

State of the Palaeoart

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The discipline of palaeoart, a branch of natural history art dedicated to the reconstruction of extinct life, is an established and important component of palaeontological science and outreach. For more than 200 years, palaeoartistry has worked closely with palaeontological science and has always been integral to the enduring popularity of prehistoric animals with the public. Indeed, the perceived value or success of such products as popular books, movies, documentaries, and museum installations can often be linked to the quality and panache of its palaeoart more than anything else.

For all its significance, the palaeoart industry is often poorly treated by the academic, media and educational industries associated with it. Many standard practises associated with palaeoart production are ethically and legally problematic, stifle its scientific and cultural growth, and have a negative impact on the financial viability of its creators. These issues create a climate that obscures the many positive contributions made by palaeoartists to science and education, while promoting and funding derivative, inaccurate, and sometimes execrable artwork. The result is the publication of objectively inaccurate and subjectively terrible palaeoart that fails to conform with fossil evidence, is incongruous with the anatomy and life appearance of organisms, perpetuates recognised palaeoart clichés and tropes (Conway et al. 2012; Witton 2013), and has limited popular appeal.

To date, discussion of these areas has essentially been limited to personal communication among interested parties and on internet discussion groups; one aim of our article here is to docu-

ment part of this dialogue in the published literature, in turn bringing the issues concerned to wider attention. We argue that palaeoartistry is both scientifically and culturally significant, and that improved working practises are required by those involved in its production. We hope that our views inspire discussion and changes sorely needed to improve the economy, quality and reputation of the palaeoart industry and its contributors.

The historic, scientific and economic significance of palaeoart

Far from being an anonymous enterprise of individuals who fancifully recreate extinct creatures, palaeoartistry has a long history, its own traditions, has helped advance the science of vertebrate palaeontology, and is a cornerstone for palaeontological outreach. Moreover, palaeoart undeniably serves as the source for products and merchandise which are globally worth millions of dollars.

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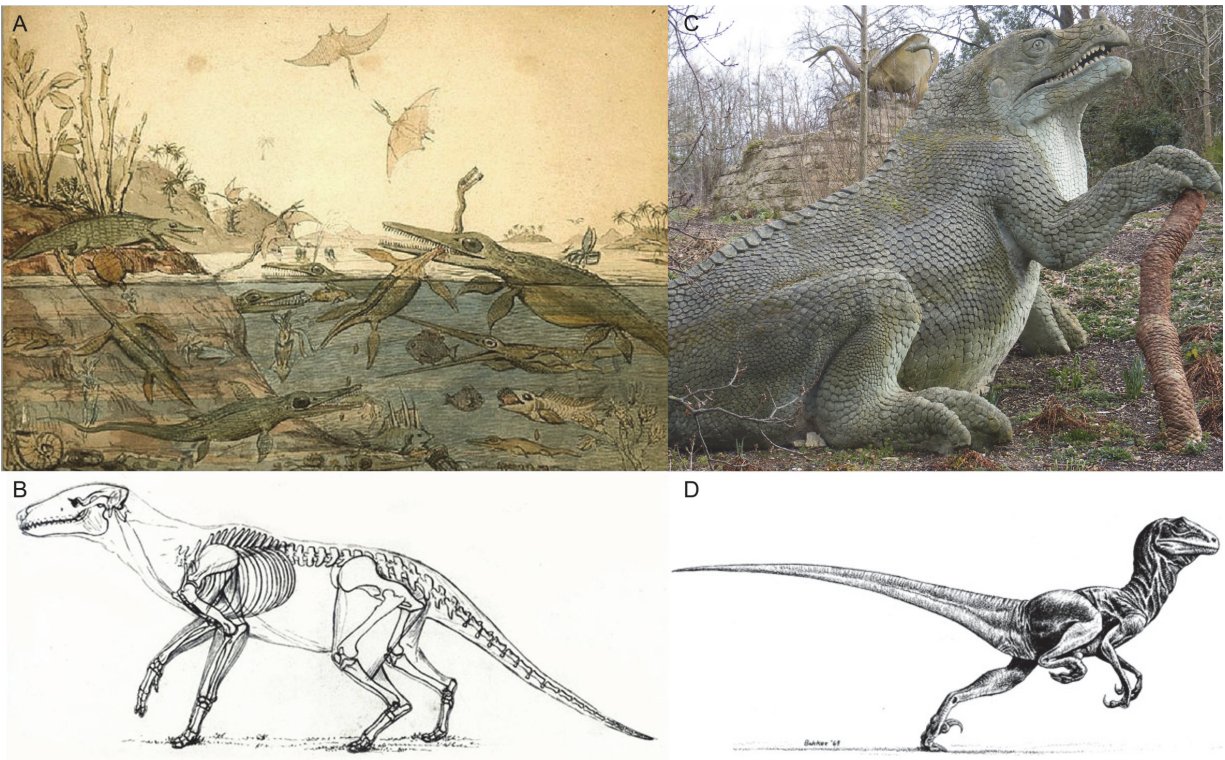


FIGURE 1. Select major works in palaeoart history. A, Henry de la Beche's 1830 *Duria Antiquior*, the first commercially available piece of palaeoart, as well as the oldest known composition of extinct animals within a reconstructed palaeo-environment; B, Baron George Cuvier's 1808 musculoskeletal reconstruction of *Anoplotherium commune*, including outline of restored soft-tissues; C, Benjamin Waterhouse Hawkins' 1854 *Iguanodon* model, part of the famous Victorian prehistoric menagerie of Crystal Palace, Sydenham; D, Robert Bakker's 1969 influential restoration of *Deinonychus antirrhopus*, an illustration which symbolises the beginning of the scientific and artistic 'dinosaur renaissance'. A – B, in public domain; C, photograph by M. Witton; D, from Ostrom (1969).

The origins of palaeoart lie within the origins of palaeontology in general. The first life reconstructions of fossil organisms date back to at least 1780 when scholars began to privately produce restorations of flying reptiles (Taquet and Padian 2004). Images depicting the life appearance of extinct creatures soon found their way into published works, such as those by Baron Georges Cuvier printed in the 1820s: the now familiar visages of reconstructed skeletons and body outlines date back to at least this date (Figure 1B, Rudwick 1992). Palaeoart became commercialised when Henry de la Beche produced *Duria Antiquior* (Figure. 1A, a watercolour scene featuring life in Jurassic Dorset, dating to 1830) to sell to academics for use in lectures. By 1854, palaeoart had made the transition from academia to public education: the life-size sculptures of fossil vertebrates, produced by Benjamin Waterhouse Hawkins and displayed in south London, had an enormous impact on the public's perception of fossil animals and their appearance. These models of fossil marine rep-

tiles, dinosaurs, mammals and other animals were created solely with public outreach in mind and were installed in the bustling, extravagant grounds of the Crystal Palace in Sydenham, London (Figure 1C). Their design famously involved collaboration with Sir Richard Owen, this being a notable early working relationship between a palaeoartist and a palaeontologist. Small replicas of these models were on sale in 1859 and pioneered the now-burgeoning tradition in which merchandise is derived from palaeontological science (Liston 2010). The academic, commercial and educational cornerstones of the palaeoart industry were thus in place by the mid-1800s. The demand for palaeoart has grown exponentially since that time, such that palaeoart of various kinds is now a familiar component of our daily lives, being featured in innumerable museum exhibitions, books, toys, logos, advertisements, and films.

Reconstructing an extinct organism and its world is skilled work. Rather than an "anything goes" approach to the appearance of fossil ani-



FIGURE 2. The production of a skeletal reconstruction (and hence a life restoration) involves the compilation of collected measurements and a rigorous effort to properly determine the proportions of the animal involved. This compilation - depicting the Lower Cretaceous theropod dinosaur *Eotyrannus lengi* - shows how measurements and proportions were compiled in order to create the conservative reconstruction shown at bottom. A more technically competent illustrator might use the same technique to reconstruct an animal via digital means only. Image by Darren Naish.

mals, accurate palaeoart is constrained by a wealth of data (see Conway et al. 2012 and Witton 2014a for overviews). This does not mean that palaeoartworks are necessarily 'right' or 'wrong', but that the most credible efforts which portray extinct creatures in accordance with scientific evidence. Credible palaeoartwork requires up-to-date knowledge of the taxon being illustrated and the geological context in which it occurs; an ability to reconstruct missing anatomical details (e.g. missing skeletal components and soft tissues) using inference from extinct and modern species; knowledge of those poses and actions which are biomechanically tenable; an understanding of animal colouration and behaviour and, of course, the ability to produce an artistically compelling piece of work in the first place. In contrast, objectively inaccurate works distort proportions measurable from fossils, omit integumentary structures documented for the taxon concerned, include blatant anatomical errors (regarding, for example, digit number or limb

form), or mix geographically and stratigraphically disparate species.

Given that significant background work is required for the production of any piece of accurate palaeoart (Figure 2), it is unsurprising that palaeoartists both bring scientific concepts 'to life' and also advance ideas and hypotheses about the portrayal and even anatomy, behaviour and biology of extinct organisms. The production of rigorous reconstructions has shed light on the proportions, postures, gaits, and body masses of extinct creatures (e.g. Bakker 1986; Paul 1988, 1991; Antón et al. 1998, Antón 2003a, b; Witton 2008). Some palaeoartists have transferred these observations into the technical literature, using the research behind their reconstructions to significantly advance our understanding of fossil animals. Perhaps the most famous example of this concerns the so-called 'dinosaur renaissance' of the late 20th century, where artists joined scientists in arguing for 'active' dinosaurs while also illustrating them

(Figure 1D, e.g. Bakker 1986; Paul 1988, 1991). Many of our most iconic palaeoart images came from this time and indisputably played a role in moulding views about dinosaur palaeobiology (Naish 2009; Liston 2010). At its best, therefore, the relationship between palaeoart and palaeontological science is mutualistic, a genuine fusion of artistry and science where both sets of practitioners are inspired by, and learn from, the other.

Outside of strict academia, palaeoart plays an essential role in popularising and communicating palaeontological and evolutionary sciences. Indeed, palaeontology is a privileged science in that its subject lends itself well to being rendered in art, and palaeoart provides a key reason for the enduring popularity of palaeontology outside of academia. Its appeal to children feeds into the important role of vertebrate palaeontology as a 'gateway science' for young people. Palaeontology is widely acknowledged for its role in introducing children to scientific processes and the fundamental components of Earth and life sciences – evolution, biodiversity, geological time, extinction and so on – and palaeoart vividly and memorably portrays these concepts.

The multi-million dollar industry of palaeontological merchandise – toys, books, films and so forth – is also almost entirely derived from palaeoart, predominantly featuring reconstructed extinct organisms rather than fossils themselves. While mostly directly benefiting industries outside of academia, sale of this merchandise offers a source of revenue for museums and indirectly fuels interest in palaeontology, which feeds back to museums in the form of visitors. The perceived economic potential of palaeoart has even led to suggestions that the commercialisation of palaeoart may be a viable alternative to the sales of fossils themselves (Shimada et al. 2014). While we have doubts about the latter point (fossil skeletons and art of fossil organisms are not interchangeable commodities: Witton 2014b), it is clear that palaeoart has significant monetary value.

Integral but unimportant: palaeoart in the eyes of many

For all its economic, scientific, and cultural significance, palaeoartists regularly find themselves being exploited by academic institutions, publishers, exhibition developers, filmmakers and other media agents. The environment in which palaeoart operates rewards work of dubious artistic and scientific value, aimed at a relatively narrow audience. Originality and accuracy are given no

incentive, and explorations of new styles and approaches are largely ignored. Even renowned, widely-respected palaeoartists struggle financially when reliant on palaeoart for employment, whereas others profit (sometimes substantially) from their work. A 'culture of copying' means that original, progressive artists are frequently passed over for commissions or consultancy and unable to build sufficient professional reputations to sell their art at respectable market value. The paradoxical result is that despite the enormous demand for palaeoart, a generally stifled and impoverished international industry can financially support only a handful of individuals.

A lack of consideration for the history of palaeoart and the contributions of its practitioners is the key problem here. Palaeoartists and their works are often considered interchangeable with one another to such an extent that artists are sometimes employed to reproduce the work of others. We are not referring to the production of artworks which are similar to other pieces, but which are anatomically, tonally and compositionally near-identical to older works, to the extent that their sources are easily identified by anyone familiar with palaeoartworks. The message behind such plagiarism is that the ideas and concepts of palaeoartists are important, but their origins - the individuals behind them - are not. We stress that these practices are not just perpetrated by small, underfunded museums or publishers: some of the largest and most respected scientific institutions and publishers engage in these unethical, copyright-infringing acts. Furthermore, not all individuals employed to reproduce art have the excuse of inexperience: several well-known professional palaeoartists practise this behaviour. Even among those who refuse requests to outright copy work, anecdotes persist of commissions where this has been broached. Copying palaeoartworks significantly affects the viability of professional palaeoartistry; diluting the importance and impact of original work to the detriment of the reputations, employability and finances of the original artists. Ultimately, it prohibits the development of a culture in the palaeoart industry that might earn individuals the work and recognition they deserve.

How has copying become so rife within the palaeoart industry? We consider one cause to be that many (though not all) individuals associated with palaeoart production are not sufficiently concerned about their product: its accuracy, historical context, and the individuals behind it are unimportant considerations. Note that this applies to some

palaeontologists who advise, choose and consult on artwork as much as non-academics. We find this attitude inexcusable given that both the artistic and scientific community generally revere their history and influences – a practise ranging from citing previous works to dedicating whole projects to historical and cultural events. It may be that some palaeontologists treat palaeoart as they do their own work, seeing the generation of derivative artworks as little different to developing hypotheses across successive papers. If so, they should remember that palaeoartists are not cited or mentioned when this occurs; nor do they gain commissions or remuneration based on how many individuals have copied their work. Compounding this problem is the fact that some palaeontologists employed as consultants consider artistic depictions of extinct animals unimportant or unworthy of checking, correcting or replacing over time; an approach decidedly at odds with the aims of the companies employing these consultants in the first place.

Another principle issue, of special relevance to book and magazine publishing, concerns the employment of ‘generalist’ (frequently in-house) illustrators for the production of derivative works based on original palaeoart. This is partly executed to meet ‘in house’ styling but, perhaps predominantly, to save money: putting salaried illustrators to work saves the expense of purchasing reproduction rights or commissioning new work from specialist artists. This practise has two effects, the first being the loss of scientific accuracy. Uncertainty over methods of fossil animal reconstruction and unfamiliarity with the subject matter forces ‘generalist’ artists to base their work closely on that of dedicated palaeoartists, and changes made to the original work – even minor ones – typically introduce errors. Conversely, outright copying means that mistakes or superseded components of the original artwork are perpetuated rather than corrected. Such errors would clearly be unacceptable in illustrations of modern animals: the correct proportions, digit counts, limb postures, integument types and so forth are clearly essential to the success of such portrayals, yet these same elements are frequently rendered inaccurately in copied palaeoart. A scaly *Velociraptor* with posteriorly-facing palms is not a *Velociraptor*, just as imagery of a cat with scales, or a bird without feathers, fails to represent these animals (Figure 3). Numerous recent projects, have equivalent issues running throughout their artwork, suggesting that the individuals behind these products did not perceive

them as problematic. However, given that a substantial amount of palaeoart is intended to be educational, this problem of inaccuracy raises legitimate questions about palaeoart production: 1) why are under-qualified individuals employed in producing art of fossil species?, 2) why are qualified palaeontologists apparently betraying a *laissez-faire* approach to artwork in their literature, museum installations and so on?, and 3) if sound advice is being given by consultants, why is it being ignored?

Creating derivative works has a second effect: reduction of original compositions and ideas. Given the near infinite artistic possibilities that are available in compositions and scenes, it is striking how ‘samey’ many palaeoartworks are. Renditions of animals attacking each other in heroic poses, roaring with wide-open mouths, and leaping at the viewer from within the picture with bared teeth and claws, are just some of the tropes identifiable within palaeoart (Conway et al. 2012, Witton 2013). Some extinct species wind up being depicted in the same composition so regularly that they have attained a comical status among palaeoartists and palaeontologists; indeed, the identification of ‘palaeoart memes’ or tropes has become a regular pursuit among interested parties. Examples include the ‘giraffoid’ version of the sauropod *Barosaurus* (Figure 4), the ‘mega-louse’ renditions of ankylosaurid ankylosaurs, reconstructions that show the iguanodontian dinosaur *Tenontosaurus* being attacked by packs of the dromaeosaurid *Deinonychus*, and images of the coelurosaur *Ornitholestes* acting as palaeoart’s version of Wile E. Coyote, perpetually locked in hapless pursuit of a Jurassic protobird. The genealogy of such images is often easily traced to single pieces of artwork and replication can involve more than composition and subject matter: artistic styles and media are also borrowed wholesale. There is very little interest in exploring more creative, stylistic avenues in the depiction of fossil life.

Seen within the context of education and the presentation of scientific hypotheses, compositionally homogenous scenes are a serious problem. For one, many palaeoart tropes are scientifically problematic. The significance of evidence for *Deinonychus* specifically predating *Tenontosaurus*, for instance, is overstated (Conway et al. 2012), and depictions of fossil reptiles roaring with wide mouths are inconsistent with vocalisation strategies in their extant relatives (Witton 2013). Again, copying of artwork spreads misconceptions about palaeontological science. Perhaps more press-



FIGURE 3. If artists made major mistakes in depicting the anatomies or proportions of modern animals - such as restoring a cat with scales, as shown here - their work would be considered an abject failure and future commissions unlikely. Fossil animals are frequently depicted with equivalent gross inaccuracies however, because many artists employed for palaeoart projects do not research or familiarise themselves with fossil data, or receive minimal guidance by consulting scientists. Painting by John Conway.

ingly, palaeoart tropes stifle the growth of the field as both an art form and an attempt to realistically portray past animal life. In particular, the near-constant depiction of extinct forms in aggressive, 'threatening' poses reinforces the idea that palaeoart only caters to young, excitable audiences or 'fanboys', and is not as sophisticated as other forms of natural history art (Witton 2014b). This impacts the value and respectability of the palaeoart industry, and ultimately the tenability of palaeo-artistic careers.

A significant contributor to the 'culture of copying' is a lack of sufficient funding for palaeoart production. Institutions that commission original work often lack adequate finance to pay for it, often because funding for the generation of artwork has not been budgeted for. Obviously, the production of high-quality palaeoart is time-consuming and requires payment that accords with the skill of the individual as an artist as well as their comprehension of palaeontology. However, many potential patrons approach palaeoartists without realistic, or indeed any offers of payment. When palaeoartists rightly ask for adequate salaries for their services,

the cheaper alternative of producing derivative artwork is wrongly regarded as the more attractive option.

What can be done about these issues?

Possible solutions to the problems outlined above have been discussed by palaeoartists for several years, primarily online. Tess Kissinger's (1996) book *Copyrights, Contracts, Pricing & Ethical Guidelines for Dinosaur Artists and Paleontologists* attempted to advise and, to a certain extent, standardise legal and financial procedures within palaeoart. Gregory S. Paul more recently used the *Dinosaur Mailing List* to argue that his product, and palaeoart in general, should be protected via the restricting of standardised poses to certain artists, legally protecting works used for reference or inspiration, and the implementation of standardised fees for palaeoartworks, unionisation and so forth (e.g. Paul 2011). Many of Paul's proposals are unrealistic, untenable and unenforceable, and confuse the problems outlined here with another factor in recent palaeoartistry – the ever-increasing pool

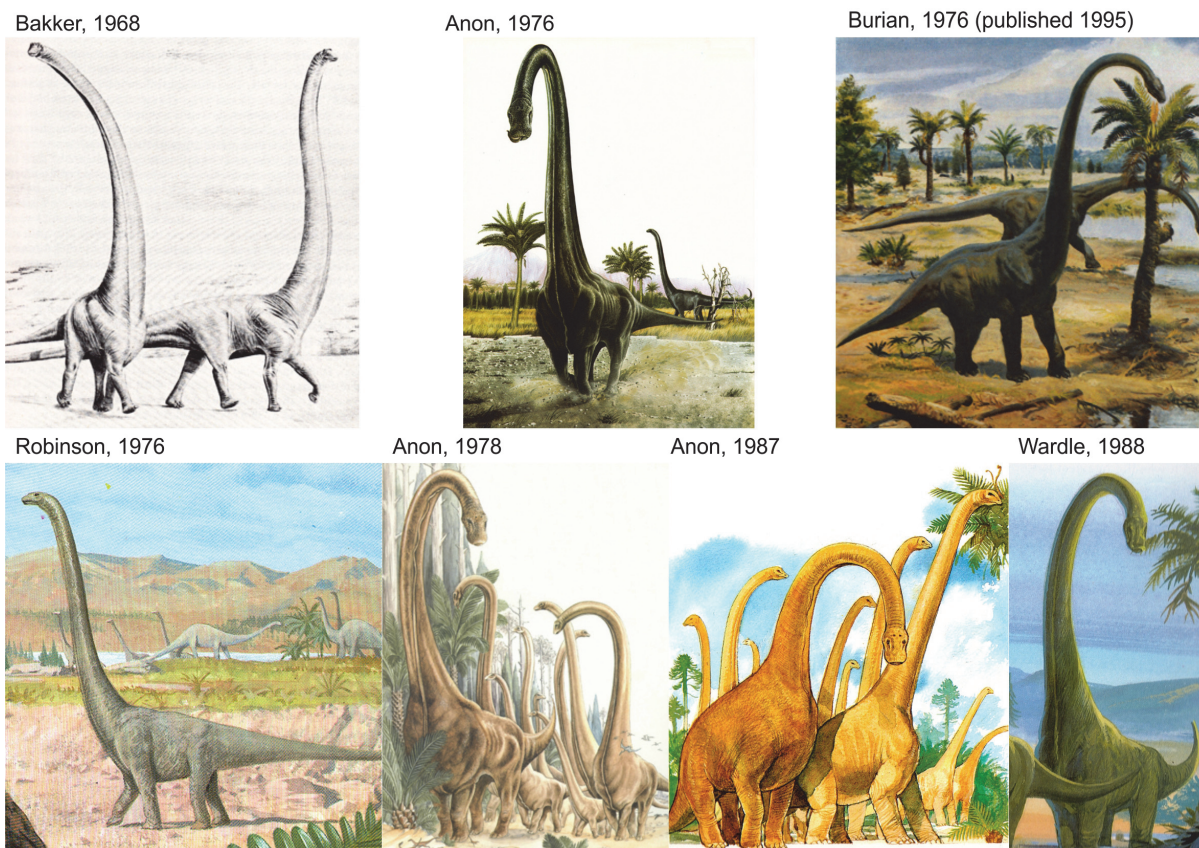


FIGURE 4. Palaeoart memes and the culture of copying, evidenced by different iterations of Robert Bakker's 1971 'giraffoid' *Barosaurus*, a distinctive reconstruction characterised by a mast-like neck, ventral midline ridge on the neck, and (via foreshortening in the original composition) a short tail. Derivative works misinterpreted the latter, thinking the tail of *Barosaurus* is actually short and introduced other questionable elements which became replicated, such as a horse-like face. This meme, one of many within palaeoart, demonstrates the problems of decreasing accuracy introduced into palaeoart through copying work, as well as a deficit of originality. We thank Marc Vincent for providing two of the images shown here. Images from Bakker (1968); Lambert (1978, 1987); Bartram (1983); Benton (1987); Halstead et al. (1988) and Špinar and Burian (1995).

of talent. While we acknowledge the effect of increased numbers of palaeoartists on the industry, we cannot see it as a problem: no-one has the right to decide how many practising palaeoartists there are, increasing competition is a factor in any industry, and the surging numbers of palaeoartists is reflective of both the vast surge of growth that has occurred in palaeontological science and scope in general, and the growth and ubiquity of the internet. Our call for fairer treatment applies to all, irrespective of prestige, contribution to palaeoartistry, and career stage.

We are optimistic that changes are happening, and can continue, without radical and unrealistic alterations to palaeoart practises. Indeed, there are indications that palaeoart is becoming more widely recognised and respected. The Society of

Vertebrate Palaeontology, in association with National Geographic, annually awards the Lanzen-dorf Paleoart Prize to artists working within palaeontological illustration, for example. Titan Books, a British publisher best known for its film and television tie-ins and graphic novels, has recently dedicated two volumes to the work of exceptional modern palaeoartists (White 2012; Csotonyi and White 2014) and additional such works are planned. The so-called 'All Yesterdays Movement' has been widely credited online (e.g. Taylor 2012; Hutchinson 2013), and several recent publications on the history of palaeontological science have given appropriate credit to the role and significance of palaeoart in shaping views on palaeontological progress (Taquet and Padian 2004; Naish 2009; Liston 2010; Moody et al. 2010; White 2012; Con-

way et al. 2012). Small palaeoart events – galleries and competitions – occur around the world and in online venues. Perhaps most importantly, some individuals associated with palaeoart production do treat artists, both contemporary and historical, very fairly. We ascribe much of this change to the internet, which has given palaeoartists more of a community and voice than ever before, and has helped raise awareness of the issues discussed here. Indeed, it is largely thanks to the internet that the ‘culture of copying’ has been identified as the problem it is, and pressure from online communities has proved effective at calling out plagiarised work. We take these points as positive signs of changing attitudes towards palaeoartists.

There is more we can do to further this cause, however. Firstly, we encourage palaeoartists to be more assertive when negotiating prices for commissions and artwork use. The prestige associated with producing or using existing palaeoartworks is sometimes considered payment in itself, particularly among amateur, part-time or early-career artists, but this attitude is largely unhelpful to the industry as a whole. Personal devaluation of artworks for the sake of obtaining a commission feeds notions that palaeoart is a cheap, disposable commodity and confuses the basic system of supply and demand which should underpin a financially buoyant industry. Working for fairer wages not only benefits the artist, but also encourages palaeoart patrons to make wiser choices as goes artist and commission demands, as well as incentivises stricter legal protection of palaeoart products and copyrights. As in any creative industry, beyond their earliest career stage (where high wages are often sacrificed for exposure and development of a reputation), artists should negotiate fair payment in line with their skill, requisite research and creative time commitments of a given artwork, and the demands of their clients. Our call for greater respect of palaeoartistry applies to those producing it as much as those who buy it.

The palaeoart community can only push its own importance so far, however: we need informed individuals using their influence to promote and change working practises at the ‘grassroots’ level. Proactive support from those involved with palaeontological education, outreach and merchandising is key here (Figure 5). The importance and relevance of palaeoartistry – specific individuals and artworks – should be paramount when decision-makers initiate or develop projects that revolve around the portrayal of extinct organisms. Those unfamiliar with palaeoart should educate them-

selves about its history and practitioners before making decisions on which artists or work to use. With technical literature and online presence on palaeoart growing, being ignorant or indifferent is inexcusable for anyone leading a palaeoart-reliant project. This extends to consultants on palaeoart projects, who should consider whether their expertise is really adequate for advisory roles. History shows that being an expert on a group of fossil organisms does not necessarily demonstrate expertise in the portrayal of their life appearance, and making poorly-informed decisions on artwork has knock-on effects on education, the potential re-use of the image concerned (and hence the budget and economics of the relevant project or company), the perpetuation of scientific inaccuracy, and the way in which the project is perceived by critics, colleagues, and the public.

The ‘culture of copying’ must also come to an end. Artists should refuse to copy the work of others, serial plagiarists should fail to win commission or employment, and art patrons should cease the usage of derivative works. If projects require a specific palaeoartwork which already exists, there is no reason not to acquire the publication rights to the original work, as would happen in any other media industry. Cheaper imitations of songs or films are not accepted as substitutes in their respective industries: palaeoart should be no different. A typical response concerning such criticism might be that lack of financing prohibits purchasing rights to original artwork. Our reply to this is that project leaders should check with artists about pricing before writing off the use of their work: the majority of artists would rather have their work used with a reduced fee, rather than have their work copied for no remuneration at all.

Longer term, more realistic budgeting for palaeoart projects is clearly required. Scientists should predict their palaeoart needs when writing grant proposals, along with other outreach elements, rather than seeing what they can afford to pay at the end of a research project. Book publishers and exhibition developers should contact artists to establish reproduction rights and fees before project finances are settled. Doubtlessly, this may see the scale of some palaeoart projects decrease, and requires pressure on financiers to recognise the superior quality of original palaeoart rather than cheaper derivatives, for which the overall better quality of their product is the incentive. We would like to see quality palaeoartists become recognised names in education, outreach and merchandising, perhaps even to the point where their names add



FIGURE 5. Fair working practises for palaeoartists can only develop if individuals involved with producing, commissioning and purchasing palaeoart push against the current climate of poor culture, inadequate financing and loose ethics. Concerned individuals should raise awareness and encourage discussion of these issues wherever they can, and especially so in the mostly-offline venues where palaeoart is produced or procured for palaeontological media. This graphic is offered as a free, unrestricted means of clearly stating support for this cause.

credence and appeal to projects they are involved with. This is far from a fanciful aim, since it is well known in palaeontology in general (and not palaeoart alone) that several individuals are consistently associated with high-quality products and bring credence and gravitas, and not 'just' technical competence and accuracy alone, to a project.

The palaeoart industry will persist for as long as people remain interested in extinct life. However, whether it will grow into a larger and healthier enterprise is reliant on changes to detrimental working practises currently rife within the industry. This will not happen unless individuals involved with palaeoart actively push for fairer working practises wherever they can. We are optimistic that increasing awareness and promotion for palaeoartists could ultimately see the current, often down-trodden palaeoart industry become a much more vital, interesting and economically sustainable one.

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