4. On the Intractable Ontology of Species

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Abstract:

'Species' is a tricky, but unavoidable term which makes biologists disagree with/contest each other in their attempts to define it. The disagreement actually stems from the intractable ontological nature of species. Not only biologists but also philosophers are engaged in the endeavour to understand species. The former attempt to define species while the latter try to determine its ontology. As a result, antinomies such as monism/pluralism or realism/antirealism come into the picture. Our sense of 'intractability' grows along with the increasing debate between these antinomies. The present paper sketches out the intractable nature of species through a historical account of the species problem. Through this paper, we have tried to decipher a 'common thread' that, perhaps, binds all our ideas of species together. This has been arrived at after noticing that when we confront the term species we all know what it refers to but we are confused when it comes to answering the question 'what it means'.

Keywords:

Ontology; Species; Monism; Pluralism; Realism; Antirealism; Intractability

On the Intractable Ontology of Species

Understanding nature is relative to the fact that it is comprised of distinct objects and the idea of classification. The classificatory practices are historically connected to the ontology in philosophy. Ontology tries to understand nature by categorizing objects based on their conditions of existence. Ontological enquires proceed with the question 'What is there?' which is the copula that connects ontology to classification. This general spirit of ontological enquiry explicit in the question is followed by the modern classificatory practices including taxonomy in biology. It is reasonable, in the sense that ontology is the forefather of classificatory practices. Carl Linnaeus, in the 18th century, brought a taxonomic revolution by proposing a hierarchical order of arrangement of biological entities which more or less is the basis of biological classification even now. In biological classification, 'species' comes at the bottom line and is considered as the fundamental unit.[1] Apart from this, the term has wider importance in other areas such as evolutionary biology and conservation biology.

1. Species in history

'*Species*', of course, is a modern term but the idea that it covers can be traced back to antiquity. Considering the given evolution theory as the dividing point in the history of biology, we can categorize species-thoughts[2] as pre-Darwinian and post-Darwinian. Pre-Darwinian species concepts are mostly considered as fixity-concepts because of their inclination towards essentialism. For them, it is the essence which binds the organisms in a particular species together. Aristotle is the key philosopher in this line of thought. He believed that species are fixed because their essences are unchangeable. This immutability of species actually favours the creationist argument which posits that God has created every species together.

This strand of essentialism was dominant until the emergence of the enlightenment but we can find its influence even in modern times. John Ray, in the 17th century, proposed that species are immutable; he says "one species never springs from the seed of another, nor vice versa" (Ray,1686).[3] Linnaeus following Ray, distinguished organisms from species according to their physical similarity.

[1] It has important role, as a basic unit, in biological fields; development, ecology, genetics, molecular biology, paleontology, physiology, systematic, etc. In a general perspective one can see the importance of species from anatomy to behavioral science.

[2] By species-thought we mean simply the debates over nature and definition of species.

[3] John Ray's Historia plantarum generalis, in the volume published , 1686, Chap. XXI

We can term their concept of species differently, as 'typological' which also emphasizes the immutable nature of species. For him, God (The infinite) had created all the species in the beginning.[4] He also believed that there are irreconcilable gaps between different species. Not only they but also all the creationists are advocates of the fixity of the species.

The 18th century, in fact, was a breakthrough in this biological tradition; biologists started thinking about the emergence of species. That means, species were seen as 'mutable', related to the changes in space-time and environment, for example, Buffon's idea of species falls in this line (Farber, 1972).[5] It is substantial to understand how De Candolle; who first introduced the word 'taxonomy', understood species. His definition of species indeed goes into morphological and lineage concepts of species; "a species is a collection of all the individuals who resemble each other more than they resemble anything else, which can, by natural fecundation, produce fertile individuals, and which reproduce themselves by generation in such a manner that we may, through analogy, suppose them all to have sprung from one single individual" (De Candole, 1813; as cited in Aldhebiani 2017) Jean-Baptiste Lamarck's idea about the transmutation of species was a radical turning point not only in species-thought but also in evolutionary thinking (Galera, 2017).

The changing nature of species in the Lamarckian theory of evolution is allied with his argument for the changes through 'use and disuse' of parts of organisms (Burkhardt Jr., 2013).[6] In Darwin's (1859) theory of evolution, he established the changing nature of species. He laid a naturalistic foundation for his theory by vindicating the causal role of natural selection in evolution. Darwin and his accomplice, Alfred Russel Wallace, thought that species are the outcome of evolution (Ruse, 2013); this belief is implicit in Darwin's book *The Origin of Species* (1859). Though a major shift had happened in biology with Darwin's theory, it actually brought a radical change in the way biologists think about species. The 'species question' turned out to be the 'species problem' in biology (Wilkins, 2010).

2. The species problem

'*Species*' becomes a problem when biologists attempt to define it but definitions (of any entity) are relative to the nature of entities. Species problem seems to be a blend of 'definitional' and 'ontological' aspects. It is clear that both biologists and philosophers are engaged with the species problem; the former is concerned with the issues related to the definition of species, while the latter analyses the ontological issues. In order to understand the problem with species, consider, for

[4] Carl Linnaeus (1758), *Systema Naturae*..
[5] See also Comte de Buffon < http://knarf.english.upenn.edu/Buffon/buffon.html>
[6] See also Jean-Baptiste Lamarck (1744-1829). <http://www.victorianweb.org/science/lamarck1.html>

example, Darwin's view of species. A first look at his account of species may give the impression that Darwin was a nominalist;[7] he says "I look at the term species as one arbitrarily given for the sake of convenience to a set of individuals closely resembling each other…" (1859, 52). David Stamos expresses a different opinion about Darwin's species account; he argues that Darwin was a realist and not a nominalist regarding the species (1999, 2007). Since it is irrelevant here discussing whether Darwin was a nominalist or a realist, we restrict ourselves to see how Darwin apparently defines species.

Definitional issues: The question one may ask is what does Darwin refer to in this definition? Here the term 'species' does not refer to any particular group of individuals such as *Canis familiaris* (Dog). This is so because (a) there are innumerable species existing on Earth, (b) it is impossible to apply the definition of a particular species (*Canis familiaris*) to another species (*Homo sapiens*), (c) species are ontologically different and (d) the definition of a particular species is strictly bound with the ontology of that species. The term 'species' manifests itself differently; it refers to both 'category' and 'taxa'. The first one indicates a rank or a category while the second one refers to the concrete particulars such as *Felis domestica* (cat) or *Pisum sativam* (pea plant). Species category is the one to which all the species taxa belong. Those who do not recognize this distinction may end up being confused (Mayr, 1996, 267). The locus of the species problem, thus, is the species category and not the species taxon. It is substantial now to make the point clear that 'species' here indicates the rank in the Linnaean taxonomy.

It is not the case that biology lacks a definition of species which causes species problem. There is a 'plethora'[8] of definitions of species in biology but they all lack universal agreement. Biologists define species differently based on different grounds- theoretical or ontological. The species definitions based on the determinants of speciation are also known as species concepts. There are at least two dozen species definitions/concepts currently in use in biology (Wilkins 2006).

Ontological Issues: Philosophers who are concerned about species engage in the literature via discussing the ontological status of species. There are arguments that species are sets (Kitcher, 1984a; 1984b), kinds (Boyd, 1999a), individuals (Ghiselin, 1974; Hull 1976) and even relations (LaPorte, 2006).[9] All these views can be both true and false at the same time. Even if this point looks odd, a close analysis of each account reveals that it is true. It is the theoretical context that decides

[7] Darwin, unlike the contemporary nominalists like Jody Hey, did not think that the term species should be eliminated from biological terminology (Ereshefsky 2010).
[8] See Ereshefsky 1998
[9] LaPorte by reviewing book *The Species Problem: Biological Species, Ontology, and the Metaphysics of Biology* (2003) notes that Stamos proposes species as relations.

the validity of a certain ontological position. From the point of view of evolution theory, species as kinds or sets appear paradoxical. Instead, 'Species as Individuals' (SAI) goes along with it. Dupre (1993) argues that if we consider the theoretical contexts to determine the ontology of species, then we end up with pluralism. This legitimizes the validity of different ontological positions in biology.

3. The dispute between 'one and many'

Biologists and philosophers who are engaged with the species problem may further be categorized as monists and pluralists based on their approach to species problem. Monists are those who ponder about the unique causal structure of species and speciation. They think about and seek one single underlying structure which delimits different taxa. The argument for a unique species concept seems to be rooted in the fear of having a conceptual nihilism in biology. Monist arguments tend to go in the following direction. There should be one species concept in biology; as already many species concepts exist in literature, biologists must decide which one among them biology should adopt; if no one is correct. We can be optimistic that future developments in biology will have a correct species concept.

Pluralists, on the other hand, argue for the legitimacy of multiple species concepts. Pluralists (Kitcher (1984a;b), Dupre (1993), Stanford (1995), Ereshefsky (1998), Mishler & Brandon (1987), Mishler & Donoghue (1982)) note that it is impossible to dream for a single species concept which meets and satisfies all the biological interests. Consider the most celebrated example of Biological Species Concept (BSC) (Mayr, 1996) that defines species as groups of interbreeding populations which are reproductively isolated from other such groups.[10] Here, the 'reproductive isolation' is the determinant which cannot be used to delimit asexual species taxa. Paleontology as an established area of biology also cannot use BSC because fossil records will not give any idea about whether two species in the past were reproductively isolated. Different biologists have different interests which may end up with various investigations in biology. In Mayr's opinion, functional biology and evolutionary biology deal with different kinds of investigations; the former seeks 'proximate' causation of a phenomenon while the latter looks up for the 'ultimate causation (1961). Kitcher (1984a, 1984b) notes this point and emphasizes the necessity of different investigative practices corresponding to the interests of biologists.

It can be observed that these rival positions are rooted in the traditional argument for the ontological structure of the world. The question that arises is: Is the world uniquely structured? There are positive and negative answers throughout history that support this question. One group attempts to give a single ontological structure; the other exhibits the equally legitimate multiple

[10] Hereafter BSC – Biological Species Concept

ontological structures of the world. It is an interplay between determinism and indeterminism. It seems,/It seems that the monists stand for determinism and the pluralists for indeterminism. Monists are concerned about the danger of the 'taxonomic Tower of Babel' in biology (Dupre, 1993); a confusing state of concepts may threaten the validity of biological explanations.

The biological explanations should converge to have a unique understanding of the term 'species'; conceptual plurality instead results in the divergence of explanations. This altogether questions the reality of the underlying phenomena; in this case, the species. Pluralists argue that legitimate concepts of species are made with reference to the true features of species. The interbreeding, phylogeny, common ancestry etc. are all true features of any species. Concepts based on these features can be true and valid. Instead of one, we get different ontological bases of species through these concepts. From the point of view of pluralism, our realist concerns should be rearranged in order to have a clear understanding of biological phenomena. The realist claims should stem from the realization of 'multiple' ontological structures that objectively exist in nature rather than a 'single' ontological structure.

4. The 'real' and the realism

Realist concerns are more interesting on the pluralist side than in monism. Almost all monists are realists in the species problem; their reality concerns are made on the basis of the nature of existence of species in nature. For example, Mayr (1996) says that species are concrete as well as extra-mental entities in nature. Pluralists are further grouped into realists and antirealists depending upon the reality concerns. Notable realists from the pluralist side are Kitcher (1984a,1984b) and Dupre (1993). Both share a common thread of arguments for pluralism; but unlike Dupre, Kitcher's realism stems out from his belief on the ideal end of biology. Kitcher (1984a, 1984b) thinks that biology, as Stanford (1995) notes, may reach at an ideal end which provides an objective understanding of all our experiences. One legitimate species concept is considered as real only when it reaches at the ideal end or somewhere near to it. Kitcher opines that all the available legitimate species concepts are converging to this ultimate end. Dupre (1993) observes that the different pluralist possibilities he defended in his account of species do not hinder the possibility of realism. There are people who defend pluralism the same way as we just discussed and they also defend antirealism.

The notable pluralist antirealists are Stanford (1995) and Ereshefsky (1998). Stanford's pluralism goes hand in hand with that of Kitcher but at the same time, he argues that Kitcher's pluralism really points towards antirealism and not realism. His criticism of Kitcher is mostly based on the inappropriateness of the thought about the ideal end and the converging nature of concepts. If the reality of a species concept is decided to refer to the converging nature, then one should have

knowledge about the ideal end. This is not possible at this point of time because we do not have an ideal set of species concepts which would provide an objective understanding of species in nature. So we are not at the ideal end. Another important point is that biological interests are evolving and we have different species concepts based on different interests. Interests may vary through time but the objective physical condition would remain the same. If concepts are made based on our interests, then they are relative to the subjective state of biologists. Hence, it is antirealism. Ereshefsky also argues for antirealism in more or less the same way as Stanford. As antirealism is a collective response to realism, the base of the reality-claims remains the same. A brief examination of the reality-claims in species problem may light up or put on hold skepticism about the varied nature of biology.

In the philosophy of science, realism refers to the claim that the world described by science is real and the descriptions of phenomena, observable and unobservable, are true (Chakravartty, 2007, 2017). Consider two examples of reality-claims from species problem: Mayr (1996) and Kitcher (1984a, 1984b). The former made the reality-claim which is allied with his consideration that species are concrete entities. The condition of existence of species is taken for granted here. Keeping in mind his additional claim that species are 'extra-mental', two possibilities open with the phrase 'extra-mental'- either it means 'outside the mind' or it means 'trans-subjective'. If the first is the case, then Mayr's claim can be interpreted as species as concrete entities existing outside the mind. That means species exist even if no mind exists. Species, in short, exist objectively. To understand this issue, the objectivity claim concerning electrons can be taken into account for comparison. Electrons are not observable but we can make out their objectivity with the help of electron detectors. The apparent claim of objectivity through mind-independence in scientific realism then is substituted with the detectable nature along with the observable nature of the entity. Detection of electrons requires human assistance along with instrument. If species are concrete entities in nature, the concreteness Mayr talked about cannot be same as the concreteness of electron. Species cannot be detected. The objectivity of species thus differs from the kind of objectivity an electron possesses. But understanding species necessitates human assistance. Now take the second case, that is, the fact that it is extra mental means 'trans-subjective'. This does not mean a complete avoidance of mind and mental abilities. It is an up-gradation from the subjective realm. Species, in this sense, is not an entity of subjective imagination. As such, species are unobservable and undetectable entities consisting of concrete instances. Hence, it exceeds the limit of subjectivity. Thus the second sense of the term extra-mental becomes more appropriate in the context of species.

Kitcher's account is an unconventional combination of pluralism and realism. The objectivity in his realism comes at the ideal end where he argues we will have an ideal set of species concepts. This implies that we will be given ontological pluralism at the end. The present biological literature

evidently shows that we do not attain such an ideal end so that we must concentrate on the multiple legitimate species concepts available in biology. How does this pluralism become realism if objectivity is an unavoidable element as realists claim? In Kitcher's account, the convergence of concepts to the ultimate end to form the ideal set is the available answer.

Thus considering the condition implicit in the argument for the 'real' nature of concepts which are converging - the concepts should either reach at the ideal end or must be near to it. It is already stated that there is difficulty in considering the nearness of species concepts to the ideal end. It is possible only when we know about the ideal end. One may still defend Kitcher's realism by referring to the objective nature of features in an organism based on which biologists derived different concepts of species. So, species concepts are real concerning the concrete existence of features. It assures the ontological pluralism concerning properties. Properties cannot exist independently. As thought and extension are inseparable from mind and matter respectively, we cannot think of features of species without presupposing the entity called 'species'. If Kitcher was right in his point that we will have an ideal set of species concept, the ultimate outcome would be the ontological pluralism of features (of species) and not of species. Realism here is not made with reference to the entity in question but with the features of that entity.

It becomes clear that understanding the existence of species acknowledges the importance of subjectivity. Observation and detection are the tools which realists in science commonly use to support their reality-claims. In our context, these tools do not lead us to make proper reality-claims of species. A radical inclusion of subjectivity (in terms of cognitive abilities) is highly necessitated to grasp the claims about the conditions of species in nature. Consider the claim that species are groups of organisms having such and such properties. The nature of the group here is homogeneous which actually renders the particular group as species. The above claim presupposes observation of homogeneity among particular organisms as well as their features. The observational integration, the borderline between concreteness and abstractness, is the stage where subjectivity actually starts its real play. We pass from observation and reach an abductive stage where we get an inference to the best explanation of the observed natural phenomena (species). Along with observation and detection, a realist may consider the possibility of 'inferability' as a condition for reality-claims. The inferability here does not mean our ability for simple inference but it refers to our ability to infer conclusions from complicated situations. Inferring fire by perceiving smoke is a simple kind of inference; inferring the orbit of a planet is a complicated one through observation of that planet around the sun. In the first case both the antecedent and the consequent are observable but in the latter, the consequent is not at all perceivable. The imperceptible nature of entities not only opens a room for inference but also makes the inferential claims liberal. People may infer differently about

the ontology of entities which exhibit imperceptible nature. This diversity brushes up our feeling of intractability.

5. The intractability of species

The discussion so far made the point clear that we use the term 'species' in biological explanations/discussions though we are conscious about the intractable nature of the ontology of species. We know what we are referring to when we use the term 'species' but the confusion arises when we are asked what 'species' mean. There is no clarity from the philosophical side whether species are kinds, or individuals, or sets. Likewise, no clear definition is given by biologists regarding species. If given five black balls and four white balls one can make two sets of white and black balls, then one can even think of species as sets. Given the evolutionary argument for the changing nature of species, there is no exaggeration to think species as individuals changing over time. One cannot even completely reject the multiple species concepts completely; all are useful in different theoretical contexts.

To conclude, /In conclusion, we can say that 'Species' are natural groups of organisms but to understand the existence of species one should use extra perceptual means. Our ability to infer, indeed, plays an important role. If a really unique ontological structure exists and which science aims at, then we lack the reality of species in every way. Presuming that there is no such unique structure enables us to stick to the best available knowledge which is useful in a pragmatic sense. In the case of species, all of us share a common thread which binds our understanding of species. The usefulness of our species concept is determined by the context. Different contexts require suitable species concepts different from the one we hold/consider/look at. So we feel there is something more to add on to each of these concepts in order to maximize their utility.

The intractability of species hence is a product of inapplicability. The species concepts reveal many determinants useful to delimit species but there are always exceptions to the rule. The intractability of the ontology of species lies with our cognitive incapacity to hold the thread which all our species concepts share. Critical thinking is required to determine whether the thread is ontological or epistemological in nature. Let us look at the future as species monists and be optimistic towards the future.

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