

The Best Fantasy Creatures are Credible

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This paper sets out to examine some of the science behind fantasy creatures and to briefly discuss the role of a credible bestiary in children's literature.

Is Writing for Children Different from Writing for Adults?

To write for children you need to be able to see the world as a child does—afresh. As this is impossible for an adult who has seen it all before, creating another world is the next best thing. Hogwarts is just such a world, as is Narnia and the world on the other side of The Divide.

A parent assumes responsibility for a child's welfare, and a children's author also has a duty to assume certain responsibilities. This is best expressed in the children's magazine *Aquila*, which has a pithy mission statement—to encourage children to reason and create and develop a caring nature. I think we also have a duty not to disseminate false or misleading information, and an obligation to present the world as something to be cherished, explored, and enjoyed. A fantasy world is always a metaphor for the real world, as we have nothing else to plunder for subject matter.

A big change in authorial responsibility occurred during the second half of the last century in a close relative of fantasy, science fiction. We stopped wondering what effect the aliens would have on *us*, and started to worry about what effect *we* would have on *them*. We began to observe ourselves a little more objectively, and we didn't like what we saw. Neither do children, on the whole—they worry about what we're doing to the planet; they have ideals and integrity, and they want to do what's right. They believe what they read when they're told it's fact, and they suspend disbelief when they're told it's fiction. But fiction is, of necessity, based on fact.

In *The Order of the Phoenix*, Harry dreams he is a snake: "...he was flat against the floor, sliding along on his belly... it was dark, yet he could see objects around him shimmering in strange, vibrant colours..." (408). Here, the snake behaves in a biologically correct fashion, although we have to translate unfamiliar sensory perceptions into terms we can understand. Pit vipers detect infrared radiation—heat—through the pit organs, situated beneath their eyes. *Strange, vibrant colours* is a reasonable alternative. A little further on it's clear that the man isn't visible in the normal sense—he's wearing an invisibility cloak.

The other side of the coin is the acromantula, an eight-eyed spider intelligent enough to be capable of human speech. Its leg-span may reach up to fifteen feet, it's carnivorous, and it may lay up to one hundred eggs at a time. This is a real mixture of the possible and the impossible—most spiders have eight eyes, all of them are carnivorous, and a hundred eggs is a perfectly reasonable number for an arachnid. And they're a lot more intelligent than we used to think they were, with real decision-making abilities (Jackson 104). However, the size of this invertebrate just isn't possible, as I'll explain later. The acromantula is wizard-bred, mind you, which brings magic into the mix. And magic is a convention that children understand.

Magic is awfully convenient. It circumvents all sorts of obstacles. But should it circumvent the laws of physics? How is a child to differentiate between the accurate biology and the fantastic? Are we introducing children to lazy thinking, which will

affect the way they accept or reject literature in the future? Writing for children *is* different from writing for adults.

Before we can look at fantasy creatures, we need to define a creature.

A young child has very muddled ideas about speciation. Although a baby is capable of telling animals apart at one year of age—a first word may well be duck, or dog—it is a long time before the rules are properly understood. When my daughter was two years old and was asked what she wanted to be when she grew up, she replied, “A police horse.” At this age, dragons and unicorns may seem as real as cats and rabbits. For a while I was quite certain that dinosaurs were my contemporaries and lived in Africa.

By the time they become teenagers, most adolescents understand the concept of a discrete species. It is ironic that the hard-and-fast rules break down once we learn more about biology, and evolution in particular.

When is a species a species? According to the Concise Oxford Dictionary, a species is “a group of animals or plants... having members that can interbreed and that differ only in minor details.” If this were the case, then the horse and the donkey would not be capable of producing a mule. However, mules are infertile. So I would add “interbreed to produce fertile offspring” to that definition. But then we encounter further problems. Mark Ridley in his book *Evolution* explains that a ring species is when two species are living in the same region and connected by a geographic ring of populations that can interbreed. A famous example of a ring species is the one containing the herring gull and lesser black-backed gulls in northern Europe (41). They do not breed with one another—yet each one can with its immediate neighbour.

Defining a real creature isn’t quite the black-and-white business it appears to be. Caution needs to be exercised when saying that a creature *never* existed. Can we be sure? The fossil record is, after all, incomplete. In 1799, a specimen of a platypus was assumed to be an elaborate hoax. (Moyal, *synopsis*)

However strange the fantasy creatures of fiction, it is also certain that there are stranger beasts by far already existing in the animal kingdom today. The chameleon can swivel its eyes in different directions and change the colour of its skin. The sea squirt finds a suitable spot on the seabed on which to spend the rest of its life and then, as it has no more use for its brain, it eats it. The female green spoon worm inhales the male, who is 200,000 times smaller than she is; he then lives out his life inside her, fertilising passing eggs. And when we take a look at the fossil record, things become stranger still. *Opabinia*, from the Burgess Shale deposits, was three inches long and had an inch-long proboscis, tipped with grasping spines with a claw at the end. It was segmented, and appears to have been covered with a soft, flexible shell. It swam using lateral lobes, breathed through gills, had five eyes on stalks, and remains unassigned to any major group of animals. (Gould, *Wonderful Life* 124-136)

The massive *Chalicotherium* appeared during the Oligocene period, 30 million years ago, and was successful enough to survive right up until the Pleistocene, one million years ago. It had the face of a tapir, the neck of a bull, the arms of a gorilla, the front claws of an anteater and the rear legs of a bulldog. (BBC) And what invented monster could compete with *Tyrannosaurus rex*?

Nothing—apart from fossils—is set in stone. New animals are still coming to light. In May this year, the first new species of monkey discovered in Africa for twenty years was announced—The Highland Mangabey, *Lophocebus kipunji*, found in Tanzania (Briggs). And when you get microscopic, our ignorance increases dramatically. Our views of what constitutes a real creature may yet be subject to change.

What is a fantasy creature?

A fantasy beast may or may not have magical properties. It may well be highly intelligent, and possess the power of speech. J. K. Rowling devotes four pages of *Fantastic Beasts and Where to Find Them* to a section entitled ‘What is a Beast?’ and concludes:

Not until 1811 were definitions found that most of the magical community found acceptable. Grogan Stump, the newly appointed Minister for Magic, decreed that a ‘being’ was ‘any creature that has sufficient intelligence to understand the laws of the magical community and to bear part of the responsibility in shaping those ‘laws’. [...] Naturally, the matter has not rested there. We are all familiar with the extremists who campaign for the classification of Muggles as ‘beasts’; we are all aware that the centaurs have refused ‘being’ status and requested to remain ‘beasts’. (xii-iii)

A fantasy setting is, in many ways, closer to the world as we know it than a science fiction one. It’s more accessible, and consequently more attractive to a child who is still awed by things that are all too familiar to an adult. Fantasy is unlikely to change gravity, or body chemistry, or a breathable atmosphere. Therefore the creatures that populate that particular world would be at home in ours.

There are several ways of creating these creatures—either by changing the size or behaviour or appendages of an existing creature, or by making a hybrid of creatures already known. Philip Gross did this very literally in *Plex*, combining a gibbon and a dog to produce a dibbon and a gog. Many mythical beasts are clear mixtures of two or more real animals. The griffin is half eagle and half lion; the Minotaur half bull and half man; and the chimera had the body of a goat, the hindquarters of a dragon, and the head of a lion, although descriptions do vary.

When I needed to invent a really scary animal myself, I fell back on a real life experience. I was camping in a tiny tent in Tsavo East National Park. At two in the morning I was woken by a clattering sound – something was going through the dirty dishes—and, horror of horrors, I needed the loo, which was on the other side of the clearing. An elephant had visited us shortly after we arrived, a troupe of baboons lived in the biggest tree, and a leopard had coughed from the bushes as we’d bedded down for the night. The scavenger could have been practically anything—that most terrifying of things, the unknown. The clattering eventually stopped, and just as I was plucking up courage to unzip the tent, something sniffed—right on the other side of the canvas. If it had been at ankle-height I wouldn’t have been too worried – a rat, or maybe a mongoose. But the sniffing was waist-height and I lay there, absolutely petrified, until dawn. When I finally ventured out of the tent there were the paw-prints of a hyena all round the outside.

Hyenas were also the bad guys in a play for children called *Where the Rainbow Ends*, by Mrs. Clifford Mills and John Ramsey, which I remember seeing when I was ten years old. They skulked behind pantomime trees and scared the living daylight out of me. They are pretty weird creatures anyway—exposed to huge levels of testosterone whilst still in the womb, they are so aggressive that in a litter of two the firstborn will often attack and kill the second within minutes. Their jaws are powerful enough to crunch bones—as testified by their excreta, which are white with calcium—and their calls sound uncannily like laughter. They needed very little alteration to turn them into something that fulfilled my every need—a dash of shape-shifting, so that they could disguise themselves as something else, a sprinkling of intelligence so that they could plan their murder and mayhem, a disgusting smell to make them thoroughly unpleasant and a voice with which to properly express their gruesome intentions. In *The Divide*, our hero, Felix, first encounters them in the forest with his elf-friend Betony.

...Felix suddenly had the sensation that something was watching him. He peered into the gloom... He squinted harder, and then he saw something move. Something a bit like a dog, but not quite. Something front-heavy, with ears that looked a little too big for it. Something with spots.

“So,” said Architrex, emerging from the shadows in his hyena-shape, “this is a human child, is it?”

A faint smell wafted across the glade; not a very pleasant one.

“You’re a sinistrom,” said Felix, feeling rather pleased with himself at the snap identification. But when he looked at Betony, she’d gone as white as a sheet and her hands were gripping the rucksack as though she wanted to squeeze the life out of it.

“Very good, human,” said Architrex.

Vomidor stepped out of the shadows next to him. “Do you want me to dispose of the tangle-child straightaway?” he asked Architrex.

“What do you mean?” said Felix.

“We don’t need Betony,” said Architrex. “We only need you.”

Betony was standing as still as a stone, her eyes wide with terror. There seemed to be no colour left in her face at all.

“Well?” asked Vomidor.

“Might as well,” said Architrex. “But you can take your time about it, if you like. I’m not in any hurry. Oh, and don’t forget to introduce yourself properly.” He lay down on the grass, his paws stretched out in front of him like a sphinx.

Vomidor grinned and said, “Vomidor, junior sinistrom grade four, seventy-three disembowelments, twelve cut throats and a beheading, at your service.” He went over to a stone, and started to sharpen his claws. “Life has some lovely little touches sometimes, doesn’t it Architrex?” he said. “Fancy *paying* me for poisoned oat-cakes. Two silver coins. You’ve got to laugh, haven’t you?” And he did laugh, long and horribly. (102-104)

I would define a fantasy creature as one that has been invented by the author to serve the story he or she is telling.

From Where Do Fantasy Creatures Originate?

There are some creatures that appear over and over again in different mythologies. Writers are frequently accused of plagiarising from one another, when they are simply going back to the same source material. There are Chinese dragons, Norse dragons, Babylonian, Egyptian, Jewish, Japanese, American... all of them based on a reptilian body-plan, and often huge. Perhaps the anatomists of old would have made good palaeontologists, as it seems likely that the fossilised bones of dinosaurs provided the inspiration.

Sarah Timmins, on the Australian Museum's website, states that:

As early as 265 AD, the people of China were recording the discovery of 'dragon bones'—pre-historic remnants of the time when giant reptiles (we now know as dinosaurs) ruled the earth. China has an abundance of rocks of the right type and age to preserve dinosaur bones (Late Triassic to Late Cretaceous sediments). Some of the best of these dinosaur-rich deposits have been exposed and excavated throughout the last 100 years. Chinese dinosaurs are renowned for being spectacular, abundant, diverse and well preserved.

These remains bore no resemblance to the contemporary creatures of the area. It may also be that the bones of mammoths gave rise to the legends of giants.

We also need to take into account the human predilection for telling stories. In the ancient world—and sometimes even today—there was no quick way of checking the veracity of travellers' tales, and the urge to embellish and exaggerate to get a more powerful emotional response from the audience runs deep. Rumour, coupled with inaccurate reporting, has played its own part in the creation of fantastic beasts—but there's often some kernel of truth. Snakes feature heavily—the feathered serpent of the Aztecs, the nagas of India, the Rainbow Serpent of Australia—and snakebite can be deadly. So can spider bites. A giant spider features in *The Lord of the Rings* by J.R.R. Tolkien and *Poison*, by Chris Wooding—to name but two examples—as well as in *Harry Potter*.

In addition to all this, there are the deformities attributable to medical conditions, such as those exhibited by The Elephant Man, John Merrick; illnesses such as leprosy, which cause serious disfigurement; and bizarre injuries. Add the mutations that crop up from time to time, and atavisms, and you've got a wide range of source material. Suetonius says that Caesar used to ride a remarkable horse, which had feet that were almost human, the hoofs being cleft like toes (Gould, 'Hen's Teeth and Horse's Shoes' 177). Horses have, in fact, never lost the genetic code for producing side toes. The evolution of the horse is one of the most complete fossil records we have—Eohippus had three toes on each hind foot, and four on both front feet. Once in a while there is a throwback, which must have seemed monstrous to a world with no understanding of genetics.

The fact that a little laboratory fiddling with mouse and chick tissue can make hen's teeth—despite the fact that no bird has had teeth for the last 60 million years—raises questions about what, precisely, you can get away with biologically. Mice are mammals, hens are birds—two different classes within the *phylum chordata*. So

where does that leave the griffin, or the hippogriff? It was pointed out to me that my griffins lay eggs, despite having a leonine back half. So does the hippogriff, according to J. K. Rowling, despite having an equine posterior. The thinking end of the creature seems to be what determines our expectations from a story point of view, because it's the thinking end that counts. Eggs just *feel* right for griffins, and a cub with a bird's head that suckled wouldn't feel right at all.

Authors mix and match what they know of real beasts, and also use the hybrids that were invented earlier in the mythologies of different countries.

The Possible and the Impossible

The *principle of similitude* tells us that if an animal doubles its linear dimensions but retains the same proportions, its surface area is quadrupled. Its volume, however, and therefore its weight, goes up by a factor of eight.

This has profound effects. The strength of an animal's bones is proportional to their cross-sectional areas—so mice have very thin, slender bones. If you made a mouse the same size as an elephant, it would have to have bones as thick as an elephant's, and it would look a lot more like an elephant than a mouse. A fourfold increase in strength must support an eightfold increase in weight.

An external skeleton is fine for a small creature, but every hollow structure grows weaker as it grows larger. Gravity will have its pound of flesh. The extra strength needed for the supporting structure of the internal skeleton exacts a ponderous price. Increase an animal's size too much, and it will no longer be viable. Once supported by water, though, everything changes—so perhaps there is still a slim chance of a breeding colony of monsters in Loch Ness.

Four times the lung capability must service eight times the body mass. Among arthropods, gases pass in and out by a diffusion process. Over short distances a tracheal respiratory system is incredibly efficient, but an increase in the length of the tracheoles leads to an increase in friction, and diffusion is retarded. Therefore, a giant spider would not have a workable respiratory system.

Size impacts on many things—respiration, strength, speed, heat loss, food consumption, jumping ability, flight.... The heavier a bird is, the faster it must fly to remain aloft. Nevertheless, there is an instance of a bird that was big enough to be capable of preying on man—the Haast eagle of New Zealand, which lived there during the Pleistocene, and flourished right up until the arrival of Polynesian man in the 14th century. It had a wingspan of 2.6 metres and was the top predator, feeding on moas. The cry it gave was passed down by word of mouth—*hokioi-hokioi*. It was recorded in rock paintings—but, unsurprisingly, it rapidly became extinct. (Kirby) Man is the neighbour you least want if you're top predator.

Size even has an effect on hearing and vision. The diameter of the eardrum is significant—elephants use infrasound, below our range of hearing. Bats squeak well above it. The smaller the creature, the shorter its vocal cords will be and, consequently, the higher-pitched its voice. Even our perception of time depends on our size. Tiny creatures live life at a different rate. D'Arcy Thompson says:

A minute insect may utter and receive vibrations of prodigious rapidity; even its little wings may beat hundreds of times a second. Far more things happen to it in a second than to us; a thousandth part of a

second is no longer negligible, and time itself seems to run a different course to ours. (34)

Being small is even weirder than being big – to a tiny insect, we all move in slow motion. Therefore, *decreasing* the size of something can *also* be a problem.

Thompson goes on:

a mouse will eat half its own weight in a day; its rate of living is faster, it breeds faster, and old age comes to it much sooner than to man. A warm-blooded animal much smaller than a mouse becomes an impossibility; it could neither obtain nor yet digest the food required to maintain its constant temperature, and hence no mammals and no birds are as small as the smallest frogs or fishes. (25)

So—The Borrowers would have squeaky little voices, scuttle about at considerable speed, listen to batsong in the evenings, spend most of the time eating and live for just a couple of years. *Honey, I shrunk the facts*.

On the other hand, King Kong would move at a snail's pace, and his voice would be so deep that his roar would be inaudible; nevertheless, the fallout from sound that is below our range of hearing could be considerable. Infrasound has disturbing effects, not all of which are yet known to us. It's not just the giants—elephants and whales—that use it, either. Elizabeth von Muggenthaler, a bioacoustician from the Fauna Communications Research Institute in North Carolina, notes that a tiger's roar contains an 18 hertz component that induces feelings of terror in humans and can paralyse prey for up to 10 seconds.

The difference in the optical equipment of King Kong and Arietty would be far less pronounced, however. The rods and cones that detect light and colour in the retinal eye are optically limited by the interference patterns of light waves. The eye of a whale is tiny, in proportion to the animal itself, whilst the eye of a bush-baby seems enormous by comparison. An insect is just too small to obtain a clear image with a retinal eye, so it has united simple eyes into the compound multi-faceted version we have seen magnified to totally unrealistic proportions in the bug-eyed monsters of science fiction films.

As our knowledge of the physiology and anatomy of life increases, so does our knowledge of what is possible and what is impossible. Sir Arthur Conan Doyle's *Lost World* would be a different place today.

Conclusion

Myths exist in science as well as fiction. The statement that according to the laws of aerodynamics a bumblebee can't fly is, itself, a myth. Rumour has it that this was based on a mathematical model scribbled on a piece of paper over dinner—but there are differences between a real bumblebee and a mathematical model of one. What was demonstrated was not the superiority of biology over aerodynamics, but rather the fact that a simple mathematical model wasn't adequate for describing the complex flight of a bumblebee. D'Arcy Thompson says: '...Everywhere Nature works true to scale, and everything has its proper size accordingly' (17). We do not know what is possible, in the great diversity of life that's past, life that's present, and life that is to come, but we are pretty sure that some things are *impossible*.

Should we only invent things that don't violate the laws of physics? Storytelling is one of the ways in which we enrich our lives, explore our fears, and celebrate our diversity. Storytelling celebrates the imagination, without which science itself would be the poorer, for you must believe in the possibility of a new discovery in order to search for it. We'd say goodbye to Superman, and the sinistroms, and Shelob. Although it is important to be able to discriminate between fact and fantasy, each has its proper place, and each can be appreciated for what it is. Maybe the role of fantasy creatures in children's literature is to demonstrate that life doesn't come in black and white, it comes in shades of grey—and every colour of the rainbow, as well. That's what we ought to be teaching our children—to learn the facts, weigh the evidence, and think for themselves.

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