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CRITICAL REVIEW OF RUPHY, STEPHANIE. SCIENTIFIC PLURALISM RECONSIDERED - A NEW APPROACH TO THE (DIS)UNITY OF SCIENCE

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ABSTRACT:
This review critically examines Stéphanie Ruphy's *Scientific Pluralism Reconsidered: A New Approach to the (Dis)unity of Science* (2016), which revisits long-standing debates on the unity and disunity of science. Ruphy challenges prevailing pluralist and antireductionist positions by proposing an alternative, "foliated pluralism". Four main properties constitute the foliated pluralism. Those four main properties are 1- transdisciplinarity, 2- synchronicity, 3- nonexclusiveness, and 4- cumulativeness. By analyzing scientific practices in astrophysics and taxonomy, she argues that persistent incompatibilities between models and classifications emerge from pragmatic constraints rather than ontological necessity. Rejecting both universalist monism and metaphysically grounded pluralism, Ruphy underscores the need for a temporally qualified, practice-oriented view of scientific pluralism. The book provides a substantial contribution to the philosophy of science, offering a nuanced perspective that reconciles pluralism with scientific methodology.

KEYWORDS:
Scientific Pluralism. Foliated Pluralism. Philosophy of science.

RESENHA CRÍTICA DE RUPHY, STEPHANIE. SCIENTIFIC PLURALISM RECONSIDERED - A NEW APPROACH TO THE (DIS)UNITY OF SCIENCE

RESUMO:

Esta resenha examina criticamente o livro *Scientific Pluralism Reconsidered: A New Approach to the (Dis)unity of Science* (2016), de Stéphanie Ruphy, que revisita debates de longa data sobre a unidade e a não-unidade da ciência. Ruphy desafia as posições pluralistas e antirreducionistas predominantes ao propor uma alternativa: o "Foliated Pluralism". Esse pluralismo é constituído por quatro propriedades principais: 1) transdisciplinaridade, 2) sincronicidade, 3) não exclusividade e 4) cumulatividade.

Ao analisar práticas científicas na astrofísica e na taxonomia, Ruphy argumenta que as incompatibilidades persistentes entre modelos e classificações decorrem de restrições pragmáticas, e não de uma necessidade ontológica. Rejeitando tanto o monismo universalista quanto o pluralismo fundamentado metafisicamente, ela enfatiza a necessidade de uma visão temporalmente qualificada e orientada para a prática do pluralismo científico. O livro oferece uma contribuição significativa para a filosofia da ciência, apresentando uma perspectiva sofisticada que reconcilia o pluralismo com a metodologia científica

PALAVRAS-CHAVE:

Pluralismo Científico. Foliated Pluralism. Filosofia da Ciência.

This is a work whose subject continues to be as old as necessary in the philosophy of science. That continued necessity is recognizable in the title not only by the words' new approach' and 'reconsidered', but also by referring to famous works concerning a somewhat familiar subject, such as Dupré's paper (1983) "The Disunity of Science", first published on 1983, and ten years later, his book *The Disorder of Things: Metaphysical Foundations of the Disunity of Science* (1993). Of course, Ruphy's book title is not an exclusive reference to Dupré but also to any author interested in the debate on unity/disunity of science, such as Galison and Stump's book *The Disunity of Science: Boundaries, Contexts, and Power* (1996), where Ian Hacking, who was the primary source of inspiration to Ruphy, published the chapter "The Disunities of the Sciences" (1996). Ruphy's book title also refers to other books addressing scientific pluralism, such as the famous book of Kellert, Longino, and Waters titled *Scientific Pluralism* (2006). Thus, Ruphy wants to contribute to the debate of unity and disunity of science through the debate of pluralism and monism, as it is taken in the already classic Kellert's book which, non-incidentally, it is now reconsidered. Why so? One of Ruphy's criticisms about Kellert's pluralist stance (2006) is that it is a position that does not cut off too much philosophical ice due to their argument against a form of monism that actually does not have much adherence among monists.

Moreover, in Ruphy's book title, we can also notice the separation of the word disunity by parentheses, which is a clear reference to the philosophical position commonly targeted by pluralists, i.e., the unity of science and related views as reductionism/monism, traditionally carried by the Vienna Circle program. Regarding that, for instance, Ruphy (2016) reminds us that at the core of the Vienna Circle's

program of the unity of science, there was a question that she thinks is still relevant. The question was "whether or not there exist different kinds of things that can be known only in different ways" (2016, p. xv. From now on I will use just the number of the page). Ruphy thinks that an appropriate answer to that question is negative because an affirmative answer would only ontologically reinforce reductionism, and even if we take it from the pluralist and antireductionist side, it would boil down to the trivial claim that not all phenomena are equal. Accordingly, the negative answer is appropriate "precisely because several styles may be mobilized to study given type of objects (forest fires, galaxies), and the domain of application of a style is not ontologically marked out; on the contrary, it is open and revisable" (31).

Nonetheless, the book aims to investigate an appropriate answer to that question found in the Vienna's program through debates on unity/disunity, reductionism/antireductionism, and monism/pluralism. However, to do that, Ruphy tries to scrutinize especially pluralists' and antireductionists' arguments against reductionists (like vertical and horizontal reductionism), as well as a way to address the unity of science. Thus, Ruphy mentions that her approach is much more focused on understanding those pluralist answers to the reductionist program, regardless of whether it is a vertical reductionism ("all our scientific theories could be reduced to one master theory in microphysics"(58-59)) mostly targeted by antireductionists as Kitcher, Fodor, and Dupré, or horizontal reductionism as that one targeted by Cartwright ("a view about the scope of applicability of scientific laws. It states that there are such things as universally valid laws" (59).).

Unsurprisingly, to fulfill that aim, Ruphy covers most of the principal authors who have been interested in those topics. Thus, among the most examined authors, the reader will see views and concepts found in Nagel, Oppenheim, Putnam, Neurath, Dupré, Cartwright, Kitcher, Fodor, and Hacking, as also as her own view called "foliated pluralism", which is influenced by Hacking's pluralist styles of scientific reasoning (1992, 1994). After presenting a series of persuasive arguments, the reader may conclude that, although there may be a disagreement with Ruphy's proposal of foliated pluralism, there remains a strong advocacy for reevaluating the necessity of scientific pluralism.

On this account, if nowadays pluralists want to cut off philosophical ice, her suggestion is to deal with science from an internalist stance, i.e., "a commitment to the idea that answers to philosophical issues about features of science (e.g., reducibility issues, the existence of natural kinds in science, the coexistence of incompatible representations, etc.) should remain dependent on (evolvable) characteristics of the epistemic context, and hence are revisable" (133). In a few words, her internalist stance is, as she stated in chapter three, practically constrained by those features. Therefore, no argument for universal or general validation of pluralism should be employed. Instead, as she stated in chapter two, we must adopt a

temporally qualified view of scientific pluralism, which is "dependent on a given stage of the development of the theories or branches of science involved" (133). Now that we have a broad picture of the book let us take a closer look at its chapters.

The book is broadly divided into three very articulated chapters. Chapter -1 mainly aims "to elaborate a philosophically substantive form of ontologico-methodological pluralism" (12), which inevitably requires a dialogue with Vienna's program. According to Ruphy, that is still a breathing subject of "whether or not there exist different kinds of things that can be known only in different ways, which was one of the central questions for the Vienna Circle, and especially Carnap, remains a very interesting question philosophically" (xv). She gives a negative answer to that question because a positive one would require a metaphysical commitment from pluralism that, whether embraced, it would become a victim of its own criticism against monism.

That is why Ruphy addresses not only how the multiplicity of languages, methods, and objects reflect a call for a practical systematic turn to pluralists, already made since Suppes's paper "Plurality of science" (1978). Indeed, it also reflects Ruphy's contending with the pluralist idea that "the mere acknowledgment and description of the multiplicity of X" (xii), being x methods, theories, or objects, would not suffice. To Ruphy, any form of reconsidered scientific pluralism, such as Hacking's or her foliated pluralism, must go beyond that mere acknowledgment. A contemporary scientific pluralism needs to truly make it "possible to grasp certain features of contemporary scientific practices…", and specifically, those features that she takes "…as essential" (xv).

However, what are these essential aspects of scientific practice? Furthermore, how do other forms of pluralism also overlook them? The short answer is the integration of the scientific reasoning styles with the ontological enrichment, resulting in foliated pluralism. Four main properties constitute the foliated pluralism. Those four main properties are 1- transdisciplinarity (given the ontological enrichment and plurality of styles, any scientific reasoning cannot be restricted "to a discipline or a scientific domain" (32)), 2- synchronicity and 3- nonexclusiveness (the requirement of "simultaneously several styles of scientific reasoning" (32)), and 4-cumulativeness ("styles of reasoning tend to accumulate in the development of science…", although a new style "…does not supersede an already existing one but rather it enlarges the palette of modes of reasoning" (32)).

Moreover, what is philosophically intriguing about her foliated pluralism is, as the name suggests, the concept of foliated standing in contrast to other pluralisms while also indicating its target. Accordingly, first, the word 'foliated'"conveys a contrast with 'patchwork' pluralism" (32). The reason is that the word 'foliated' not only stands against monism or reduction but also diverges from other

pluralisms, such as Cartwright's (1999) metaphysical nomological pluralism and the notion of a patchwork world. Second, beyond the contrast with other pluralisms, the notion of foliated upholds that there are different sciences and kinds of scientific knowledge. Each one calls for "specific methods of inquiry and the subject of distinct disciplines" according to their own aims (32). A consequence of this is that the plurality of styles of reasoning "simultaneously superpose various modes of knowledge" covering/erasing "traditional disciplinary borders" (32).

That superposition, foliation, comes with substantial ontological consequences, "ontological enrichment", besides methodological and epistemic effects as well, since "the use in scientific practice of different styles of reasoning widen and diversify the classes of propositions that can be true or false about them" (31). Thus, scientists do not only add new entities to their bestiary of entities; instead, "new kinds of entities gives rise to an ontological enrichment of the objects studied by science" (30-1).

The second chapter - Intertheoretic relations and their metaphysical import- focuses on arguments about unification/disunity by different forms of reduction and nonreduction of theories, as much as diversified antireductionists' answers to these challenges. Ruphy shows that antireductionists' disagreement with the ontological unification of science, often found in intertheoretical reduction, is built upon two general strategies. Those strategies are based on the so-called generally valid arguments, i.e., a form of metaphysical import with a universal extension of its elements. The first strategy adopted by antireductionists against intertheoretical reduction usually claims for "autonomous levels of explanation in nature" (38), as macro and micro levels, and the second one claims that the idea of the very reduction is impossible (38) due to the structure of the world. These strategies trap antireductionism in the same pitfalls that reductionism is accused of falling. Therefore, Ruphy states that antireductionists should abandon the generally valid argument, sticking with the so-called temporally qualified "epistemically reliable explanatory practice of scientists" (41), which is sensitive to internal aspects of science such as contexts, aims, fields, and questions.

Among its advantages, Ruphy reminds us that reductionists, as Nagel (1961), are one of the main targets of those two strategies and admit that a temporally qualified argument works better rather than a generally valid argument. Of course, not every antireductionist would be satisfied with that partial triumph. However, another advantage of being far from the generally valid argument strategy is not losing touch with scientific practice. For instance, since "(creative) scientists are opportunistic: they will be reductionist (or, for that matter, antireductionist) whenever it pays off" (52), the fruitfulness "of 'local' reductionist methodologies is an empirical, temporally qualified issue" (52). The argument for general validation falls into scientifically uninteresting discussions, and it "turns out to be meaningless as a

metaphysically realist claim" (58). According to Ruphy, the starting point for pluralists should be "the contention that the representations delivered by science depend on our practical and epistemic interests" (82). That is important because her internalist approach points out the thesis of double relativity. The double relativity "not only does our image of the world in terms of order or disorder vary depending on the evolution of our best theories, but it can also vary depending on the questions that we happen to ask about the system being studied with a given theory" (78). In other words, the double relativity thesis has nothing to do with epistemic relativism. Rather it refers to how our scientific image of the world are directly related with our best theories and the questions guiding our research. Naturally, this seems to be a pacific statement, but one that carries disputable consequences.

Notwithstanding that, Ruphy does not deny the importance of metaphysics in scientific debate but rather only highlights that the unification of theories, or as she calls it, synthetic intertheoretical unification (75), which is different from ontological unification, is a matter of practical and non-systematic needs and must be treated as such, even by pluralists antireductionists. An example is "the synthesis between genetics and the theory of evolution" (76), where no ontological import follows from that nonreductive intertheoretic relation. We will see that the same claim is made in chapter three but concerning structuralism and monism. To undermine both cases, she concludes the chapter two agreeing with Carnap and Neurath that "the issue of the unity of the object domain of science and the issue of the unity of laws and theories by reduction should be treated separately" (79).

Based on that, Ruphy embraces a temporally qualified view under her internalist stance of science and its practical issues, such as scientists' interests, questions asked, aims, and contextual limitations. Furthermore, her internalist stance on scientific theories goes hand in hand with the thesis of double relativity, which concerns "first, relativity to a given theoretical framework but also, secondly and more radically, relativity to the questions asked within this framework", that is, to questions of what pays off and what does not (77).

In Chapter 3, the author will focus on the plurality of representational models instead of theories and laws. To do that, she will debate some cases of incompatible representational pluralism and how her internalist stance applies. Throughout the chapter, Ruphy argues that mature science can also be pluralist friendliness, especially from representational practices in science, which is now spread. She mentions two cases in astrophysics. First, throughout the practice of simulating the universe and our galaxy with two computational models (Sky and Besançon), and second, in taxonomic practices of stellar classifications. With respect to the universe models, Ruphy says that astrophysics' models and submodels are chosen according to philosophical and investigative interests that result in a path dependency of models, which

consequently yields persistent incompatible pluralism. For instance, in the Milk Way's modelings, Ruphy explains the source of that persistent incompatible pluralism. She argues that it is a product from the astrophysicist's lack of means for testing "the submodels independently against data" (105). Thus, to realize a test about any submodel, that "submodel often needs to be interlocked with other submodels" (105), which is part of a path dependency between these models and other submodels, ending up in that persistent incompatibility.

That experience of persistent incompatibility yielded her to what she called an *epistemological embarrassment*: "the existence of a persistent plurality of incompatible but equally empirically successful models" (94). Besides, she argues that such persistent incompatibility of multiple accounts does not need metaphysical foundations. That persistent incompatibility is a result of context-dependency (she calls path dependency of models and submodels), questions made, investigative interests, and needs at play.

Moreover, that persistent incompatibility, as Ruphy states, is an extension of Hacking's styles of scientific reasoning, with a plurality of ontological and methodological consequences that decline any metaphysical import, which also relates ontological and theoretical dimensions. Furthermore, how compatible or incompatible forms of plurality explore pluralism of representations is "welcome and easily justifiable as a methodological precept aimed at maximizing epistemic success" (90). In contrast, drawing any metaphysical conclusions about the world or its complexity is useless.

Another case explored in the chapter to support incompatible pluralism is the taxonomic practices in stellar classifications. The question underneath the case is if, in what sense, stellar kinds are natural kinds. Ruphy argues that similarity parameters in stellar classifications do not mean that stellar kinds are natural kinds, at least in the traditionally philosophical essentialist and realist sense. Ruphy complains that philosophers' debates on natural kinds differ from scientists'. Scientists are more likely to take pragmatic constraints than philosophers.

An especially enlightening case of that distinction between philosophers and scientists regarding natural kinds problems is seen through the so-called taxonomic nomadism of stellar classifications. Taxonomy nomadism, by and large, is the idea that whatever the privileged parameters used for classifications, they are not permanent. In stellar's case, since stars may "not have the same spectral type, class of luminosity, mass loss, and so on, throughout its life" (122), then the properties used for stellar classifications are seen as "transitory properties" (122). In other words, taxonomic nomadism not only conflicts with the traditional philosophical concern with a metaphysical base for "the existence (or lack thereof) of a 'natural order'" (111) but also that practice is "an embarrassment for certain philosophical

standpoints on natural kinds" (123), and therefore "it is a feature much appreciated by astrophysicists" (123), even if not so much by philosophers.

That is peculiarly noticed in taxonomic monism due to usually philosophical requests for "one unique way of classifying things" (127) or when for "metaphysical claim about the objectivity and uniqueness of the distinction demarcating natural kinds." (127). For instance, when looking for a taxonomic (similarity, privileged) parameter, scientists search for measurable (manifested) features that can be applied to a large number of members of a phenomenon and used to derive internal properties of that phenomenon, creating a link between directly observable and indirectly observable features. That is also how astrophysicists classify stars, linking observable (such as the class of luminosity) and unobservable properties (such as intrinsic brightness). On this account, Ruphy reminds us that "[o]bservational access to structural properties is thus mediated by theoretical modeling" (120) in an open-ended theory-ladenness approach where theoretical modeling of measurable empirical features "were measurable for a large number of stars and that were deemed significant from a theoretical point of view" (119).

In conclusion, most of chapter three is a long argument to establish the distinction between those philosophical and scientific practices, working as background for the general question on pluralism-monism about the scientific enterprise and how the examples support her internalist stance. On this account, although philosophical tides turned in favor of incompatible pluralism, it does not mean that we have any fundamental reason to believe that it will always be or should always be that way. There is no reason to fall into the metaphysical trap of supporting pluralism from an alleged demand, as pointed out by Kellert et al. (2006), "that some parts of the world (or situations in the world) are such that a plurality of accounts or approaches will be necessary for answering all the questions we have about those parts or situations" (134).

On the contrary, she urges us to keep compatible and incompatible pluralism, at least in "our epistemic horizon" (135), because, in this non-separatist fashion, pragmatic motivations in the scientific enterprise can be easily observed. On this account, we will be guided by pragmatic concerns that nature belongs to science, as investigations need, aims, interests, path dependency, context, and running out of money also does belong to the nature of research.

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