apatosaurus*, *Triceratops*, *Ceratosaurus*, *Allosaurus*, pterodactyl, live iguana and spider; all accurate except for bat-winged pterodactyl and over-sized *Archelon*; iguana and spider unconvincing; cavemen never fought dinosaurs.
- King Kong Escapes* (1968): man-in-suit *Gorgosaurus*; ridiculous remake of classic King Kong versus *Tyrannosaurus rex* scene demonstrates the shortcomings of man-in-suit effects over claymation.
- When Dinosaurs Ruled the Earth* (1970): claymation *Chasmosaurus* and "prehistoric monster;" monster is fictitious and a cavewoman's pet!
- The Land That Time Forgot* (1975): puppet *Mosasaurus*, *Plesiosaurus*, *Triceratops* and *Ceratosaurus*; scientifically accurate, though ungainly.
- People That Time Forgot* (1977): full-size model pterodactyl; why doesn't it flap its wings?
- Planet of the Dinosaurs* (1980): claymation *Monoclonius*, *Ornithomimus*, *Polocanthus*; not very accurate; check out the leisure suits and 70's jive talk!
- Legend of Dinosaurs and Monster Birds* (1983): model plesiosaur; scientifically ridiculous; not a single real dinosaur or bird in the movie!
- Baby – Secret of the Lost Legend* (1985): model and man-in-suit apatosaurus; fairly accurate, though anthropomorphized.
- Jurassic Park* (1991): dispelled some dinosaur "myths" but replaced them with new ones, such as acid-spitting dilophosaurs.
- Carnosaur* (1993): full-size puppet of *Velociraptor*; OK.
- Godzilla vs. King Ghidorah* (1993): man-in-suit Godzilla; just as bad as always.
- The Lost World [Jurassic Park II]* (1997): *Velociraptors* became veritable gymnasts; dinosaurs behaved more intelligently than the human cast!
- Godzilla* (1998): great looking monster but excessive size makes it hard to swallow!

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