

Methods of Palaeontological Reconstruction

John Conway

The Open University, Milton Keynes

email: john.a.conway@gmail.com :: website: palaeo.jconway.co.uk

The field of palaeontological reconstruction is an old one, probably as old as palaeontology itself, yet the literature on the life appearance of extinct animals is rather limited. The information required for accurate palaeontological reconstructions is often limited to by-products of science concerned with other areas, such as biomechanics or phylogenetics. There has been little discussion of how the problems related to the field differ from the concerns of mainstream palaeontology, or how those differences might be addressed in a systematic way.

Palaeontological reconstruction faces a difficult challenge in that we are forced to reconstruct aspects of an animal's appearance and behaviour where little or no technical literature can be brought to bear. This is a consequence of differing concerns of palaeontological reconstruction and mainstream

palaeontology. Palaeontological reconstructions are bound to providing a complete picture, colours have to be chosen, skin has to be textured and folded, animals have to be shown doing something, and so on. Palaeontology, on the other hand, is perhaps more rightly characterised as a search for knowledge which can be had from the evidence we have.

Hence, while the mainstream palaeontological and zoological literature obviously contains a wealth of necessary information necessary for palaeontological reconstruction, it is important to recognise the areas where it fails to provide direction. These areas could benefit from a more systematic approach.

Current Methodology

The current methodology of palaeontological reconstruction is systematic with respect to evidence in many respects. Many lines of scientific evidence are marshalled and synthesised; such as direct fossil evidence (bones, soft tissue impressions and trackways), biomechanical studies, phylogenetic bracketing, and others. These provide the main scientific bases for reconstructing any animal; an "envelope" within which the reconstruction must stay.

Outside this envelope we have a host of artistic decisions, which include obvious things such as medium, style, composition and so on. However, the artistic side of reconstruction also includes decisions about some of the less knowable (or at least known) aspects of an animal's appearance: "artistic license".

In large projects such as museum exhibits and television documentaries, the scientific side of reconstruction is usually handled by scientists, and the artistic side by directors, illustrators, modellers, etc. In smaller and amateur projects both sides may be handled by a single person. In most cases, however, the method remains roughly the same, whether we're talking about a major new exhibit at the NHM, or a lone palaeo-enthusiast drawing dinosaurs in their spare time.

Problems with the Current Methodology

Previous discussions on the problems of palaeontological reconstruction have been concerned directly with the subject matter (e.g. Paul 1987) or have focussed on the dynamics of scientist/artist collaboration (e.g. Hallett 1987, Russell 1987). While these remain important concerns, they do not address broader questions about the unique problems facing the methodology of palaeontological reconstruction.

The broader problem facing palaeontological reconstruction is that it requires that a complete picture of an animal's anatomy, colouration, and often a large portion of its behaviours, must be reconstructed, even though these may not be the focus of scientific research. Soft tissue, colouration and behaviour are among the most visible aspects of any reconstruction, and yet remain largely within the domain of "artistic license"—i.e. aesthetically motivated guesswork. This has become seen as a natural division (perhaps even a positive thing, as artists can exercise their imagination):

This aspect of restoration [colour] is most asked about, least knowable, and least important.

— Gregory S. Paul (1987)

The current state of affairs is problematic. Many areas that are left to artistic guesswork do not, in fact, have to be left at the mercy of aesthetic concerns. Animal colouration and patterning, for example, have functional and phylogenetic constraints which are only weakly implemented in current reconstructions. A more rigorous approach could provide us with more accurate and believable reconstructions (and a better answer to the common question "how do we know what colour they were?" than "We don't").

Solutions

One way to address these problems is what I like to call the *palaeontographical* approach. Key to this approach is understanding that many aspects of the life appearance of extinct animals do not grow organically out of the palaeontological literature. Instead, we could strive to integrate palaeontological illustration into the scientific research cycle.

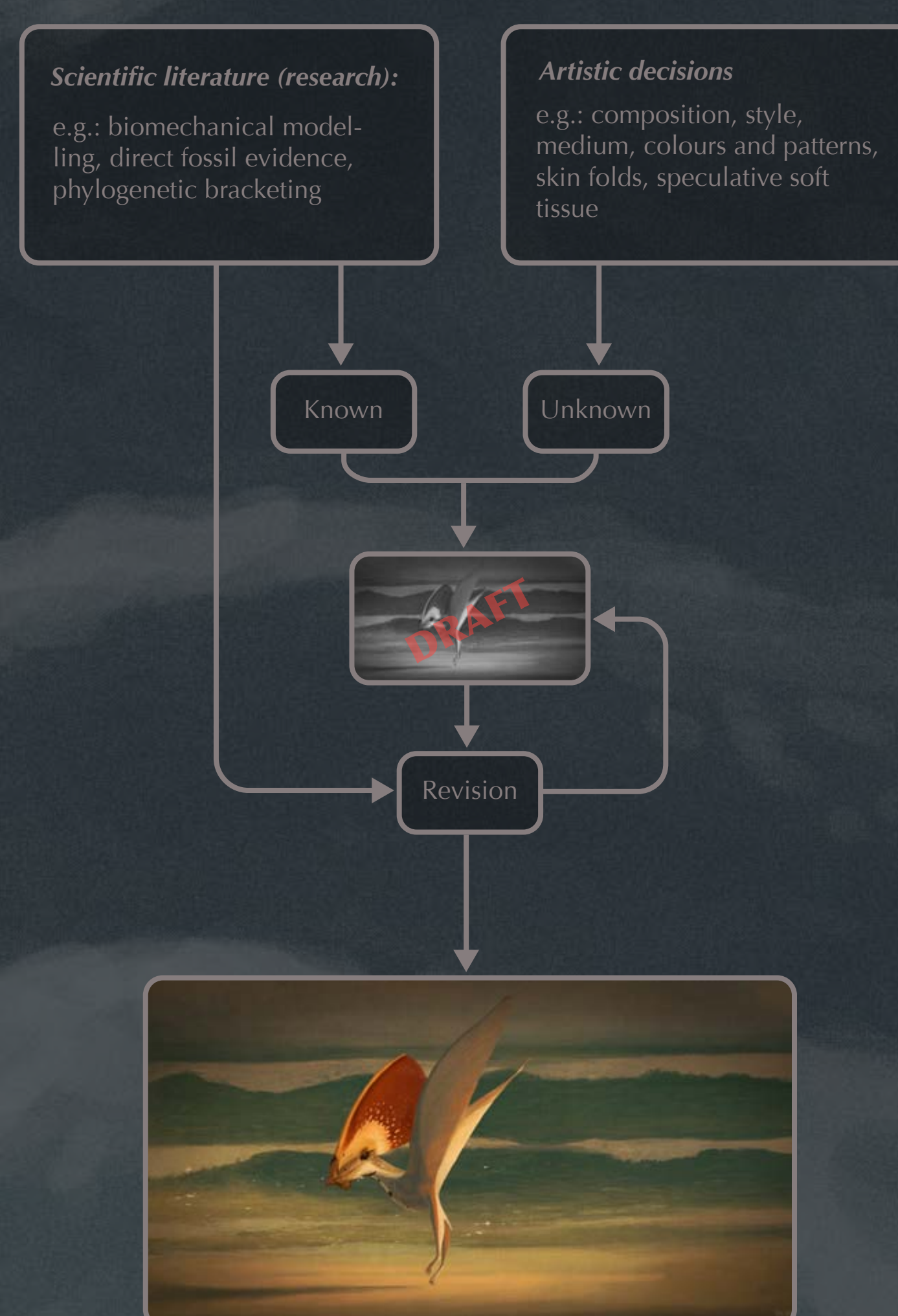
Instead of marshalling as much evidence as we can from the literature, and then filling in the rest of the picture with guesswork, we could recognise the inevitable gaps in the current scientific literature, and ask *what do we need to know in order to fill in the complete picture?* These aspects might suggest novel research, or constructing new predictive frameworks based on available sources. Ideally, this research would then feed back into the scientific literature, creating an iterative cycle, which could fill many of the gaps in the literature relevant to the appearance of extinct animals.

References

Hallett, M., 1987. "Bringing dinosaurs to life" in Czerkas, S.J. & Olson, E.C. (eds) *Dinosaurs Past and Present, Volume I*. Natural History Museum of Los Angeles County, Los Angeles.

Paul, G.S., 1987. "The science and art of restoring the life appearance of dinosaurs and their relatives: a rigorous how-to guide" in Czerkas, S.J. & Olson, E.C. (eds) *Dinosaurs Past and Present, Volume II*. Natural History Museum of Los Angeles County, Los Angeles.

Russell, D.A., 1987. "Models and paintings of North American dinosaurs" in Czerkas, S.J. & Olson, E.C. (eds) *Dinosaurs Past and Present, Volume I*. Natural History Museum of Los Angeles County, Los Angeles.



The current approach

Evidence is gathered from the scientific literature, the unknown aspects filled with artistic guesswork, the work may be revised, and then completed. This is a linear process, from science to art.

The palaeontographical approach

Evidence is gathered from the scientific literature, the unknown aspects suggest new research—an iterative cyclic process.

