Radical Pluralism, Classificatory Norms and the Legitimacy of Species Classifications

Abstract *Moderate pluralism is a popular position in contemporary philosophy of biology. Despite its popularity, various authors have argued that it tends to slide off into a radical form of pluralism that is both normatively and descriptively unacceptable. This paper looks at the case of biological species classification, and evaluates a popular way of avoiding radical pluralism by relying on the shared aims and norms of a discipline. The main contention is that while these aims and norms may play an important role in the legitimacy of species classifications, they fail to fend off radical pluralism. It follows from this that the legitimacy of species classifications is also determined by local decisions about the aims of research and how to operationalize and balance these. This is important, I argue, because it means that any acceptable view on the legitimacy of classification should be able to account for these local decisions.*

Keywords: legitimacy of classification; radical pluralism; moderate pluralism; species classification; classificatory norms;

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1. Pluralism and the legitimacy of classification

Pluralism, which I will take to be the claim that there are multiple legitimate classifications of a particular domain, is a popular position in contemporary philosophy of biology. It has been defended for individuals (Wilson, 1999), genes (Waters, 2006), race (Pigliucci & Kaplan, 2003), and populations (Gannett, 2003) among many other things. Its appeal lies mostly in its fit with scientific practice; it simply happens to be the case that in many biological subdisciplines, scientists productively use multiple, cross-cutting classifications of the same things for different purposes. Adopting a pluralist position about those things helps to explain how these different classifications can all be legitimate. Pluralism also has practical benefits for scientists themselves. Developing multiple classifications rather than putting all money on one horse can be beneficial for satisfying different aims, dividing scientific labour into manageable chunks, or having alternatives in case one classification turns out to be unproductive (Chang, 2012).

Despite its appeal, some have argued against pluralism on the basis of what Ereshefsky (1992, p. 681-684) calls the 'no criterion objection'. As Hull (1987, p. 178) puts it, 'the greatest danger of pluralism is that it provides no means or even motivation for reducing conceptual luxuriance'. Developing this objection in the context of species classification, Ghiselin (1987, p. 136; cited in Slater, 2017, p. 8) writes that

> one can pick and chose [sic] among a variety of criteria, such as reproductive isolation, and similarities and differences in this, that, and the other. But we are not told how to make the criterion of membership be an objective one.

The idea is that if we can consider multiple classifications legitimate, based on various patterns we observe, there seems to be no reason why we should not consider *any pattern* a legitimate basis for classification. Thus, the fear is that pluralism, appealing as it may be, slides off into a radical form of pluralism that considers innumerable different classifications equally legitimate.

This no-criterion objection deserves to be taken seriously, as any philosophical view on the legitimacy of classification that leads to radical pluralism fails to meet two crucial desiderata of such views: descriptive accuracy and normative potency. The first of these implies that any acceptable view on the legitimacy of classification should be able to account for successful classificatory practices (Boyd, 2000; Khalidi 2013; Slater, 2014). If we look at such practices, it is clear that radical pluralism of the kind described above is rare. Biologists typically do not consider *any* observed pattern an equally legitimate basis for classification, and commonly provide reasons for favouring one pattern over another. A descriptively accurate view on the legitimacy of classification must be able to account for these reasons and biologists' selective representation of patterns. A view on the legitimacy of classification that leads to radical pluralism fails to do this and thus is, as Hacking (2007, p. 229) writes, at risk of being merely 'scholastic' talk, or part of an 'inbred set of degenerating problems that have increasingly little do with the issues that arise in a larger context'.

Secondly, such a view would also fail to meet the desideratum of normative potency, which holds that any acceptable philosophical view on the legitimacy of scientific classification should provide guidance on how to regiment classifications and arbitrate classificatory disputes (Craver, 2009). This desideratum poses a problem for radically pluralist views, as they consider any classification that tracks some pattern in the world equally legitimate. Clearly, such a view will be of little use to decide which of several competing classificatory schemes should be adopted, funded, or taught.

For these reasons, pluralist-minded philosophers have attempted to resist the slide to radical pluralism by relying on what I will call 'classificatory norms'. These are the generally accepted aims and norms of a scientific discipline that determine the legitimacy of classification in that domain and, in doing so, reduce radical pluralism to a more moderate variant. The main aim of this paper is to present and evaluate this popular way of avoiding radical pluralism and accounting for the legitimacy of scientific classification. Like much of the earlier philosophical work on classification, I will do this focusing on the case of species. The main contention of the paper is that while generally accepted classificatory norms may play an important role in the legitimacy of species classifications, they ultimately fail to fend off radical pluralism. I show that in addition to these norms, taxonomists rely on local decisions about the aims of their research and how to operationalize and balance these. This is important, I argue, because it means that any good philosophical view on the legitimacy of scientific classification should be able to account for such local decisions.

The structure of the paper is as follows. The second section specifies what is meant by radical and moderate pluralism, and develops the no-criterion objection in the context of species. The third section discusses how currently popular views on the legitimacy of scientific classification address this worry by appealing to classificatory norms, and the fourth section then argues that this solution is unsuccessful. The fifth section discusses the implications of this failure for philosophical accounts of the legitimacy of classification. The final section summarizes and concludes the paper.

2. World-based classification and radical pluralism

The previous section pointed out why radical pluralism poses a threat to philosophical views on the legitimacy of classification. This discussion provides a useful starting point to characterize the difference between moderate and radical pluralism. This is important, as one might worry that this difference is somewhat arbitrary, and consequently not philosophically interesting. The discussion above suggests that pluralism is only attractive if we retain the ability to make sense of scientific practice (descriptively accurate) and regiment scientific classifications (normatively potent). This implies that there is an important difference between radical and moderate pluralism: the former is any pluralism that is subject to these problems because it accepts too many classifications, and the latter is any view that accepts multiple classifications without succumbing to these problems. Thus, even if there is no clear boundary between the two, and the difference is merely quantitative, there is still a meaningful distinction.

With this distinction in hand, we can investigate more closely why moderate species pluralism risks sliding off into radical pluralism. Pluralism is not simply the claim that a domain *can* be classified in multiple ways; this would be a trivial position, as it is easy to come up with infinitely many gerrymandered classifications for any domain. Rather, pluralism about a particular domain implies that there are multiple *legitimate* classifications of that domain. The radical pluralism that proponents of the no criterion objection worry about is the position that there are very many classifications that are *equally legitimate*. To understand and evaluate this objection, then, we must clarify what precisely determines the legitimacy of scientific classification.

Hull and Ghiselin, as is apparent from the latter's citation above, assume that the legitimacy of species classifications is somehow determined by what the world is like. Interpreted in this sense, the no criterion objection holds that once we accept that several classifications might be legitimate, we lack the means of holding a 'reasonable middle ground' (Hull, 1987, p. 178) between monism and a radical pluralism that recognises any feature of the world as a legitimate basis for classification. Of course, this argument needs further spelling out. While it is generally assumed, both in the literature on species and in the literature on classification more generally, that the legitimacy of classifications depends on what the world is like, there is no one who defends that simply any feature of the world can equally legitimately serve as the basis for classification. Instead, philosophers of classification typically argue that only particular kinds of features in the world should guide classification. There are, broadly speaking, three competing views on this: essentialism, causal views, and simple similarity views. To evaluate the no criterion objection, it is worth considering whether it still holds on these popular and more restrictive views on the relation between the world and classification.

The first and most restrictive of these views is essentialism. According to the essentialist, legitimate classifications are those that track essences or essential properties (Ellis, 2001; Putnam, 1975). Such essences form the necessary and sufficient conditions for a particular to be member of a legitimate category, and often also explain the other, non-essential properties of those particulars. To use a time-worn example, 'gold' is considered a legitimate category because all its instances share an essence, namely a particular atomic structure, which at the same time explains some of gold's other properties, such as its melting point and colour. As essentialism prioritizes a small part of the similarity relations (namely, those that involve essential properties) as the basis for classification, it would avoid radical pluralism. However, it is now well-known that the groups that biologists recognise as species do not share any unique set of phenotypic or genotypic traits, and essentialism concerning species is widely rejected (e.g. Sober, 1980). While essentialism may thus fend off radical pluralism in parts of the world with essentialist categories, is fails to do so for species classification.

A second view on how the world determines the legitimacy of scientific classification is what one might call a simple similarity view (Häggqvist, 2005; Slater, 2014). According to this view, a category is legitimate if it tracks the stable clustering of properties in the world. The idea is that while there are very many similarity-relations, some of these tend to cluster together and form clusters that are stable in a wide range of contexts. For example, the groups of organisms that biologists recognise as species have a wide range of morphological, behavioural, genetic and developmental properties in common, and tend to remain similar in many of these respects throughout their life. Particulars in a category like 'all organisms in Cambridge', on the other hand, most likely share only one noteworthy property; moreover, this category is not very stable, as organisms move in and out of Cambridge continuously. The simple similarity view rejects such unstable categories characterized by few properties, and only considers categories legitimate if the particulars share enough properties in a sufficiently stable fashion. In other words, this view adopts a criterion of *sufficient similarity* for the legitimacy of classification.

Unlike essentialism, the simple similarity view seems to fit well with the groups that taxonomists recognise as species, because these are usually made up of organisms that are similar in many respects and in a relatively stable fashion. It is also worth noting that some taxonomic approaches, like phenetics and the Phylo-Phenetic species concept, even explicitly adopt criteria of sufficient similarity for the legitimacy of species individuation. However, like many have pointed out in objections to these phenetic approaches to classification (e.g. Hull, 1997, p. 360), a criterion of sufficient similarity ultimately fails to fend off radical pluralism. First, given the enormous number of similarity-relations in the organic world, radical pluralism would most likely still obtain on the simple similarity view even with a threshold of sufficient similarity. To see this, consider that within any species, some organisms will share more properties than others, and different organisms may share slightly different sets of properties. According to the simple similarity view, these different sets of similarities should all be recognised as different, legitimate categories. Second, the criterion of sufficient similarity is set by the researchers, and not by the world. Hence, if we assume that the legitimacy of classification is determined only by the world, it follows that the criterion of sufficient similarity is arbitrary. This means that there is no qualitative difference between groups that just meet the criterion of sufficient similarity and groups that just fall short of meeting it. This, in turn, means that the simple similarity view slides off into more radical forms of pluralism as the required degree of similarity is lowered.

Given that essentialism does not apply to species classification, and the simple similarity view fails to fend off radical pluralism, it is perhaps not surprising that the third and final view on the relation between the world and classification, which I will call the causal view, is the most popular with respect to species. This view holds that the legitimacy of classification lies in its tracking the causal structure of the world (Boyd, 1999, 2000; Khalidi, 2013). This view also regards legitimate categories as stable clusters of properties, but adds to this the requirement that this stability must be explained by a set of causal processes or mechanisms that lie at the basis of this clustering. For example, similarity between the organisms of a species is the result of causal processes such as interbreeding, shared selection pressures, shared developmental mechanisms, inherited niches, and so on. Species classification, then, is considered legitimate if it picks out groups of organisms that are similar due to a shared causal basis. This causal view fits very well with taxonomic practice, where species are commonly individuated on the basis of similarity due to genealogical causal history and evolutionary causes of intraspecific cohesion (Baum, 2009; De Queiroz, 2005).

One might think that the causal view is more likely to fend off radical pluralism than the simple similarity view. As the causal view denies that all that is required for legitimacy is simply some similarity relation, it only recognises a subset of the categories recognised by the simple similarity view. More precisely, it only recognises those property-clusters with an appropriate causal basis. Given that such causal bases often explain many similarity relations at once, adopting them as the basis for classification should thus lead to fewer classificatory schemes than when we start from the similarity relations themselves.

However, while the requirement of a causal basis is likely to decrease the absolute number of legitimate classifications, it is not clear whether it can fend off radical pluralism. Various authors have raised what may be called an argument from causal complexity to claim that the causal view on classification leads to radical pluralism too (Barker & Velasco, 2013; Dupré, 1993; Stegenga, 2016). This argument has two premises. First, it holds that some parts of the world are causally very complex, i.e. phenomena in these domains are affected by innumerable fine-grained causes or mechanisms. Second, it holds that no classification can track the complete causal structure of those parts of the world, so a classification is legitimate if it tracks at least part of this causal structure. This second premise follows directly from the pluralist position, which denies that there is a single best classification but still holds that there are multiple legitimate classifications. Assuming then that a classification is legitimate if it tracks at least part of the causal structure of the world, it follows that there are innumerable legitimate classifications of those parts of the world that are causally complex.

This argument has been proposed by various authors in different contexts. Discussing Boyd's (1999) causal view on the legitimacy of classifications, Craver (2009) argues that there are innumerable different ways of individuating the causal basis of legitimate categories, and, hence, of individuating the legitimate categories themselves. Stegenga (2016) makes a similar argument about populations. Interpreting populations as groups of organisms unified by fine-grained causal relations between the organisms, he argues that there are always so many of these that innumerable legitimate classifications can be constructed on the basis of them. Finally, Barker and Velasco (2013) make a similar argument about evolutionary groups in general. They argue that regardless of the processes or patterns that one takes as the causal basis of such groups, these can always be specified in countless different fine-grained ways, leading to countless equally legitimate classifications.

Let me apply this argument to the case of species with a brief example borrowed from Barker and Velasco (2013, pp. 975-976). Suppose we define species, as many taxonomists do, on the basis of evolutionary cohesion between the members of the species. Among the main causes of evolutionary cohesion is the fact that organisms within a species are subject to the same selection pressures. However, organisms are subject to a great number of selection pressures. And while there may be considerable overlap between the groups of organisms affected by each of these selection pressures, it is also beyond doubt that they rarely pick out precisely the same groups, and often pick out very different groups. Moreover, selection pressures vary over time and space, and thus affect different organisms to a different degree. Organisms also differ in the way they respond to these selection pressures. Thus, many different classifications are possible depending on which of many selection pressures we focus on, and the degree of intensity of these pressures we deem relevant. One organism might be part of a group that responds similarly to increased aridity, while it is part of another group that responds similarly to the amount of sunlight. The number of kinds rapidly increases when we take more causal factors and combinations of causal factors into account, such as other selection pressures and interactions like interbreeding.[1]

The argument from causal complexity implies that there are countless classifications that track parts of the causal structure of the organic world, and hence are legitimate if this structure is the only relevant criterion. Given the complexity of the organic world and the high number of causes at work in forming species-level groups, it is clear that this leads to a radical form of species pluralism. Earlier in this section, I already argued that essentialism does not apply to species and that the other viable view on the way the world constrains species classification, namely the simple similarity view, also leads to radical pluralism. It follows that any view on the legitimacy of species classification that considers this legitimacy to be only dependent on the world is subject to radical pluralism and its descriptive and normative problems.

3. Classificatory norms to the rescue

The previous section argued that if we take the world as the only factor determining the legitimacy of species classifications, then radical pluralism inevitably follows. Slater points out

[1] It is worth noting that the differences between these kinds are not merely a matter of boundary-drawing. While there may be many kinds that have very similar extensions (e.g. kinds based on various intensities of one selection pressure), the diversity of causal factors and possible combinations of causal factors implies that many of these kinds have substantially different extensions too.

that while this argument may hold, there is an easy response here for the moderate pluralist. He writes that

> [t]he moderate pluralist contends not merely that different classification systems are possible – this is obviously true – but that among those different possibilities, a number of them are legitimate by the lights of shared higher-level aims. Classificatory choice operates within a limited space of legitimate possibilities. The question of moderation or radicalness of classificatory pluralism for a given domain turns on the size of this space – the degree to which the world and our norms constrain our classificatory activities – at any level we care to countenance. (Slater, 2017, p. 9)

In other words, Slater accepts that there are innumerable ontologically valid classifications, but argues that only a few of these are suitable given the purposes we have for constructing these classifications in the first place. The claim then is that radical pluralism turns into moderate pluralism when we take into account the requirements of the aims of classification. For example, one could say that species classifications should in the first place be useful for biological research. This way, moderate pluralists can rule out categories such as the cook's kale, cauliflower and cabbage. While these categories track real features of the world and are useful for the cook's purposes, they go against the scientific aims of taxonomy by splitting up *Brassica oleracea* into several non-historical groups.

The idea that the aims of a classification determine its legitimacy and thus fend off radical pluralism is a common one among pluralists. Kitcher (1984, p. 309), for example, writes that the legitimacy of species classification is determined by what is biologically interesting, and retains nine distinct classificatory schemes. Similarly, Dupré argues that the legitimacy of classifications depends on them being useful for 'some significant purpose' (1993, p. 51), and that 'relative to a sufficiently well-articulated set of aims of enquiry there may very well be, and often is, a best way of classifying the phenomena within a domain' (2002, p. 31). In line with this, Boyd (1999, p. 148) connects the legitimacy of natural classification to the 'inductive and explanatory aims' of a discipline. Ereshefsky (2001, chapter 5), finally, argues that generally accepted classificatory norms bridge the gap between a radical 'anything goes' pluralism and a moderate pluralist view.

Of course, the aims that determine the legitimacy of species classification cannot just be any set of preferences. As there are innumerable conceivable goals, this would bring us back to radical pluralism. In other words, the moderate pluralist requires an account of what norms should guide taxonomy. While such an account is beyond the scope of this paper, we can derive at least three properties these norms must have in order to play the constraining role required for moderate pluralism.

First, the classificatory norms that constrain species classification must be shared across the discipline of taxonomy, and this discipline must range over all work on species classification. If taxonomic research takes place in multiple disciplines, pluralism obtains because different scientific disciplines have different aims that in turn favour different classifications. Not surprisingly, those who rely on classificatory norms to avoid radical species pluralism all assume such a broad discipline and shared goals. Ereshefsky (2001) refers to biological taxonomy as the relevant discipline and to a single shared aim as restricting the legitimacy of species classifications. Similarly, Kitcher (1984, p. 309), Boyd (1999, p. 148) and Slater (2017) refer to the goals of biology, evolutionary biology and functional biology when discussing the constraining role of classificatory norms.[2]

Second, to significantly reduce the number of legitimate classifications in a domain, the shared goals must be limited in number and hierarchically ordered. Again, this is because different classifications are legitimate depending on the goals that are adopted. If taxonomy has many competing goals, and different taxonomists pursue different aims or balance them in different ways, then the number of legitimate classifications increases. Radical pluralism of aims results in radical pluralism of legitimate classifications. This requirement fits well with Ereshefsky's (2001) claim that the single overriding goal of taxonomy is to allow biologists to make inferences about the organic world.

One may object here that a multitude of goals need not necessarily lead to a multitude of different legitimate classifications: it may well be that different aims lead to the same classification, thus avoiding radical pluralism. However, the argument from causal complexity discussed in section 2 suggests that such convergence of classifications is unlikely. According to that argument, there are innumerable different classifications that all track some aspect of the causal structure of the organic world. Some of these are as different as focusing on entirely different causal processes (e.g. interbreeding and selection pressures), while others are only slightly different in that they focus on fine-grained differences between different instances of similar causal processes (e.g. different intensity-ranges of the same selection pressure). The point here is that given this enormous number of ontologically valid classifications, it is unlikely that any two aims are optimally served by precisely the same classification. It follows that a multitude of goals is likely to lead to an equal multitude of legitimate classifications.

[2] Elsewhere, Boyd (1999, p. 148) explicitly points out that disciplines (or, as he calls them, disciplinary matrices) need not correspond to 'academic or practical disciplines otherwise understood'. Instead, a disciplinary matrix is any 'family of inductive and explanatory aims and practices, together with the conceptual resources and vocabulary within which they are implemented' (Boyd, 2000, p. 57). This is compatible both with interpreting these matrices as relatively broad scientific disciplines (e.g. evolutionary biology), and with interpreting them as research projects. Boyd's (e.g. 1999, p. 168) references to biology as the relevant disciplinary matrix for species classification suggests the former interpretation.

Finally, like the general aims themselves, the ways in which these aims are operationalized must be generally accepted and limited in number. Let me explain. In order to cover the whole diversity of taxonomic research projects, the overriding goals of the discipline must be rather general. Such general goals are too vague to guide classificatory choices in a direct and precise way. Instead, they have to be operationalised through low-level norms that spell out the best way to attain the general goals.[3] For example, Slater (2017, p. 7) argues that a norm favouring intrinsic over extrinsic properties as a basis for classification may be seen as a lower-level operationalization of a more general norm favouring the stability of classifications, which in turn may be an operationalization of a more general aim like Ereshefsky's 'facilitating inferences'.[4] It is best then to think of classificatory norms in terms of a hierarchical set of nested norms, where the higher-level norms justify lower-level norms, and the overall goals ultimately justify all other norms. In that sense, the overriding aims of a discipline are considered intrinsically valuable within that discipline, while the lower-level norms are only instrumentally valuable as a means of fulfilling the overriding aims. The point here is that classificatory norms can only fend off radical pluralism if the ways in which the general goals are operationalized through lower-level norms are limited in number and universally accepted within the discipline. This is because different operationalizations of aims lead to different classifications, and consequently to pluralism

Let us take stock of the arguments so far. I have presented the no criterion objection to moderate species pluralism, and considered classificatory norms as a response to this objection. I then argued that this response is only successful if these norms meet three conditions: (1) the aims of species classification must be shared across the broadly conceived discipline of taxonomy; (2) the aims of taxonomy must be low in number and hierarchically ordered; and (3), the overriding aims must be operationalized in a low number of ways, and these operationalizations must be generally accepted. If these conditions are met, it seems that Hull's 'reasonable middle ground' of moderate pluralism may be possible after all.

One could object here that it is trivially true that there are innumerable possible goals that taxonomists could pursue, which in turn could be operationalized in many different ways. Without a further meta-norm to arbitrate between these norms and operationalizations, the conditions above are not met and we are led back to the radical pluralism we are trying to avoid. And it is not clear where such a meta-norm could be found, as there are again innumerable possible meta-norms to choose from, and so on *ad infinitum*. However, the

[3] Ereshefsky (2001) calls these low-level norms 'methodological rules', Slater (2017) calls them 'ground-level norms'.

[4] This is also in line with much recent work in the philosophy of science that emphasizes the importance of the ways general goals and norms are operationalized in scientific practice (see Fagan, 2017 and Kendig and Eckdahl, 2017 for examples with detailed case studies).

obvious fact that there are many *possible* norms does not show that the *actual* goals of taxonomy do not constrain the legitimacy of classification (Slater, 2017, p. 9). Thus, the question is whether *in fact* all taxonomic research is part of a single discipline that shares a few general aims that limit the number of legitimate classifications. I turn to this question in the next section.

4. The multiple aims of taxonomy

Ereshefsky (2001,183) investigates important texts by leading taxonomists, and concludes that there is surprising agreement in taxonomy about the ‘single overall aim’ that guides species classification. Together with a limited set of low-level norms, Ereshefsky argues, these aims lead to a tempered pluralism. Arguing against Ereshefsky’s conclusion, this section shows that none of the three requirements for classificatory norms to constrain radical pluralism are met. It follows that shared classificatory norms in taxonomy do not fend off radical species pluralism.

4.1. Species classification in many disciplines

To avoid radical pluralism, the classificatory norms that constrain species classification must be shared across the relevant scientific discipline, namely, taxonomy. In addition, it is also important that this discipline covers all research on species classification, as the different aims of different disciplines would lead to pluralism. This poses a problem for the moderate species pluralist, as the extension of taxonomy is not at all clear. Taxonomy is sometimes defined as the scientific discipline involved with assigning names to groups of organisms, identifying groups of organisms and ordering these groups in a system of classification, or with discovering, identifying and naming species and reconstructing their history. More importantly, taxonomic research is also closely entangled with other scientific disciplines. Gotelli (2004) uses his research on North American ants to illustrate the impact of taxonomy on ecological research. He emphasizes the importance of usable taxonomic keys, current nomenclature not hindered by synonymy, species occurrence records, and phylogenies. Similarly, Isaac et al. (2004) argue that a reliable and stable taxonomy is crucial for ecology, where species figure as the units of many of the patterns under investigation. Others (e.g. Braby & Williams, 2016; Frankham et al., 2012; Khuroo et al., 2007) emphasise the importance of taxonomy for conservation biology, which requires a reliable inventory of life.

The connection between taxonomy and other disciplines of evolutionary biology is further illustrated by the fact that a large share of recent taxonomic work is published as part of papers exploring hypotheses from these disciplines. Indeed, this is increasingly seen as a necessary aspect of taxonomic research. Halme et al. (2015, p. 1834) write that

> [b]uilding one´s resume´ strategically is becoming more and more of a standard among academics and publishing solely descriptive taxonomy has become a difficult pathway to scientific positions. Many skilful taxonomists already work in close collaboration with systematists and evolutionary biologists or they are working on evolutionary hypotheses themselves, which allows publishing in higher-impact journals and improving citation rates.

The point here is that the close relation between taxonomy and other disciplines suggests that the goals of taxonomy are not entirely distinct from the goals of these disciplines. Often taxonomic research is part of broader research projects, or taxonomists are motivated by the needs of other disciplines. This suggests that there are many ways of individuating the discipline that any particular taxonomic research is part of. If we assume that different disciplines come with different aims, species pluralism follows from the different ways in which taxonomy is individuated and the different disciplines in which taxonomists operate.

4.2. A plurality of aims

Ereshefsky (2001, 175) assumes that taxonomic research broadly falls within one discipline, and argues that this discipline is unified by the aim of providing 'empirically accurate classifications that allow biologists to make inferences'. This subsection argues that while inferential strength is undoubtedly an important aim of taxonomy, it does not exhaust these aims or override all others.

One central aim of taxonomy is to store information in an efficient way and provide a clear naming system. Taxonomists Nelson and Platnick (1981, p. 9), for example, write that 'classifications obviously perform an essential function in information storage and retrieval. They allow us to deal with tremendous amounts of data by subsuming a great deal of information into single words'. Another important aim of taxonomy lies in providing measures for biodiversity through proxies such as species richness and species density. As Carvalho et al. (2014, 323) point out, this goal often does not coincide with that of supporting inferences, as optimizing the latter requires extensive study of phylogeny, biogeography and evolutionary processes while optimizing the former is probably best served by using our resources to describe more taxa in a faster and more superficial way. Yet another aim of taxonomy, finally, is to facilitate modelling. Mota-Vargas and Rojas-Soto (2016), for example, emphasise that the outcomes of Ecological Niche Models are directly dependent on the choice of criteria for species delimitation, and argue that these criteria should be chosen in function of what the model in question is testing. In such cases, species delimitation serves the particular goals of that model rather than general inferential strength.[5]

The aims of taxonomy discussed in the previous paragraph are all epistemic rather than non-epistemic, as they concern advancing biological knowledge rather than the use of classifications outside of science. There is, however, no reason to think that the goals of taxonomy are purely epistemic. Various authors have recently argued that non-epistemic goals are no less important than epistemic goals in guiding science (Elliott & McKaughan, 2014; Potochnik, 2015, 2017). Species classification does not seem to be an exception here, as taxonomic research is commonly driven by non-epistemic concerns.

Most importantly, taxonomists frequently emphasize facilitating biodiversity conservation as an important goal. For example, Frankham et al. (2012) argue that the choice of species concepts in taxonomy should be geared towards the conservation aims of taxonomy. They point out that human impact on the environment has caused the habitats of many species to be split into unconnected fragments, effectively splitting these groups into multiple small groups. Because these fragmented groups would interbreed if their habitats were still connected, they are likely to be recognised as a single species under the Biological Species Concept (BSC). At the same time, these small groups are likely to be recognised as separate species under the diagnosability-based Phylogenetic Species Concept (PSC), because they quickly become diagnosable due to drift. In such cases, Frankham et al. argue, taxonomists should adopt the BSC, as this would promote conservation action aimed at re-establishing gene-flow between the fragmented populations. Using the PSC, they argue, makes such policy unlikely and in this way puts these groups at risk of inbreeding depression and potentially extinction. A similar example comes from Wege et al. (2015), who argue that taxonomists in Western-Australia should prioritize groups of conservation concern, particularly those that are susceptible to mining activities in that area, to allow effective conservation action before those groups go extinct. In both these examples, it is clear that conservation aims are intrinsically valued and substantially impact species classification.

Biodiversity conservation is not the only practical goal that guides taxonomists. The recent plenary meeting of the Linnean Society of London titled ‘Who Needs Taxonomists?’ (see Linnean Society, 2014) provides a wide range of examples of taxonomic research directly aimed at practical applications. These include topics as diverse as sea lice important for the salmon farming industry, the trade in sandalwood essential oils and star anise, mining projects in Guinea and the impact of climate change on the distribution of coffee species. One

[5] MacLeod (2013) points out that philosophical accounts of scientific classification have focused too much on inferential strength at the expense of other purposes of classification such as facilitating modelling, experimentation, understanding, and explanation. Ereshefsky’s claim about taxonomy fits well in this pattern.

particularly interesting example comes from Attenborough (2015), who argues that effective prevention and combat of malaria require species classification that is as specific and detailed as possible, effectively consisting of PSC species rather than BSC species. More precisely, Attenborough points out that there are many morphologically cryptic groups with fixed genetic differences. While these groups cannot be readily distinguished except by molecular data, the variables affecting malaria transmission often differ between these groups. Thus, combatting the transmission of malaria requires distinguishing between these groups. He argues that species classifications that overlook these differences risk leading to interventions that likewise overlook these differences. He writes that using the PSC is important 'to improve human health in the tropical Western Pacific, sub-Saharan Africa and other places still greatly afflicted by this scourge' (Attenborough, 2015, p. 147).

The importance of these practical goals is further reflected in the guidelines of important funding sources for taxonomy such as the 'Biotechnology and Biological Sciences Research Council' and 'Natural Environment Research Council', which explicitly require taxonomic research to have direct practical applications, and mention food security, industrial biotechnology, health research, and more generally, wealth creation (see Linnean Society, 2014). Kim and Byrne (2006, p. 799) express this source of goals for taxonomy powerfully when they write that '[t]axonomy should be reinvigorated and reinvented through collaborative, interdisciplinary research that brings taxonomic insights to bear on topics important to twenty-first century society (e.g., food security, invasive species, and ecosystem services).' They argue that the mere description of biodiversity and the construction of an inferentially strong system form an overly narrow view on the goals of taxonomy. Instead, taxonomic research should accommodate 'environmental and societal issues' (p799).

The discussion in the previous paragraphs suggests that taxonomy has many intrinsically valued non-epistemic and epistemic goals. This has direct implications for the ability of classificatory norms to keep radical species pluralism at bay. These norms only limit the space of legitimate classifications to a moderate number if there are only a few, generally accepted goals. If there are many different goals, and if different taxonomists work with different goals in mind, radical pluralism re-enters through these multiple goals.

To resist this conclusion and avert radical pluralism, moderate pluralists could at this point argue that the plurality of goals guiding taxonomy are hierarchically ordered. The point is that if some goals consistently trump all other goals, moderate pluralism is compatible with a large range of goals in taxonomy (see Ereshefsky, 2001, pp. 170–171). On such a view, the main aims of the discipline largely shape species classification, while secondary aims only play a role in the limited space left by these main goals.

However, there is no reason to think that this is the case. This is clearly illustrated by debates concerning DNA-barcoding, an approach to species identification and classification that recognises groups as a species on the basis of a short mitochondrial DNA marker. Some biologists argue that DNA-barcoding should not be used for species classification because it does not take into account morphological, phylogenetic or ecological data, and thus provides knowledge that is more superficial than traditional taxonomy. Others argue that given the pressing conservation concerns, we should adopt DNA-barcoding because it is faster and cheaper than traditional approaches, and requires far less specialist knowledge (see Costello et al., 2013; Joppa et al., 2011). Such a fast, easy-to-use and standardized taxonomic procedure is attractive to many users of taxonomy because it would speed up the construction of a complete and user-friendly inventory of life. Thus, this is a clash between the broadly epistemic goals of taxonomy and its practical goals.

This explicit debate among biologists shows that there is no universally accepted goal that consistently trumps other goals. Instead, there is genuine disagreement, and multiple goals play a role. These undoubtedly include broad epistemic goals like maximizing inferential strength, but also more specific epistemic and non-epistemic aims like avoiding inbreeding depression in fragmented populations or prioritizing the conservation of threatened endemic species. Depending on which of these aims are pursued and how they are balanced, different legitimate classifications will result.

4.3. A plurality of low-level norms

One may object that the diversity of aims ascribed to taxonomy above can easily be rephrased in terms of a few very general goals, such as 'support inferences and explanations' and 'simplicity' or even 'usefulness'. This is consistent with the taxonomic literature, as taxonomists often explicitly state the goals of their discipline in such general terms (see Ereshefsky, 2001). However, regardless of whether this accurately describes the goals of taxonomy, this move fails to reduce pluralism. In order to see this, it is helpful to turn to the third condition for classificatory norms to constrain pluralism, namely, a limited and shared set of low-level norms that operationalise the general aims. If there are many different sets of low-level norms that are equally suitable to attain the high-level goals of a discipline, pluralism still obtains even if there is general agreement about the overriding aims. Phrasing the high-level goals of taxonomy in very general, vague terms makes it likely that this is the case. That is, goals like 'support inferences' or 'allow for practically useful classifications' can be interpreted and operationalised in innumerable ways. Depending on how we do this, different low-level norms and different classifications result, resulting in radical pluralism.

This is confirmed by the enormous methodological diversity in the field of species delimitation (Camargo & Sites, 2013; Sites & Marshall, 2004). Even among taxonomists who subscribe to the same conception of species, and thus arguably also to similar goals of taxonomy, there is a dazzling variety of methods being used for species delimitation. For example, the currently popular Multi-Species Coalescent-Based Methods are more repeatable and universally applicable than traditional morphology-based methods, as they rely on the same (homologous) neutral loci in different taxa and the statistical methods yield the same results independently from who runs them. Traditional morphology-based methods, on the other hand, are more prone to bias because they require expert judgment but are not dependent on the limitations and accuracy of the assumptions of the models (Camargo & Sites, 2013). Thus, different methods accomplish different low-level aims. This is important, as these different methods often lead to different outcomes for the same groups of organisms. Satler et al. (2013), for example, apply seven commonly used model-based methods to the same group of trapdoor spiders, which variously yield between three and eighteen different species.

Thus, even if we assume that these approaches to species delimitation are all different operationalisations of the same high-level goals, it is undeniable that they do this by means of different low-level aims that ultimately lead to different results. Given the high number of methods of species delimitation, this yields pluralism of the radical kind.

4.4. Classificatory norms do not fend off radical pluralism

The arguments in the previous subsections show that shared classificatory aims and norms are not sufficient to fend off radical pluralism. Even if such shared norms exist in taxonomy, they are supplemented by further aims and decisions about how to operationalize and balance these aims. Depending on which of innumerable possible further aims, balancing schemes and operationalizations we select, different classifications will result. It follows that if we take generally shared norms along with the world as the only factors relevant for the legitimacy of species classification, radical pluralism cannot be avoided.

One might object here that this pluralism is of the moderate rather than the radical sort; even if each research project adopts slightly different aims and operationalizations, it does not follow that there are *innumerable* legitimate classifications.[6] However, while the pluralism that results from relying on classificatory norms is clearly less radical than the pluralism discussed in section 2, it is still too promiscuous to qualify as moderate. To see why, it is worth remembering that moderate and radical pluralism are distinguished on the basis of the descriptive and normative problems associated with radical pluralism. Even if classificatory norms strongly reduce radical pluralism, the resulting pluralism still seems to suffer from these

[6] I thank an anonymous reviewer for pointing out this objection.

problems. More precisely, having a distinct classificatory scheme for each research project makes it hard to arbitrate between multiple competing scientific classifications (the normative problem); in addition, the resulting number of classifications remains far removed from the moderate pluralism or even monism we observe in current taxonomic practice (the descriptive problem).

5. Local decisions determine the legitimacy of classification

The previous sections have argued that radical species pluralism threatens for any view that makes the legitimacy of classification only dependent on the world and shared classificatory norms. Fortunately, the arguments in this paper also suggest what is missing from such views: local decisions. Local aims of research and decisions concerning the operationalization and balancing of these aims also shape the outcomes of species classification. It follows that any philosophical view that aims to make sense of the legitimacy of such classifications should include these local decisions, as well as general norms and the world.

It is beyond the scope of this paper to propose such an account in any detail. It is clear however, that it would differ substantially from currently available views on scientific classification that ground the legitimacy of classification solely in the world and classificatory norms shared across a 'domain' (Slater, 2017, p. 9) or 'disciplinary matrix' (Boyd, 1999, p. 165). As these views assume that the relevant aims and low-level norms are shared across broad fields of science, they fail to capture the impact of local aims and local decisions concerning operationalizations. While Slater's, Boyd's, and also Ereshefsky's (2001) views may be compatible with a role for local decisions, they do not discuss it explicitly and thus leave a crucial aspect of the legitimacy of classification unexplored.

Two such unexplored aspects that a view on the legitimacy of classification should incorporate are particularly noteworthy. First, the role of local decisions implies that classifications are highly path-dependent and contingent on the particular research projects and contexts in which they are developed. This means that a classification can be legitimate even if it could very well have turned out differently had other, equally valid local decisions been made about the aims of research and the operationalization of these aims. What matters for legitimacy in such cases is what decisions were in fact made in classificatory practice. Thus, the fact that a category is recognised and plays a role in successful classificatory practices is an important part of its legitimacy.

Second, my arguments imply that there may often be competing classifications that meet the relevant constraints of the world and generally accepted norms. A suitable philosophical view on the legitimacy of classification should provide an account of how clashes between such classifications are or can be resolved. The need for such an account is illustrated by such clashes in classificatory practice. Take, for example, the recent controversy about a phenomenon called ‘taxonomic inflation’, which is the strong increase in species numbers due the splitting of existing species into multiple smaller groups (Isaac et al., 2004). Despite an abundance of data and general agreement about the appropriate species concept, there has been no progress in the debate between those who claim that such splitting is desirable and those who claim it is not. This stalemate as well as the frequent use of normative terms such as ‘inflation’ suggests that the disagreement at hand is one between different sets of aims and low-level norms. To account for such debates and the ways they can be resolved, it is important that philosophical views on the legitimacy of classification dedicate appropriate attention to the role of local aims and local decisions concerning operationalization.

While the arguments presented for it in this paper are new, a similar view on the legitimacy of classification has been proposed by others. Discussing the legitimacy of scientific classification in general (rather than focusing on species), Thomas Reydon (2015, p. 70) argues that ‘a crucial part of classificatory practices consists in local decisions of investigators in particular contexts of research […]’. According to Reydon, the result of these local decisions is that scientific categories are fundamentally shaped by their investigative context, i.e. the aims of research as well as practices and institutions. Reydon (2015, p. 67) explicitly emphasizes that this context is typically not shared by all members of a discipline and varies between different research projects. Reydon calls this view on scientific classification the ‘co-creation model’, as it makes scientific kinds the joint creation of the world and the investigative context in which the kinds are developed.

Like the view defended here, Reydon connects the legitimacy of classification directly to the local decisions of researchers embedded in a particular research context with a particular set of aims. Moreover, his view also implements the two aspects discussed above. First, Reydon emphasises how scientific classification is path-dependent. Not only are kinds dependent on the aims and practices of particular context in which they are developed, they also impact further classificatory research. Second, Reydon also points out that scientific classifications in the same domain often vary depending on the particular context of investigation for which they were constructed. While he does not explicitly connect this to debates between proponents of different classifications, it is easy to see how his view could account for such debates.

6. Conclusion

This paper has discussed the no criterion argument for radical species pluralism and argued that because taxonomy has many goals and ways of operationalizing these goals, this radical pluralism cannot be avoided solely by relying on classificatory norms. This implies that in addition to relying on the world and classificatory norms, taxonomists involved in species delimitation also rely on local decisions concerning these aims and norms. This means that any philosophical view on the legitimacy of these classifications must be able to account for these local decisions.

It is worth considering the extent to which the arguments in this paper can be extended beyond the case of species classification. As the arguments about the goals of taxonomy in section 4 are empirical rather than philosophical, the conclusions of this paper do not straightforwardly apply to domains outside taxonomy. I believe, however, that given the close entanglement of many scientific disciplines and their practical applications (see Douglas, 2014), similar arguments could be constructed for many of the fields to which the argument from causal complexity applies. If this is true, then the conclusions concerning philosophical views on the legitimacy of classification have more general bearing too. However, providing detailed arguments for this is beyond the scope of this paper.

Acknowledgements

This work was supported by the Arts and Humanities Research Council (AH/14/Pool/5). I would like to thank Tim Lewens, Jacob Stegenga, Hardy Schilgen and Nick Jardine for very helpful and much appreciated feedback on earlier versions of this paper. I also want to thank three anonymous reviewers for their particularly helpful suggestions.

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