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;

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).

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

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

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

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

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

65   For these reasons, pluralist-minded philosophers have attempted to resist the slide to radical
66   pluralism by relying on what I will call 'classificatory norms'. These are the generally accepted

67 aims and norms of a scientific discipline that determine the legitimacy of classification in that
68 domain and, in doing so, reduce radical pluralism to a more moderate variant. The main aim
69 of this paper is to present and evaluate this popular way of avoiding radical pluralism and
70 accounting for the legitimacy of scientific classification. Like much of the earlier philosophical
71 work on classification, I will do this focusing on the case of species. The main contention of
72 the paper is that while generally accepted classificatory norms may play an important role in
73 the legitimacy of species classifications, they ultimately fail to fend off radical pluralism. I show
74 that in addition to these norms, taxonomists rely on local decisions about the aims of their
75 research and how to operationalize and balance these. This is important, I argue, because it
76 means that any good philosophical view on the legitimacy of scientific classification should be
77 able to account for such local decisions.

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

2. World-based classification and radical pluralism

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

98 With this distinction in hand, we can investigate more closely why moderate species pluralism
99 risks sliding off into radical pluralism. Pluralism is not simply the claim that a domain *can* be
100 classified in multiple ways; this would be a trivial position, as it is easy to come up with
101 infinitely many gerrymandered classifications for any domain. Rather, pluralism about a

102 particular domain implies that there are multiple *legitimate* classifications of that domain. The
103 radical pluralism that proponents of the no criterion objection worry about is the position that
104 there are very many classifications that are *equally legitimate*. To understand and evaluate
105 this objection, then, we must clarify what precisely determines the legitimacy of scientific
106 classification.

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

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

134 A second view on how the world determines the legitimacy of scientific classification is what
135 one might call a simple similarity view (Häggqvist, 2005; Slater, 2014). According to this view,
136 a category is legitimate if it tracks the stable clustering of properties in the world. The idea is
137 that while there are very many similarity-relations, some of these tend to cluster together and

138 form clusters that are stable in a wide range of contexts. For example, the groups of organisms
139 that biologists recognise as species have a wide range of morphological, behavioural, genetic
140 and developmental properties in common, and tend to remain similar in many of these
141 respects throughout their life. Particulars in a category like 'all organisms in Cambridge', on
142 the other hand, most likely share only one noteworthy property; moreover, this category is
143 not very stable, as organisms move in and out of Cambridge continuously. The simple
144 similarity view rejects such unstable categories characterized by few properties, and only
145 considers categories legitimate if the particulars share enough properties in a sufficiently
146 stable fashion. In other words, this view adopts a criterion of *sufficient similarity* for the
147 legitimacy of classification.

148 Unlike essentialism, the simple similarity view seems to fit well with the groups that
149 taxonomists recognise as species, because these are usually made up of organisms that are
150 similar in many respects and in a relatively stable fashion. It is also worth noting that some
151 taxonomic approaches, like phenetics and the Phylo-Phenetic species concept, even explicitly
152 adopt criteria of sufficient similarity for the legitimacy of species individuation. However, like
153 many have pointed out in objections to these phenetic approaches to classification (e.g. Hull,
154 1997, p. 360), a criterion of sufficient similarity ultimately fails to fend off radical pluralism.
155 First, given the enormous number of similarity-relations in the organic world, radical pluralism
156 would most likely still obtain on the simple similarity view even with a threshold of sufficient
157 similarity. To see this, consider that within any species, some organisms will share more
158 properties than others, and different organisms may share slightly different sets of properties.
159 According to the simple similarity view, these different sets of similarities should all be
160 recognised as different, legitimate categories. Second, the criterion of sufficient similarity is
161 set by the researchers, and not by the world. Hence, if we assume that the legitimacy of
162 classification is determined only by the world, it follows that the criterion of sufficient
163 similarity is arbitrary. This means that there is no qualitative difference between groups that
164 just meet the criterion of sufficient similarity and groups that just fall short of meeting it. This,
165 in turn, means that the simple similarity view slides off into more radical forms of pluralism as
166 the required degree of similarity is lowered.

167 Given that essentialism does not apply to species classification, and the simple similarity view
168 fails to fend off radical pluralism, it is perhaps not surprising that the third and final view on
169 the relation between the world and classification, which I will call the causal view, is the most
170 popular with respect to species. This view holds that the legitimacy of classification lies in its
171 tracking the causal structure of the world (Boyd, 1999, 2000; Khalidi, 2013). This view also
172 regards legitimate categories as stable clusters of properties, but adds to this the requirement
173 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

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[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.

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

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

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

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

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

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

285 Second, to significantly reduce the number of legitimate classifications in a domain, the shared
286 goals must be limited in number and hierarchically ordered. Again, this is because different
287 classifications are legitimate depending on the goals that are adopted. If taxonomy has many
288 competing goals, and different taxonomists pursue different aims or balance them in different
289 ways, then the number of legitimate classifications increases. Radical pluralism of aims results
290 in radical pluralism of legitimate classifications. This requirement fits well with Ereshefsky's
291 (2001) claim that the single overriding goal of taxonomy is to allow biologists to make
292 inferences about the organic world.

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

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[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.

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

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

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

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[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

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

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

384   *4.2.   A plurality of aims*

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

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

403   model in question is testing. In such cases, species delimitation serves the particular goals of

404   that model rather than general inferential strength.[5]

405   The aims of taxonomy discussed in the previous paragraph are all epistemic rather than non-

406   epistemic, as they concern advancing biological knowledge rather than the use of

407   classifications outside of science. There is, however, no reason to think that the goals of

408   taxonomy are purely epistemic. Various authors have recently argued that non-epistemic

409   goals are no less important than epistemic goals in guiding science (Elliott & McKaughan, 2014;

410   Potochnik, 2015, 2017). Species classification does not seem to be an exception here, as

411   taxonomic research is commonly driven by non-epistemic concerns.

412   Most importantly, taxonomists frequently emphasize facilitating biodiversity conservation as

413   an important goal. For example, Frankham et al. (2012) argue that the choice of species

414   concepts in taxonomy should be geared towards the conservation aims of taxonomy. They

415   point out that human impact on the environment has caused the habitats of many species to

416   be split into unconnected fragments, effectively splitting these groups into multiple small

417   groups. Because these fragmented groups would interbreed if their habitats were still

418   connected, they are likely to be recognised as a single species under the Biological Species

419   Concept (BSC). At the same time, these small groups are likely to be recognised as separate

420   species under the diagnosability-based Phylogenetic Species Concept (PSC), because they

421   quickly become diagnosable due to drift. In such cases, Frankham et al. argue, taxonomists

422   should adopt the BSC, as this would promote conservation action aimed at re-establishing

423   gene-flow between the fragmented populations. Using the PSC, they argue, makes such policy

424   unlikely and in this way puts these groups at risk of inbreeding depression and potentially

425   extinction. A similar example comes from Wege et al. (2015), who argue that taxonomists in

426   Western-Australia should prioritize groups of conservation concern, particularly those that are

427   susceptible to mining activities in that area, to allow effective conservation action before

428   those groups go extinct. In both these examples, it is clear that conservation aims are

429   intrinsically valued and substantially impact species classification.

430   Biodiversity conservation is not the only practical goal that guides taxonomists. The recent

431   plenary meeting of the Linnean Society of London titled 'Who Needs Taxonomists?' (see

432   Linnean Society, 2014) provides a wide range of examples of taxonomic research directly

433   aimed at practical applications. These include topics as diverse as sea lice important for the

434   salmon farming industry, the trade in sandalwood essential oils and star anise, mining projects

435   in Guinea and the impact of climate change on the distribution of coffee species. One

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[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.

471 However, there is no reason to think that this is the case. This is clearly illustrated by debates

472 concerning DNA-barcoding, an approach to species identification and classification that

473 recognises groups as a species on the basis of a short mitochondrial DNA marker. Some

474 biologists argue that DNA-barcoding should not be used for species classification because it

475 does not take into account morphological, phylogenetic or ecological data, and thus provides

476 knowledge that is more superficial than traditional taxonomy. Others argue that given the

477 pressing conservation concerns, we should adopt DNA-barcoding because it is faster and

478 cheaper than traditional approaches, and requires far less specialist knowledge (see Costello

479 et al., 2013; Joppa et al., 2011). Such a fast, easy-to-use and standardized taxonomic

480 procedure is attractive to many users of taxonomy because it would speed up the construction

481 of a complete and user-friendly inventory of life. Thus, this is a clash between the broadly

482 epistemic goals of taxonomy and its practical goals.

483 This explicit debate among biologists shows that there is no universally accepted goal that

484 consistently trumps other goals. Instead, there is genuine disagreement, and multiple goals

485 play a role. These undoubtedly include broad epistemic goals like maximizing inferential

486 strength, but also more specific epistemic and non-epistemic aims like avoiding inbreeding

487 depression in fragmented populations or prioritizing the conservation of threatened endemic

488 species. Depending on which of these aims are pursued and how they are balanced, different

489 legitimate classifications will result.

490 *4.3.   A plurality of low-level norms*

491 One may object that the diversity of aims ascribed to taxonomy above can easily be rephrased

492 in terms of a few very general goals, such as 'support inferences and explanations' and

493 'simplicity' or even 'usefulness'. This is consistent with the taxonomic literature, as

494 taxonomists often explicitly state the goals of their discipline in such general terms (see

495 Ereshefsky, 2001). However, regardless of whether this accurately describes the goals of

496 taxonomy, this move fails to reduce pluralism. In order to see this, it is helpful to turn to the

497 third condition for classificatory norms to constrain pluralism, namely, a limited and shared

498 set of low-level norms that operationalise the general aims. If there are many different sets of

499 low-level norms that are equally suitable to attain the high-level goals of a discipline, pluralism

500 still obtains even if there is general agreement about the overriding aims. Phrasing the high-

501 level goals of taxonomy in very general, vague terms makes it likely that this is the case. That

502 is, goals like 'support inferences' or 'allow for practically useful classifications' can be

503 interpreted and operationalised in innumerable ways. Depending on how we do this, different

504 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

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[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.

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