
Preface to the First Edition

The history of research into the philosophy of language is full of *men* (who are rational and mortal animals), *bachelors* (who are unmarried adult males), and *tigers* (though it is not clear whether we should define them as feline animals or big cats with a yellow coat and black stripes).

Umberto Eco¹

"What sort of insects do you rejoice in, where you come from?" the Gnat inquired.

"I don't *rejoice* in insects at all," Alice explained, "because I'm rather afraid of them—at least the large kinds. But I can tell you the names of some of them."

"Of course they answer to their names?" the Gnat remarked carelessly.

"I never knew them do it."

"What's the use of their having names," the Gnat said, "if they won't answer to them?"

"No use to *them*," said Alice; "but it's useful to the people that name them, I suppose. If not, why do things have names at all?"

"I can't say," the Gnat replied. "Further on, in the wood down there, they've got no names ..."

Lewis Carroll²

Why should we look at one concept in science, out of the context of the larger theories, practices and societies in which it occurs? Why trace "species?" This sort of question is raised by both philosophers and historians when histories of scientific ideas are written.

Philosophers tend to dislike history for several reasons. One is that they often address issues and ideas as if the opponent is sitting across the symposium table from them, no matter whether that opponent lived last week, last century or last millennium. Philosophers of science often treat history as a source of anecdotes to illustrate some more general point, such as the way the Copernican Revolution changed philosophical understanding, or how genes overcame vitalism. Famously or infamously, Imre Lakatos "rationally reconstructed" the history of scientific ideas in a footnote, because history is messy, and failed to clearly illustrate the philosophical point.

Historians tend to dislike intellectual histories, because such histories treat ideas as free-floating objects ("free-floating rationales" as Dennett calls them) independent of the individual psychologies and life histories, and of the social conditions in which they were raised and elaborated. Also, histories of ideas are too easy to do. All you need do is find some apparent resemblance between ideas at time *a* and time *b*,

¹ Eco 1999, 9.

² Carroll 1962, 225.

and you have a narrative. Historians, rightly, want to see actual historical influences, and the effects of social and cultural contexts, the differing *epistemes* at work.

Both professions can go too far. I think history comes in a number of scales, which following a practice in ecology, I will call *alpha history*, *beta history*, and *gamma history*. Alpha history is done by investigating archives, and looking at locales and artifacts. It is hard and local work, and will give the *data* of the larger scale histories. Beta history is done by covering a restricted period, or biography, or event. It relies on the alpha material, and synthesizes it into a narrative explanation of the subject. Gamma history, though, is out of fashion. Rather than being a "life and times" or "history of the period," it attempts to take alpha and beta historical work and synthesize a grand-scale narrative. And because a *really* grand scale narrative is almost impossible to do by one person, it pays to limit the subject to something manageable. This book is at the edge (some might uncharitably say, over the edge) of that limit. But if gamma history is not worth doing, why then is alpha and beta history?

Philosophy of science has become increasingly grounded in history. It is becoming the norm for philosophers of science to appeal closely to the historical development, failures as well as successes, of a given discipline or problem. Majorie Grene and Ian Hacking are perhaps the exemplars of this approach, although David Hull has also made a plea for actual examples in philosophy of biology.³ And historians of science such as Polly Winsor and Jan Sapp have offered excellent case studies and narratives of all three kinds for philosophers to use. There is a shift towards this now, and that might justify a conceptual history at this time. However, there's another reason for writing this now, and that is that if philosophers don't do this, and historians don't, the scientists will, and have. A major target of this book is the scientist-developed *essentialism story* of the past 50 years. Polly Winsor and Ron Amundson, among others, have written critiques of the view that before Darwin, every biologist was held in thrall to Aristotle's essentialist biology, but there is no overall summary of this. Also, the essentialism story is used to justify or critique various species conceptions by the biologists themselves. History has a role in scientific debate.

Generally, scientists have a "rolling wall of fog" that trails behind them at various distances for different disciplines, above which only the peaks of mountains of the Greats can be seen. In medical biology, for instance, this wall is about five years behind the present. Little is cited before that, and those works that are, are cited by nearly everyone. So, there is a tendency for what Kuhn called "textbook history" to become the common property of all members of the discipline. However, taxonomy is an unusual discipline, in that the classical works are more widely cited and appealed to than in most other sciences. The ideas of an eighteenth-century Swede or French author can carry weight in a way that the genetics or physics of that time do not. Partly this is because a large element of taxonomy is conceptual: logical and metaphysical ideas, which change slowly, carry probative force. So asking "what is a species?" is to ask a philosophical and historical as well as a scientific question, and how the notion of species arrived at the present debate in part defines that debate.

Doing this kind of history is rather like trying to work out the past from a series of old photographs in a box in the attic you got from your grandparents. Faces appear

³ Hull 1989.

in various guises, resemblances recur, and it is almost impossible to identify exactly who is whose child, friend or mere passers-by. Nevertheless, having that box of snapshots, one is the richer for it in understanding both the past and the present.

So, I seek absolution from each of these three professions—philosophy, history, and biology. I believe I show there is a basic error involved in the essentialism story that can be resolved by a conceptual history. Scientific history is at least partially conceptual, so I don't think it is illicit to write a conceptual history. But the conceptual history of an *idea*? That might be too much. Well, this is not exactly the history of an idea. It is a combined history of *various* ideas and words that have a subtle ambiguity in philosophy and biology. And it is my claim that this ambiguity has confused the present debate over species in both fields. I will summarize the argument here, so that it is clear what the issues this book addresses are.

The essentialism story is a view that has taken biologists and philosophers by storm. Primarily advocated, and largely developed—I hesitate to say invented—by Ernst Mayr, it is the view that there are basically two views of biological taxa in general, and species in particular. One is the view deriving from Plato and Aristotle, on which all members of a type were defined by their possession of a set of necessary and sufficient properties or traits, which were fixed, and between which there was no transformation. This is variously called *essentialism*, *typological* or *morphological thinking*, and *fixism*. The other is a view developed in full by Charles Darwin, in which taxa are populations of organisms with variable traits, which are polytypic (have many different types), and which can transform over time from one to another taxon, as the species that comprise them, or the populations that comprise a species, evolve. There are no necessary and sufficient traits. This is called *population thinking*.

I will argue that the essentialism story is false. It is based, as Polly Winsor has shown, on a misreading of the *logical* tradition in which *species* is a class that is differentiated out of a larger class, or *genus*, by a set of necessary properties all members bear, as being a claim about *biological* species, which are not so defined, but are instead diagnosed by morphological characters. There is a clear distinction between the *formal* definitions of logical species and the *material* characters and powers of the biological organisms of a biological species pretty well from the beginning of modern natural history, but arguably even from Aristotle onwards. This is the first claim.

A second related claim is that living species were always understood to include or require a *generative power* rather than morphological similarity or identity, which was always held to be a way of identifying them at best. I call this the *generative conception of species*, and it was held as much in the classical writings of Aristotle and Theophrastus, as by the moderns, and the present views of species are equally within that ancient tradition. There are plenty of cases of medieval, early modern, and recent pre-Darwinian authors employing some variant of this conception, allowing for deviation from types. Moreover, the use of diagnostic characters neither requires essences of a causal or material kind, nor implies that all diagnostic characters are borne by every member of the species. In the diagnostic sense, Darwin was as much a formal essentialist as Linnaeus, and modern taxonomists are still today. In short, generation, not definition, is what counts for living species.

My third claim is that the notions of fixity of species and essence and type are decoupled from each other. Types are not the same as essences, and they had a

number of roles to play in classification. Fixity of species was invented by John Ray in the seventeenth century, and repeated by Linnaeus, and it was solely based on piety, not metaphysics. Where material essences were employed, for instance by Nehemiah Grew, they were considered to be causal essences for biological structures rather than of taxa, and this was also the view of the ideal morphologists of the early nineteenth century after Goethe. If essences play any role in taxonomy at all, it must be well after Darwin, and it is possible it never was really held before the essentialist story developed, or was invented, around 1958.

So much for the history. Philosophically, essentialism underwent a revival in the 1960s in the philosophy of language, in part because of a reaction to Popper's philosophical attack on *methodological* essentialism outside biology. This was, I believe, a reason why essentialism became a problem in philosophy of biology. Platonism, however, is a recurring theme in both biology and philosophy in the scientific period, and it is possible that philosophical interpretations of biology in the period were motivated in part by the increasing atomism and materialism of writers like Locke and Boyle, who were influential on many biologists, such as Buffon and Lamarck.

There is a distinction to be had between the naming of species and their underlying biological descriptions. Part of the modern debate rests on a confusion between nomenclature and the reference of names on the one hand, and the accounts given of the formation and maintenance of species. Species "nominalists," who I refer to as *species deniers* in the biological traditions, deny that the names refer to anything biologically real (which is not to argue against scientific realism—the reality referred to here is simply the status of species as objects in biology; whether they are real in a metaphysical sense is outside our scope here). Species *taxa* realists hold that the taxa are real objects in biology. Species *category* realists also believe that the rank of species is a real phenomenon, in that species have a unique and peculiar organization that other taxa, below and above that rank, do not have.

In summary, then, we have three claims that this book is intended to demonstrate: the logical and the natural species are distinct ideas that largely share only a term; there was a single species "concept" from antiquity to the arrival of genetics, the *generative conception*; and types are neither the same as essences nor something that changes much with Darwin.

The book also lists the modern "species concepts" (or rather, definitions of the word and concept *species*) in play. It will become clear that most of these are partial definitions, some of which are simply not operationally applicable. It is my belief that each biologist doing systematics will construct for themselves a conceptual sandwich out of these elements, one that suits the tastes required for studying the group of organisms they do. So the latter part of the book is a kind of conceptual delicatessen. Biologists, like anyone else engaged in an intellectual enterprise, tend towards monism of theoretical ideas: so *species* conceptions that work for them must work in all other cases. This is especially obvious in the "animal bias" of workers like G. G. Simpson and Theodosius Dobzhansky, who simply denied that things that were not species the way sexual animals were species, were in fact species at all. I hope to show here that the term has a wider application than in a few leading cases. The philosophical arguments, however, must wait for another book.

Preface to the Second Edition

He who ventures to write on the origin of species, ought to define what a species is, so ought he to do who describes species, no matter whether he considers his task finished when the description has been made, or whether he intends to make use of the described species to build up a more or less elaborate system. In other words: the systematist, as well as the evolutionist, ought to state clearly what he means by a species.

As a matter of fact, neither of them usually does.

Johannes Paulus Lotsy⁴

... this book was not actually a "safe" book for a historian to write. It flaunts the conventions of disciplinary specialization; it has a large chronological range and deals with a considerable variety of subject matters; and while it might not be strictly interdisciplinary, it takes in the history of science, religion, philosophy, theology, and more. This makes it vulnerable within a highly specialized profession ...

Peter Harrison⁵

My motivation for revising and expanding the first edition of this book is due to several factors. One is that continued exploration of the concept of species has led me to modify some of my conclusions. The main historical novelty of this edition is that I have become convinced that the reason for the introduction of *species* in the first place was the attempts by theologians in the sixteenth century to determine how many kinds of animals were included on the Ark, which necessitated that there be a fundamental kind from which all other apparent species could be formed after the Deluge. There are several errors of fact that also needed to be corrected, particularly my misidentification of Claude Thomas Alexis Jordan as Karl Jordan.⁶

The second reason is that the philosophical issues were not adequately explained, as one reviewer noted, for non-philosophical readers, and this led me to consider that the ancient and modern philosophy of biology accounts of species and kinds in general needed to be covered. Given that this topic covers historical, philosophical, and scientific issues, it is important that readers from each of these specialties are given sufficient cues to be able to follow these issues.

Finally, modern debates on the nature of species, both the biological entities and the categorical class, are in part philosophical and in part scientific, ironically, often made out by scientists when they discuss *species*. As there have been several recent books since the first edition was published, readers are due an account of these debates, and so I have summarized them in a final chapter (coauthored with Brent Mishler), in which I take the liberty of giving my own views and conclusions.

⁴ Lotsy 1916, 13.

⁵ Harrison 2016, 743f

⁶ Pointed out, a bit stridently, by Mallet 2010.

Arthur O. Lovejoy once referred to the inquiry of *philosophical semantics*.⁷ It is this inquiry I am engaged upon here. Not merely the history of ideas, but the philosophies underlying them, are what philosophers of science, historians of science, and scientists themselves must rely upon to understand the evolution of science itself. Otherwise we live in an eternal present, and repeat the debates of the past.

I hope that these revisions will be welcomed.

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⁷ Lovejoy 1936, 14: "... a study of the sacred words or phrases of a period or movement, with a view to a clearing up of their various shades of meaning, and an examination of the way in which confused associations of ideas arising from these ambiguities have influenced the development of doctrines, or accelerated the insensible transformation of one fashion of thought into another, perhaps its very opposite. It is largely because of their ambiguities that mere words are capable of this independent action as force in history."