Title: Education and Outreach: The history of dinosaur palaeoart
Author(s): Szymon Górnicki
Volume: 7
Article: 9
Page(s): 1-9
Published Date: 01/09/2017
PermaLink: http://www.palaeontologyonline.com/articles/2017/education-outreach-history-dinosaur-palaeoart

IMPORTANT

COPYRIGHT

CITATION OF ARTICLE

Please cite the following published work as:

Górnicki, S. 2017. Education and Outreach: The history of dinosaur palaeoart. Palaeontology Online, Volume 7, Article 9, 1-9.

Education and Outreach: The history of dinosaur palaeoart

by Szymon Górnicki*1

Introduction:

Non-avian dinosaurs are iconic animals that dominated life on land for 170 million years during the Mesozoic era, and have captured the imagination of scientists and non-scientists alike for as long as we have known about them. As a result, dinosaurs have also dominated palaeoart — artistic representations of past life. Palaeoart is closely linked to the science of palaeontology, resulting from the desire to reconstruct what extinct organisms looked like when they were alive, and is increasingly informed by the latest scientific discoveries. This article provides a brief historical account of dinosaur palaeoart, explaining how this work has changed as our understanding of the anatomy and biology of dinosaurs has improved.

Scaled-up lizards:

The first scientific attempts to recreate the closest extinct relatives of birds on the basis of their fossils date to the nineteenth century. The first ever reconstruction of the skeleton of a dinosaur (Fig. 1A) is the work of English palaeontologist Gideon Mantell, created in 1832 but not published until 1968. Mantell's ideas inspired what are probably the oldest life restorations of dinosaurs (Fig. 1B; *Iguanodon*, *Hylaeosaurus*, *Megalosaurus* and birds, accompanied by turtles, plesiosaurs and crocodile) and their environment (the 140-million to 125-million-year-old Wealden formation in southern England), made in 1833 by the artist George Scharf. In this work, non-avian dinosaurs were depicted as huge, crawling lizard-like animals. Among them, *Iguanodon* was thought to be the largest, at about 30 metres long (today we believe that such large sizes were restricted to some sauropod dinosaurs), with a rhinoceros-like horn (Fig. 1; the discovery of 31 well-preserved skeletons in 1877 in a Belgian coal mine proved that this horn was actually a thumb spike). This image dominated palaeoart for nearly two decades, partly owing to the small number and incompleteness of dinosaur fossils known at that time (for example, in 1824, the only known remains of Megalosaurus were single bones of several individuals). Other artists who reconstructed dinosaurs according to Mantell's interpretations included John Martin (Fig. 1C), Samuel Griswold Goodrich and Josef Kuwasseg.

Great reptiles:

The world's first life-sized sculptures of dinosaurs (Fig. 2) were made by the British artist and amateur scientist Benjamin Waterhouse Hawkins, according to the instructions of the British palaeontologist Richard Owen, who coined the word 'dinosaur' in 1842. These reconstructions were created to

accompany the relocation of the 1851 Great Exhibition hall from London's Hyde Park to Crystal Palace Park in 1854, and they remain open to visitors to this day. The dinosaurs recreated by Hawkins are *Megalosaurus*, *Iguanodon* and *Hylaeosaurus* (Hawkins also reconstructed Palaeozoic and Mesozoic reptiles and Cenozoic mammals). Hawkins' art represented the first prehistoric theme park, and it helped to popularize dinosaurs, palaeontology and palaeoart. In 1855, with Henry Ward, Hawkins created the first example of dinosaur merchandise — miniatures of the Crystal Palace dinosaurs.

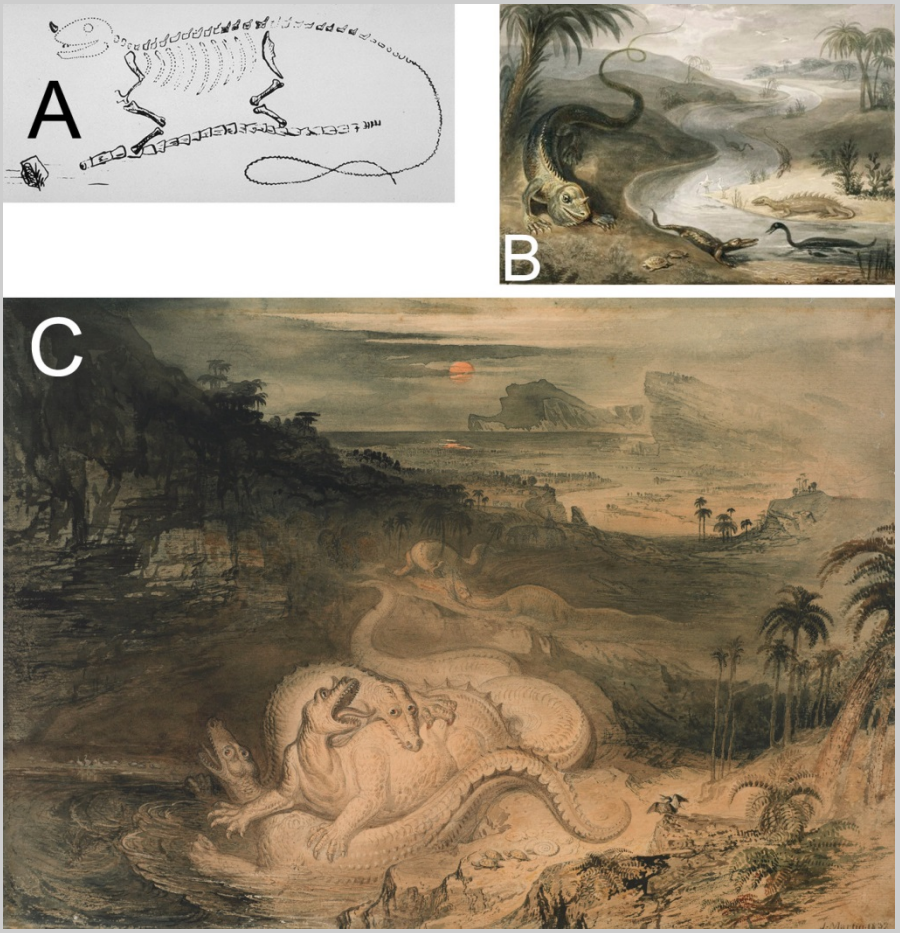

Figure 1 — Examples of Gideon Mantell's visions of dinosaurs. A, Skeletal restoration of *Iguanodon* by Gideon Mantell, 1832. Source: Wikimedia Commons. B, *Iguanodon*, *Megalosaurus* and *Hylaeosaurus* (also: birds, turtles, plesiosaurs and crocodile) by George Scharf, 1833. Source: D. R. Dean (1999). C, *Iguanodon*, *Megalosaurus*, *Hylaeosaurus* and *Pterosaur* by John Martin, 1837. Source: Wikimedia Commons. Images not to scale.

The visions of dinosaurs brought to life by Hawkins and Owen are still gigantic lizards (although not as big as previous estimates), with *Iguanodon* again having a horn on top of its head (Fig. 2B; this was a result of comparison with the rhinoceros iguana). However, these reconstructions also show some characteristics of mammals. They have a more upright posture, and body proportions similar to those of large living mammals, such as elephants or rhinoceroses. For example, the reconstruction of *Megalosaurus* looks like a reptile with the head and tail of a crocodile and the body of a rhinoceros (Fig. 2A; we now know that *Megalosaurus* was a bipedal theropod like *Allosaurus*). The same dinosaurs also appear in the works of the French painter Edouard Riou.

Figure 2 — Dinosaurs from Crystal Palace Park. A, *Megalosaurus*. B, *Iguanodon*. C, *Hylaeosaurus*. Credit: S. Górnicki.

The kangaroo era:

Major changes in how dinosaurs were reconstructed date back to 1858, when the US palaeontologist Joseph Leidy proposed a bipedal posture for *Hadrosaurus*, evidenced by the disproportion in the size of its limbs. This was the first skeletal reconstruction of a dinosaur standing upright. The end of the nineteenth century was marked by the discovery of numerous relatively complete dinosaur skeletons in the United States, and shapes depicted for dinosaurs began to differ markedly from those of modern reptiles. They were drawn with more slender bodies, and longer necks and limbs; some had spikes, horns and bony plates, uncommon in modern animals. However, because of their association with living reptiles, they were still considered slow, heavy, large, cold-blooded and relatively unintelligent. During this period, all bipedal dinosaurs were depicted in a characteristic kangaroo pose (Fig. 3A, B). As in the standing kangaroo, the tail of the reconstructed dinosaur was lowered to the ground and served as a third leg. During walking, it was dragged along the ground. The spine was almost vertical, which gave the profile a human-like character. Quadrupedal dinosaurs were also reconstructed dragging their tails along the ground (Fig. 3C–E). Some of these, such as sauropods, were illustrated living in swamps or lakes, submerging most of their body in water to help counteract its weight (Fig. 3E). Their necks were curved like those of swans, meaning that their heads were always above the water.

The most famous and influential artist of this era is the American Charles Robert Knight. Knight created illustrations of dinosaurs in the Impressionist style, under the influence of the palaeontologist Edward Drinker Cope. Other famous artists of this period are Rudolph Franz Zallinger, Zdeněk Burian, Gerhard Heilmann and Heinrech Harder.

The dinosaur renaissance:

Again, the discovery of new fossils led to the next step forward in the accuracy of dinosaur palaeoart. In 1969, palaeontologist John Ostrom described an unusual (for the time) theropod dinosaur called *Deinonychus*. It was thought to be relatively small (2.5–3.5 metres long), a bird-like, agile, fast predator with a relatively large brain (Fig. 4A). This finding, along with the discovery of dinosaur tracks showing running and herding behaviours, publications on the idea of warm-blooded (endothermic) dinosaurs and the realization that dinosaur tails were held upright, triggered the ‘dinosaur renaissance’, a dramatic change in how these animals were viewed. Since then, dinosaurs have been portrayed by

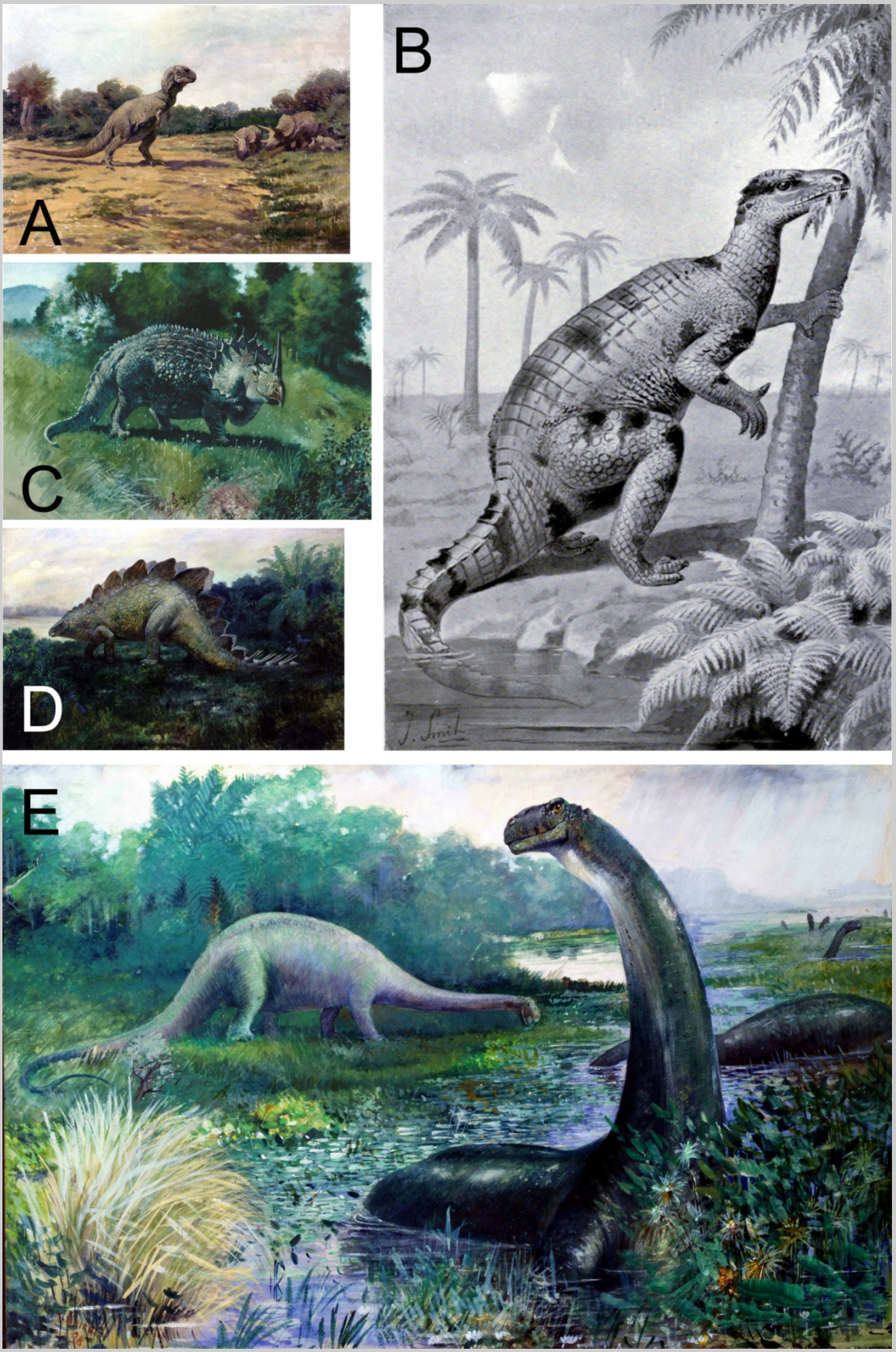

Figure 3 — Examples of dinosaurs from the kangaroo era. A, *Tyrannosaurus* and *Triceratops* by Charles Knight, 1919. Source: Wikimedia Commons. B, *Iguanodon* by Joseph Smit, 1905. Source: Wikimedia Commons. C, *Agathaumas* by Charles Knight, 1897. Source: Wikimedia Commons. D, *Stegosaurus* by Charles Knight, 1901. Source: Wikimedia Commons. E, *Brontosaurus* (in the water) and *Diplodocus* (on land) by Charles Knight, 1897. Source: Wikimedia Commons. Images not to scale.

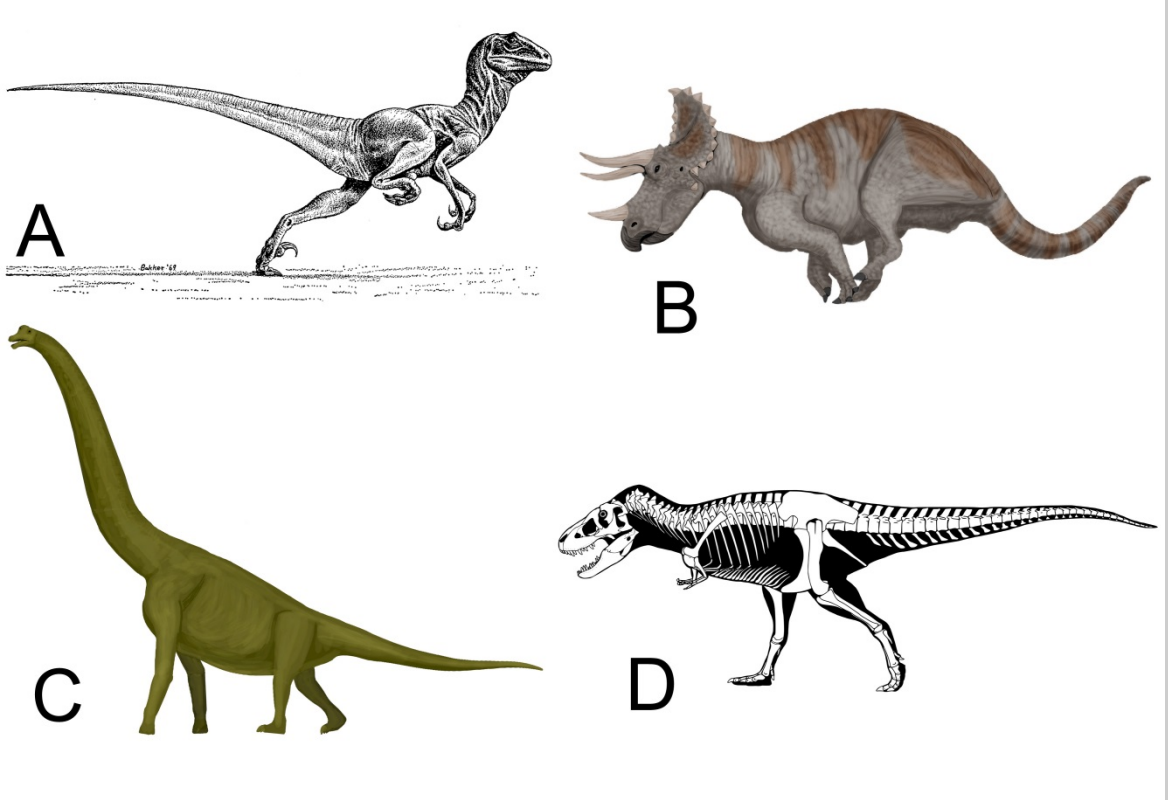

Figure 4 — Examples from the dinosaur renaissance. A, *Deinonychus* by Robert Bakker. Source: Ostrom (1969). B, *Triceratops* in Bakker style (based on Robert Bakker, 1986). Source: S. Górnicki. C, *Giraffatitan* in Paul style (based on Gregory Paul, 1977). Source: S. Górnicki. D, *Tarbosaurus* skeletal reconstruction (modified from Karol Sabath, 2005). Images not to scale.

some leading palaeoartists as dynamic, warm-blooded and often quick, with complex behaviours. Their spines were set roughly parallel to the ground, and they no longer dragged their tails (Fig. 4). Another significant change in the drawings and sculptures of dinosaurs was the presentation of sauropods as terrestrial animals (Fig. 4C). Skeletal drawings in the form created by Charles Knight in the 1940s and similar to what we see today — white bones on a black background representing the body profile during life — were popularized by Gregory Paul and Robert T. Bakker (Fig. 4D). It is during this time that the word paleoart was first used, by the US artist Mark Hallett. It quickly became widespread.

The work of palaeoartists became increasingly scientific and they put more emphasis on studying the anatomy of modern animals and the palaeobotany of the landscape. In addition, they developed ways to reconstruct anatomy with scientific accuracy, and worked more closely with palaeontologists. Some even started writing scientific articles themselves. At the same time, some palaeontologists began to pay more attention to palaeoart.

The dinosaur renaissance did start some negative trends, however, such as the reconstruction of dinosaurs with very small amounts of soft tissue (sometimes with every opening of the skull visible in the reconstructed living animal), as well as a focus on extreme violence and dynamic poses in the illustrations, so that viewers could get the impression that dinosaur life was a constant fight for survival.

Bakker, a US palaeontologist and palaeoartist, was a key figure in the dinosaur renaissance. He published influential books and articles with innovative illustrations (such as Fig. 4A) that inspired generations of scientists and illustrators. Bakker and Ostrom popularized the view, suggested by English biologist Thomas Henry Huxley in 1867, that dinosaurs are very closely related to birds. The most influential artist of the dinosaur renaissance is Gregory Paul, author of books and articles about the reconstruction and life appearance of dinosaurs, as well as high-quality illustrations. The other key artists of the time include Hallett, Doug Henderson, Eleanor M. Kish, John McLoughlin, Peter Zallinger and John Gurche.

Post-renaissance dinosaur art:

In 1988, Paul's book *Predatory Dinosaurs of the World* fuelled the idea of feathered dinosaurs in mainstream palaeoart (Paul, Bakker and Hallett had been depicting theropod dinosaurs with feathers as far back as the late 1970s). The presence of feathered dinosaurs was confirmed by fossil discoveries in Asia in the second half of the 1990s, including forms such as *Sinosauropteryx* (Fig. 5A) and *Caudipteryx*. This led palaeoartists to depict dinosaurs with feathers instead of reptilian scales (Fig. 5A, B), chiefly in those theropods that are most closely related to birds (coelurosaurs). Furthermore, drawings of sauropod heads started to place the nostrils lower and more forward than before (reflecting attempts to reconstruct the ancestral-reptile nostril configuration), and with larger amounts of covering soft tissue. Most sauropods were reconstructed with one-clawed hands (titanosaurs were drawn without claws) and 'n'-shaped feet, based on studies of tracks. *Diplodocus* and its relatives (and sometimes other sauropods) were illustrated with a row of triangular dorsal spines, as suggested by discoveries of fossilized skin impressions. For several years at the end of the twentieth and start of the twenty-first centuries, sauropods were reconstructed with their necks parallel to the ground (Fig. 5C), and it was claimed that they could not raise their necks much higher (this was a result of a study of the bones in sauropod necks, and of digital modelling). Subsequently, debate over head and neck posture in sauropods was re-invigorated (based on the study of the postures of extant amniotes, that is reptiles, birds and mammals); it is still unresolved. This is reflected by the existence of palaeoart showing both types of reconstruction (Fig. 5C, D).

The study of melanosomes, pigment cells that gave feathers their colour during life, brought about further advances in the accuracy of palaeoart. This allowed, for the first time ever, reconstructions of feathered dinosaurs with potentially true feather colours (Fig. 5A; the first Mesozoic dinosaur reconstructed with real plumage colour was *Anchiornis* in 2010). However, a limitation of this approach comes from the fact that the melanosomes representing certain colours are fossilized in different ways, and we do not definitively know what impact fossilization processes have on the preservation of pigments.

Unfortunately, some negative trends stemming from the dinosaur renaissance were continued. The plumage recreated was often too thin, and in certain cases all muscle and bone outlines were still visible (Fig. 5B). The backgrounds to artworks were conservative, with mostly flat, stage-like plains as the foreground and other elements, such as volcanoes, only a background.

Some of the most important palaeoartists from this period included Luis V. Rey, Stephen Czerkas, Wayne Barlowe, Julius Csotonyi, Todd Marshall, Crawley Creatures group, Tyler Keillor and Raul Martin.

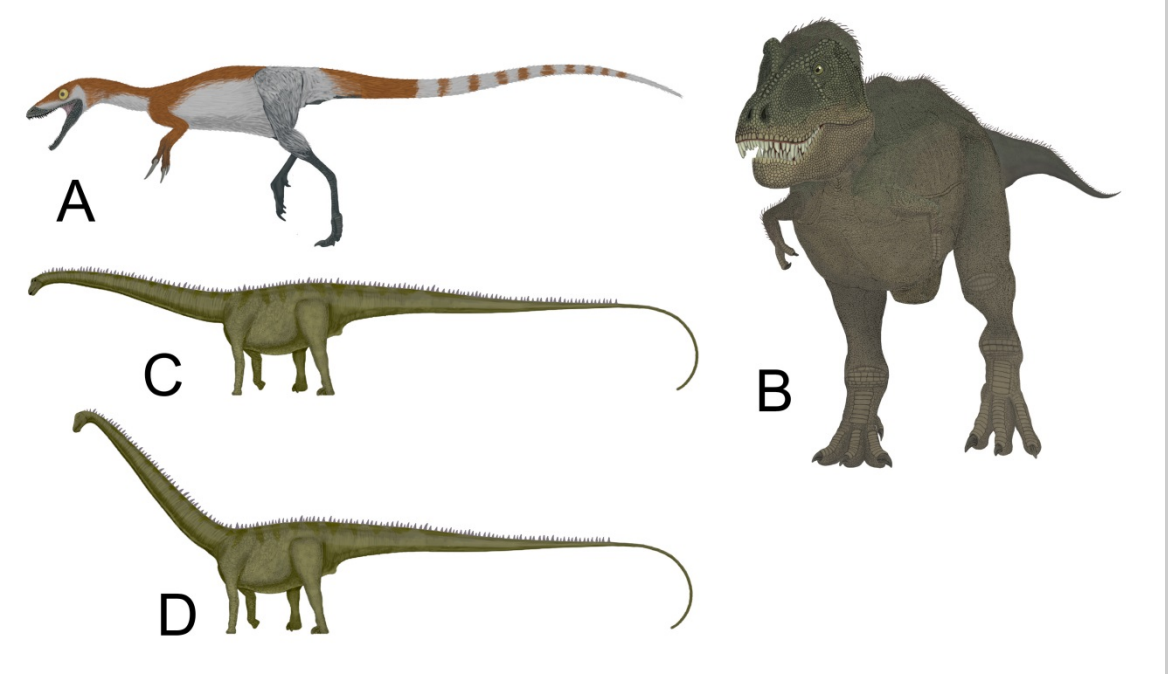

Figure 5 — Examples of post-renaissance dinosaurs. A, *Sinosauropteryx* (based on Qiang Ji and Shu'an Ji, 1996). B, *Tyrannosaurus*. C, D, *Diplodocus* (based on Scott Hartman, 2006). Source: S. Górnicki. Images not to scale.

The soft-dinosaur revolution:

The latest movement in palaeoart began in the 2010s and was popularized by the release of the groundbreaking book *All Yesterdays* by John Conway, C. M. Kosemen and Darren Naish, with skeletal drawings by Scott Hartman. Followers of the 'soft-dinosaur revolution' produced reconstructions of extinct animals with realistic amounts of soft tissue. They noted that we often do not know from the skeleton alone whether a species of dinosaur could have had skin features such as dewlaps, wattles, soft crests or frills (for example, it has been suggested that the large nostrils of ceratopsians and hadrosaurs probably housed some sort of soft-tissue structures), or large deposits of fat, like humps. Drawing on this, modern palaeoartists often incorporate speculative aspects into their work.

The discovery of numerous fossils with preserved coverings of filaments or feathers (at the beginning of 2017, more than 40 feathered dinosaur species were known) has resulted in the bodies of all maniraptorans (a group of coelurosaurs closer related to birds than to ornithomimids) being shown covered with dense feathers, as in birds (Fig. 6A). The longest feathers are on the legs and at the ends of the tail. More and more other dinosaurs are also now presented with feathers (Fig. 6C–E). However, there is currently limited information (i.e. through the use of phylogenetic bracketing to interpret the integument of dinosaurs) on how common feathers were among dinosaurs. Furthermore, we find dinosaurs such as *Kulindadromeus* (a small Jurassic neornithischian; Fig. 6D) with extinct forms of skin covering that we cannot compare to anything that exists today. Spikes, horns and plates are also shown in artworks, covered by structures make of keratin, the same material that makes up hair and feathers. To avoid duplicating the negative trends, mistakes, stereotypes and tropes of past eras, current palaeoartists often also show speculative, less well-known behaviours (Fig. 6B, C; such as playing or mating displays).

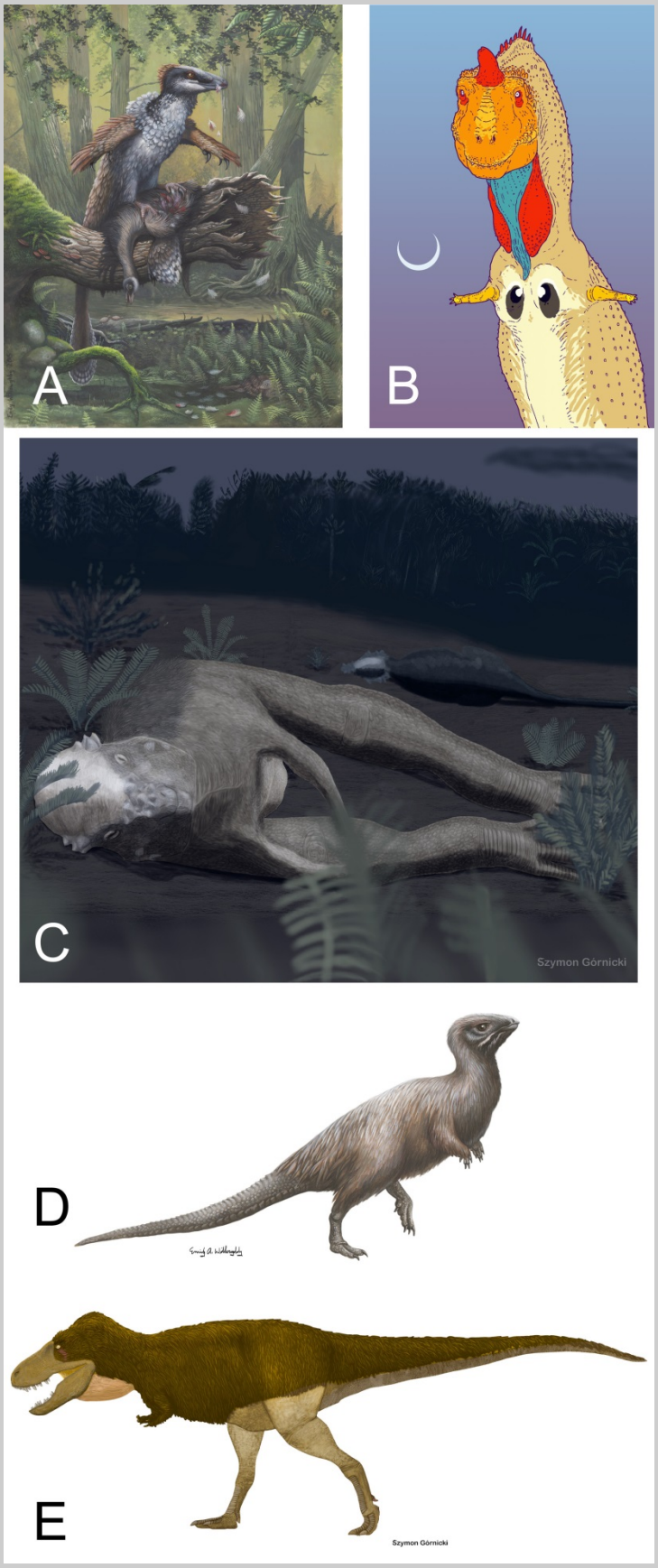

Figure 6 — Examples of dinosaurs from the soft-dinosaur revolution. A, *Dakotaraptor* and *Ornithomimus*. Source: E. Willoughby. B, *Majungasaurus*. Source: C.M. Kosemen. C, *Pachycephalosaurus*. Source: S. Górnicki. D, *Kulindadromeus*. Source: E. Willoughby. E, *Tarbosaurus*. Source: S. Górnicki. Images not to scale.

Opponents of this trend suggest that allowing more speculation can result in very unrealistic reconstructions. Moreover, it may be difficult for non-scientists to appreciate which aspects of palaeoart are firmly grounded in scientific evidence, and which are purely speculative, leading to misunderstandings of dinosaur biology.

Despite the field's long history, the first official definition of palaeoart was not formulated until 2015. Modern palaeoartists are increasingly self-aware, open to new ideas and discussions about the reconstruction process. Many images of dinosaurs are now created using computer software. Today, there are many well-educated palaeoartists with a strong background in palaeontology and anatomy. Among them are John Conway, Mark Witton, Emily Willoughby, Scott Hartman, C. M. Kosemen and Davide Bonadonna.

Summary:

Our understanding of Mesozoic dinosaurs, and with it their artistic reconstructions, has gone through much change, from huge lizards through monster-like reptiles to more active, agile and bird-like animals. Major shifts in dinosaur palaeoart have also influenced the rest of palaeoart; for example, the dinosaur renaissance made artists prepare more dynamic reconstructions of other animal groups. Moreover, new findings and state-of-the-art research have increasingly shown that in the case of some dinosaurs, we are already very close to reality. Works of dinosaur palaeoart are not quite photos from time travel, but may be the closest we ever get to seeing Mesozoic dinosaurs.

Suggestions for further reading:

Bakker, T. *The Dinosaur Heresies* (William Morrow and Co, 1986). ISBN: 9780688042875.

Conway, J., Kosemen, C. M., Naish, D. & Hartman, S. *All Yesterdays: Unique and Speculative Views of Dinosaurs and Other Prehistoric Animals* (Irregular Books, 2012). ISBN: 9781291177121.

Dean, D. R. *Gideon Mantell and the Discovery of Dinosaurs* (Cambridge University Press, 1999). ISBN: 9780521420488.

Moore, R. *Dinosaurs by the Decades: A Chronology of the Dinosaur in Science and Popular Culture* (Greenwood, 2014). ISBN: 9780313393648.

Naish, D. Artistic depictions of dinosaurs have undergone two revolutions. *Scientific American Tetrapod Zoology blog* (2014).

Paul, G. S. *Predatory Dinosaurs of the World*. (Simon & Schuster, 1988). ISBN: 9780671619466.

Rudwick, M. J. *Scenes From Deep Time: Early Pictorial Representations of the Prehistoric World*. (University of Chicago Press, 1992). ISBN: 9780226731056.

Selznick, B. & Serlin, D. A. Buried history of paleontology. *Cabinet Magazine Online* 28 (2008).

---

[1] Freelance palaeoartist, Kalisz, Poland, sgornicki@o2.pl