

Kant's Space of Theoretical Reason and Science: A Perspectival Reading¹

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Abstract: This paper aims to show how Kant's account of theoretical reason can inform the contemporary debate over unity and pluralism of science. Although the unity of science thesis has been severely criticized in recent decades, I argue that pluralism as the sole epistemic principle guiding science is both too strong and too weak a principle. It is too strong because it does not account for the process of theory unification in science. It is too weak because it does not answer the question of how science ought to be done. I then look at a promising 'perspectival' (i.e., epistemically situated) approach to the problem Kant presents in the Appendix to the Transcendental Dialectic. I argue that the logical principles of systematicity (homogeneity, specification, continuity) form a 'perspectival space' within which scientists can pursue both unity and disunity of cognition. Finally, I suggest that the existing conflict between pluralism and unity ultimately resides in a metaphysical characterization of unity that does not correctly capture its epistemic significance in science. Looking at Kant's 'perspectivism' not only allows us to resolve this apparent antinomy, but also to rethink unity and pluralism as mutually inclusive regulative principles.

Keywords: unity of science, pluralism, perspectivism, reason, systematicity, Appendix

1. Introduction: unity, pluralism, and perspectivism

The unity of science thesis ('monism')—the idea that unity plays an important, if not crucial, role in the investigation of nature—has been severely criticized from many quarters in recent decades.² Only a small minority of philosophers of science would now defend the once popular metaphysical claim that science is a unified system which is supposed to reflect the unity of nature.³ Setting here aside metaphysical questions regarding the unity of nature and its correspondence to scientific representations, critics have further argued that unity is not a welcome hypothesis even from a purely *epistemic* point of view. It is on the latter point of view—in particular, with respect to *scientific theorizing*⁴—that I will focus my attention in this paper.

¹ Preprint version. To be published in Caranti, L. and Pinzani, A. (eds.) 2021. *Kant and the Contemporary World*. London: Routledge.

² Early criticism of the unity of science thesis can be found in Suppes 1978. More recent criticism in Dupré 1996, Cartwright 1999, and Chang 2012, discussed below.

³ Proponents of this claim include, e.g., Paul Oppenheim and Hilary Putnam; see their paper, "The Unity of Science as a Working Hypothesis" (Oppenheim and Putnam 1958).

⁴ I use 'scientific theorizing' to refer to the construction and employment of theories in science, broadly construed.

Dupré, Cartwright, Chang, and many others have in different ways argued that unity is not a desirable epistemic requirement in the actual practice of how most of scientific research is conducted. For instance, Dupré 1996 has argued that theoretical unity is socially and politically undesirable; Chang 2012 that it is such an unreachable requirement that we are better off not looking for unitary theories. Even more radically, it has been argued that such a thesis would detrimentally affect science as it would lead us to privilege systematic considerations over more valuable empirical evidence (Cartwright 1999). Such accounts are undoubtedly persuasive. It is uncontroversial that the present state of scientific theorizing is characterized by a plurality of models, theories, and classifications, each revealing different aspects of phenomena. Pluralism—the view that phenomena cannot be fully explained by a single theory and, instead, require a plurality of theoretical approaches for their investigation—seems the meta-scientific principle that is best suited to guide scientific research.⁵

There is a plurality of views about scientific pluralisms and the description I offer here is only a primer to a much complex topic. But what all pluralists seem to agree on is that the plurality of approaches that presently characterizes most areas of scientific investigation does not necessarily represent a “deficiency” of science (Kellert et al. 2006: x) A recent and influential account—‘perspectivism’ or ‘perspectival realism’ (Rueger 2005; Giere 2006a; Teller 2011; Massimi 2018)—feliculously captures and motivates this aspect of pluralism. Multiple approaches and theories are nothing but different *perspectives* from which we investigate phenomena. Given our epistemic limitations—the point of view we occupy—science is perspectival through and through.

According to Giere’s perspectivism, not only is scientific observation perspectival because of the limited sensitivity of the instruments we use (partiality of the input, non-transparency of the instrument), scientific theorizing (from data models to scientific principles) is perspectival too: “Newton’s laws characterize the classical mechanical perspective; Maxwell’s laws characterize the classical electromagnetic perspective; the Schrödinger Equation characterizes a quantum mechanical perspective”, and so on (Giere 2006a: 14). As noted by Massimi, while Giere’s perspectivism focuses on historical considerations, other types of perspectivism, like the one advocated by Rueger 2005 and Teller 2011, privilege the cultural situatedness of our knowledge over the historical one (Massimi 2018: 168–9). As a result, they focus on the synchronic coexistence of different theories rather than on their development over time. While there are significant disanalogies between the two forms of perspectivism, they both share the insight that our epistemic limitations fundamentally condition the possibility of scientific knowledge. In both cases, the plurality of approaches is not to be regarded as a defect of our knowledge. It is instead the inevitable result of the epistemic situation we occupy.

If we accept that pluralism characterizes the way we need to think about nature, there seems to be no room left for a principle of unity in science. Indeed, as I will show in the next section, most pluralists (within and outside perspectivism) reject monism as a valuable epistemic principle in science. Such rejection, however, raises a number of concerns: Does the acceptance of pluralism inevitably entail the exclusion of unity from a purely epistemic point of view? Is

⁵ For the distinction between plurality and pluralism, see Kellert, Longino, and Waters 2006: ix-x.

pluralism sufficient as the only epistemic principle guiding scientific research? Isn't it possible to redefine scientific pluralism and monism as non-conflictual principles? In the remainder of this paper, I will try to address these questions and suggest a reconciling solution. I will first problematize the contemporary understanding of the relation between unity and pluralism in science (Section 2); I will then look at a *perspectival* approach to the problem Kant's presents in the *Critique of Pure Reason* (Section 3); finally, I will try to explain how Kant's perspectivism might inspire the current debate (Section 4).

2. Unity vs. pluralism: an 'antinomy' that awaits a solution?

The debate between pluralism and unity I briefly introduced in the previous section seems to present us with two mutually exclusive epistemic principles. Scientific research should be guided *either* by a pluralistic principle *or* by a postulated unity of scientific cognition. Since pluralism has proven to be empirically more suited to scientific research, one should fully endorse it and reject monism. I contend that such incompatibility is not the inevitable upshot of two contradictory principles. Rather, it results from a misleading characterization of these very principles. As I will argue, pluralism and monism can and, indeed, must coexist and complement each other in scientific research.

Let's first try to better qualify the conflict between pluralism and monism in the current debate. As previously mentioned, pluralism comes in different varieties. I will here focus on the variety of pluralism proposed by Kellert, Longino, and Waters in their programmatic volume on scientific pluralism, namely "empirical pluralism", or the "pluralist stance" (Kellert et al. 2006: xiii). This version of pluralism is meant to avoid the limits of weaker and stronger formulations of pluralism, while remaining representative of most pluralist takes. Empirical pluralism amounts to a "commitment to avoid reliance on monist assumptions in interpretation or evaluation coupled with an openness to the ineliminability of multiplicity in some scientific contexts" (ibid.). With respect to scientific theorizing, this definition implies: i. (negatively) that an empirical pluralist should not rely on any monist assumption while elaborating scientific theories; and ii. (positively) that an empirical pluralist is open to the possibility of a persistent multiplicity of incompatible, yet explanatory, theories describing phenomena.

As can be seen, the incompatibility with monism is built into the very definition of empirical pluralism. But what kind of monism should a pluralist avoid? As Kellert, Longino, and Waters put it, scientific monism is the view that "the ultimate aim of a science is to establish a single, complete, and comprehensive account of the natural world" (ibid.: x). Crucially, scientific monism assumes that "the nature of the world is such that it can, at least in principle, be completely described or explained by such an account" (ibid.). Scientific monism is therefore defined as a metaphysical thesis about the *nature* of the world. Pluralists do not, however, support the opposite metaphysical claim. Instead, they argue that whether such theories might be unified is an "open, empirical question" (ibid.). I side with pluralists in thinking that unity cannot be simply stated as a metaphysical truth about the nature of the world. But I want to problematize the resulting rejection of monism as such. If we rule out unity as a metaphysical truth, does this mean that it cannot still play an important role from an epistemic point of view?

I suggest that empirical pluralism, as the sole epistemic principle guiding scientific research, is, at the same time, both too strong and too weak a requirement. It is too strong for it does not fully account for the process of unification existing in science: history provides us with brilliant cases of theory unification (Einstein's special theory of relativity is paradigmatic in this sense) and there are fields, like fundamental physics, in which unification still plays a significant and programmatic function (e.g., in the quest for a theory of 'everything' that unifies the four fundamental forces). It is true that pluralists do not deny the possibility of unification—they treat it as an open question—, but the process of theory unification remains epistemically unexplained. If we commit ourselves to avoid monist assumptions, how could we even attempt to unify theories in the first place? The empirical pluralist's reply that evidence should guide us is clearly ill-equipped to provide a satisfactory answer. Empirical evidence is exactly what prompts pluralism and it is unclear how it can lead us to unificatory hypotheses without relying on a different set of assumptions. Indeed, theory unification is rarely possible on experimental grounds alone—the construction of the electroweak theory being a clear example of such evidential insufficiency for unification (see Morrison 2008: 49).

Furthermore, a pluralistic programme which is merely satisfied with a plurality of approaches and strategies seems also too weak a principle. For it does not really address the question of how scientific research *ought* to be done. Shall we regard the multiple approaches and theories presently available as the definitive ones? Or shall we look for ever finer-grained descriptions and explanations? An empirical principle of pluralism leaves us with no definite answer to such concerns. Indeed, since it rests content with any given plurality of theories, it seems insufficient to express the very pluralistic urge that motivates it.

Some pluralists have come to explore the possibility of complementing pluralism with some weaker—metaphysically uncommitted—forms of monism. Giere's perspectivism is emblematic in this respect. Although perspectivism is the pluralistic view that there is a plurality of legitimate historically (or culturally) motivated perspectives on phenomena, Giere recognizes that there are cases in which it is indeed recommendable to unify perspectives into larger points of view. What we need to do is not to introduce a metaphysical doctrine of the unity of the world. We need instead to complement perspectivism with a mere "methodological presumption", according to which "we presume there is a unique causal structure to the world" (Giere 2006a: 34; see also 2006b: 36). Importantly, this should not be regarded as a necessary requirement of our reasoning: it is an additional desideratum of our scientific practice that might lead us to further unifications. As Giere puts it:

From a perspectival point of view, one need not be too upset with the current situation in theoretical physics. Good theoretical science does not require finding genuinely universal principles. Well-fitting models, based on a variety of principles, are good enough. And, indeed, that is all that can be found across most of the sciences. (Giere 2006b: 33)

The picture here suggested is of a self-sufficient epistemic principle of pluralism that may be complemented by a principle of unity at a higher level of inquiry. In other words, the two epistemic principles are compatible at different levels: while pluralism is necessary for scientific research *as such*, monism might turn out to be a useful methodological maxim when it comes to

particularly ambitious scientific projects. I will argue, however, that the compatibility between pluralism and monism does not merely concern the possibility of further unification in science. Further unification is, as it were, the tip of the iceberg of a larger problem. Unification, I suggest, is an on-going process that is ubiquitous at any level of science and is implied even at the level of the pluralistic image of models.

The self-sufficiency of pluralism, even at the ‘basic’ level of science, is indeed questionable. Take two standard examples of ‘perspectives’ in the history of science: Newton’s theory of motion and Maxwell’s theory of electromagnetism. It is difficult not to see these two perspectives as *themselves* instances of unification. Newton’s theory famously unified celestial and terrestrial mechanics. Maxwell’s theory brought together electromagnetism and optics. Both theories (despite being ultimately incompatible) showed that different phenomena can be successfully unified with each other. More generally, to do without a principle of unity at the basic level of science would be to discourage the very process of theory construction, namely the hypothetical subsumption of different phenomena under general, abstract principles. To quote Giere’s own example, it would require “something like concluding that different samples of the same radioactive isotope had different half-lives and that no further explanation of this difference was possible” (Giere 2006a: 34–5). This example clearly goes a bit further than showing that a mere desideratum of unity might be added to a self-sufficient principle of pluralism. It seems to suggest, instead, that unification—as a methodological rule—is an epistemic principle that necessarily complements pluralism even at the basic level of scientific inquiry.

There seems to be no contemporary account that offers promising solutions to this debate. But following Kitcher 1999 and Breitenbach and Choi 2017, I submit that a solution can be inspired by Kant’s account of theoretical reason in scientific cognition. Rather than presenting a loosely Kantian-inspired interpretation of the role of unity in science, however, I will look into Kant’s text to see whether it directly offers arguments that may be used in the current debate.⁶ Crucially, although Kant is generally presented as a strong advocate of the unity of science thesis, I will argue that Kant’s conception of systematic unity contains—perhaps surprisingly—compelling remarks on the compatibility between unification and pluralism in the space of reason. “Insightful men”—Kant notes at the end of the first part of the Appendix to the *Transcendental Dialectic*—are “in conflict with one another” as to whether they should follow a “maxim of the manifoldness of nature” or the one “of the unity of nature” in empirical investigations (A667/B695).⁷ As I will explain, the incompatibility between these two maxims results from an apparent ‘antinomy’ of reason: the antinomy, however, soon disappears as we recognize the principles that ground the maxims as regulative principles rather than opposed objective insights. As such, Kant says, “these maxims can of course be united” (*ibid.*).

⁶ Kitcher presents a Kantian-inspired ‘modest unificationism’ that tolerates multiple accounts, but still aims to reduce their number. Inspired by Kant’s notion of systematic unity, Breitenbach and Choi 2017 make a convincing case that the unavoidable plurality of accounts should not discourage our attempt to integrate them in a unified system. While my paper greatly benefits from both contributions, I will try to present Kant’s systematic unity not merely as an ideal of unification but as a conceptual space that result from both unification and pluralism.

⁷ References to the *Critique of Pure Reason* follow the standard A and B pagination, citing Kant 1998. All other Kant citations refer to the *Akademie* edition and to the English translation used.

In particular, I suggest that an interesting variation on perspectivism can be found in Kant's conception of reason.⁸ While standard perspectivism focuses on the plurality of observational points of view, Kant's 'perspectivism' privileges the common space within which different perspectives can be taken up. Kant's space of reason is a place where plurality and unity can and indeed must coexist with each other as principles, or 'axes', that are both essential to scientific theorizing. In the following section, I will elaborate on what I take to be the three crucial features of Kant's perspectivism (i. ideas as *foci imaginarii*; ii. plurality of points of view; iii. the unified space of reason). In the final section, after some clarification on the difference between Kant's treatment of the problem and the contemporary debate, I will explain how Kant's perspectivism might enlighten the discussion.

3. Kant's perspectival space of reason

3.1 *The regulative function of reason*

Kant addresses the problem of the systematic unity of our empirical cognition in the very much debated Appendix to the Transcendental Dialectic in the *Critique of Pure Reason*.⁹ In the Appendix Kant finally presents the long-promised positive use of reason and its ideas. Ideas are "deceptive" and "transcendent" when they are mistaken for "concepts of real things" (A643/B671). The Transcendental Dialectic shows that when we treat mere ideas as such—when, for example, we treat the idea of God as that of an object and we even attempt to demonstrate its existence—reason inevitably oversteps the boundaries of possible experience. Ideas, however, do retain a "good" and "*immanent*" use when directed not toward objects, but towards the faculty that, in Kant's architectonic, directly has to do with objects, namely the faculty of the understanding, or the faculty of concepts (see A126). Reason, in its positive use, is therefore presented as a second-order faculty. While the understanding has to do with objects, reason, as Kant puts it, "does not *create* any concepts (of objects) but only *orders* them and gives them that unity which they can have in their greatest possible extension, i.e., in relation to the totality of the series." (A643/B671) As a result, in Kant's terminology, the employment of reason cannot be *constitutive* as that of the understanding. The concepts of the understanding constitute the objects of experience, but reason, as we saw, is further removed from objects. Reason maintains, however, an important *regulative* function: that of guiding the activity of the understanding by ordering its particular concepts.

From these two closely related features of reason (its being a second-order faculty and having a regulative use) it would seem that its contribution to empirical cognition is a useful tool, or, at best a welcome desideratum.¹⁰ Kant's point would be similar to that of those pluralists who are willing to concede some role to unification in science. Although pluralism has proven to be

⁸ A similar proposal (with respect to realism in science) can be found in Massimi 2017. This paper is, however, non-committal to the realism of scientific theories and focuses instead on the epistemic features of perspectivism.

⁹ Particularly in its first part (A642/B670–A668/B696).

¹⁰ E.g., Guyer has famously argued for this position: "Systematicity is not a factor which enters into understanding's constitution of empirical knowledge itself, but only an additional desideratum which reason seeks to find or construct in the empirical knowledge produced by understanding" (Guyer 1990: 28).

efficacious in most cases, we might keep a methodological principle in favour of unity. Good science—they argue—does not require unity, yet we might desire or even look for higher forms of unification in some specific cases. A weak principle of unity is all that pluralist science may at best need. However, I contend that this is not a good depiction of Kant’s position, and further, that Kant has good reasons to think about unity and pluralism in a different way. Reasons that—as I will show in the last section—can be applied to the current debate (with some caveats). Importantly, Kant characterizes the regulative use of reason not just as desirable or useful, but as “an excellent and indispensably necessary” one (A644/B672). As emphasized by Massimi, this indispensably necessary use is clearly presented in ‘perspectival’ (and ‘optical’) terms (see Massimi 2017, forthcoming). Let’s take a closer look at the Appendix in order to understand what kind of perspectivism is here at stake. I contend that Kant’s perspectivism is best described by the following three main features.

3.2 First perspectival feature: *ideas as foci imaginarii*

The first perspectival feature of Kant’s account of reason has already attracted considerable attention in the literature. Kant presents the necessary function of ideas of reason in clear optical terms. Drawing upon optical treatises of his time, Kant defines the ideas of reason as *foci imaginarii* (imaginary standpoints) for the rules of the understanding.

[Transcendental ideas] have an excellent and indispensably necessary regulative use, namely that of directing the understanding to a certain goal respecting which the lines of direction of all its rules converge at one point, which, although it is only an idea (*focus imaginarius*)—i.e., a point from which the concepts of the understanding do not really proceed, since it lies entirely outside the bounds of possible experience—nonetheless still serves to obtain for these concepts the greatest unity alongside the greatest extension. (A644/B672)

In describing ideas as imaginary standpoints, Kant is presumably referring to the VIII axiom of the first book of Newton’s *Opticks* (1704).¹¹ It is worth comparing the Kantian example with its source.

¹¹ See, e.g., Grier 2001: 37, and Allison 2004: 425. Massimi forthcoming notes that Kant does not mention Newton in the *Appendix* nor in the *Dreams of a Spirit-Seer* (1766) where the metaphor appears for the first time. She then argues that Kant’s source is actually Descartes’s *Treatise on Man* (which Kant did mention in 1766). While it is plausible that Kant inherited the metaphor from Descartes, I also maintain that Kant was at least partly inspired by Newton’s *Opticks*. In the *Dreams*, just after mentioning the *focus imaginarius* for the first time, Kant explains this analogy by using the example of an object reflected by a concave mirror—interestingly, the same image appears in the second part of the VIII axiom (see Newton 1952: 19 and Ak. 2:344; Kant 1992b: 331–2). Furthermore, as I will argue below, the ‘optical illusion’ Kant is talking about perfectly matches Newton’s description of the illusion occurring when an object is reflected by a mirror.

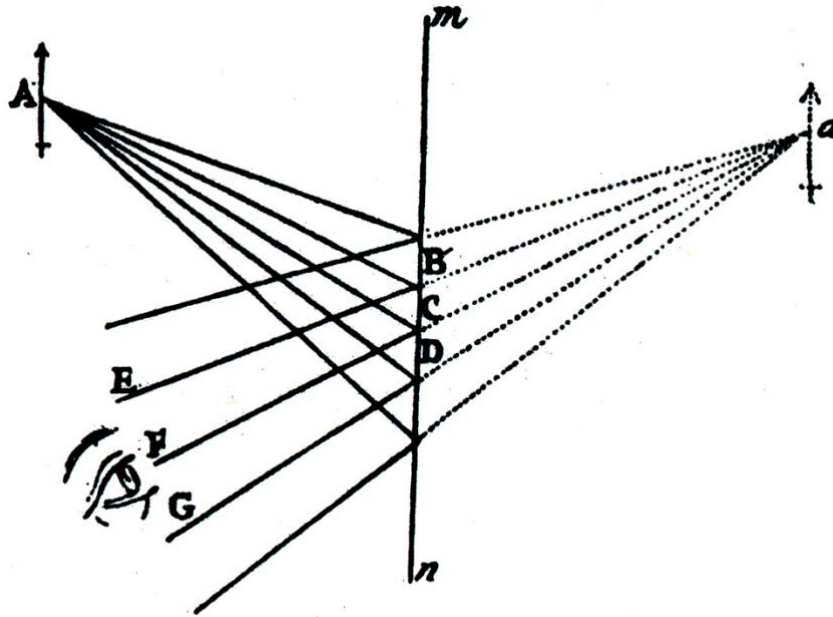


Figure 1. Illustration of the VIII Axiom, from Newton's Opticks (4th edition, 1730)¹²

According to the VIII axiom, an object (A) reflected by a mirror (*mn*) appears to be in the place (a) from where all the rays diverge towards the observer.¹³ As the focal point (a) unifies all reflected lines and guides the eyes of the observer, ideas of reason unify the manifold of concepts and guide the understanding. Kant illustrates this use of reason with a number of examples taken from a variety of scientific disciplines: chemistry (“*pure earth*”, “*pure water*”, and “*pure air*”; A646/B674), psychology (“*fundamental power*”; A649/B677), astronomy (planetary motion; A663/B691), physics (“*gravitation*”; A663/B691) and biology (“*hereditary distinctions between families*”; A667/B695). In each of these cases, reason projects an idea in order to bestow unity upon the particular cognitions of the understanding. In projecting ideas, however, reason runs the risk of taking them as concepts of real objects. But as we saw, ideas cannot be regarded as concepts of objects. As Kant explains:

Now of course it is from this that there arises the *deception*, as if these lines of direction were shot out from an object lying outside the field of possible empirical cognition (just

¹² Reprinted in Newton 1952. Permission to reproduce the image granted by Dover Publications.

¹³ “AX. VIII. An Object seen by Reflexion or Refraction, appears in that place from whence the Rays after their last Reflexion or Refraction diverge in falling on the Spectator’s Eye. If the Object A be seen by Reflexion of a Looking-glass *mn*, it shall appear, not in its proper place A, but behind the Glass at *a*, from whence any Rays AB, AC, AD, which flow from one and the same Point of the Object, do after their Reflexion made in the Points B, C, D, diverge in going from the Glass to E, F, G, where they are incident on the Spectator’s Eyes. For these Rays do make the same Picture in the bottom of the Eyes as if they had come from the Object really placed at *a* without the Interposition of the Looking-glass; and all Vision is made according to the place and shape of that Picture” (Newton 1952: 18).

as objects are seen behind the surface of a mirror); yet *this illusion (which can be prevented from deceiving) is nevertheless indispensably necessary if besides the objects before our eyes we want to see those that lie far in the background*, i.e., when, in our case, the understanding wants to go beyond every given experience (beyond this part of the whole of possible experience), and hence wants to take the measure of its greatest possible and uttermost extension. (A644–5/B672–3; my emphases)

What is the optical “illusion” Kant is referring to? Newton’s axiom may help us answering this question. The real object (*A*), which is placed behind the observer (and thus outside her visual field), appears to be in front of her (that is “behind the surface of a mirror”; *mn*), in the place *a*. The illusion is thus created by the fact that the reflected image is almost identical to the vision we would have if *A* were really placed in *a*.¹⁴ This seems to be exactly the optical phenomenon Kant uses in order to explain the ideal ‘vision’. The rays between *mn* and *a* represent the illusion that enables the observer to extend the visual field from the space between her and the mirror (given experience: *EB*, *FC*, *GD*) to the space between the mirror and *A* (possible experience: *AB*, *AC*, *AD*). The illusion deceives the observer when she mistakes what is merely a focal point (*a*; an idea) for a real object (*A*; an actual object). By doing so, she turns a mere regulative principle into an unwarranted metaphysical principle. Reason, however, can fully recognize the nature of ideas as projections and use them to orient the concepts of the understanding. It thereby becomes critical: it can eliminate the error and legitimately hope to extend its visual field.

Let’s take stock here. While the perspectival nature of the ideas of reason as focal points should be clearer now, the status of necessity attached to them may still raise some perplexity. For Kant seems to formulate such necessity in hypothetical terms: we need to employ ideas only if we want to go *beyond given experience* and attain the greatest unity of cognition. Does this mean that the regulative function of ideas is a mere additional desideratum of science? In other words, are ideas ‘necessary’ only when we look for ‘higher’ unifications? I contend that this is not the case. Indeed, Kant presents this use of reason as *hypothetical*—but it would be a mistake to read it as a mere afterthought of scientific inquiry. Kant says:

If reason is the faculty of deriving the particular from the universal, then: Either the universal is *in itself certain* and given, and only *judgment* is required for subsuming, and the particular is necessarily determined through it. This I call the ‘apodictic’ use of reason. Or the universal is assumed only *problematically*, and it is a mere idea, the particular being certain while the universality of the rule for this consequent is still a problem; then several particular cases, which are all certain, are tested by the rule, to see if they flow from it, and in the case in which it seems that all the particular cases cited follow from it, then the universality of the rule is inferred, including all subsequent cases, even those that are not given in themselves. This I will call the ‘hypothetical’ use of reason. (A646–7/B674–5)

¹⁴ The image is still reversed in the direction perpendicular to the mirror surface.

Reason can be used either apodictically or hypothetically. In the former case, the universal is given and the particular is determined through it; in the latter, the particular is given but the universality of its rule is only projected as a ‘problematic’ concept (i.e., as an idea). Now, to say that the hypothetical use of reason is only necessary for higher unities of empirical cognition would mean to say that at least *some* universal concepts are given to us in experience through concepts of the understanding and empirical intuitions—in other words, from experience.¹⁵ But can we obtain something like universality or apodictic certainty from experience? Kant is quite clear that this is not the case:

Empirical concepts, together with that on which they are grounded, empirical intuition, cannot yield any synthetic proposition except one that is also merely empirical, i.e., a proposition of experience; thus it can never contain necessity and absolute universality [...] No universally valid, let alone apodictic proposition could ever come from empirical intuition: for experience can never provide anything of this sort. (A47–8/B64–5)

As Kant affirms here and elsewhere, experience can never yield any kind of “necessary and apodictic propositions” (A721/B749) for all empirical cognitions are confronted with the problem of induction. If the universal is never given in experience, then it must be hypothetically postulated for *any* empirical concept in accordance with the ideas of reason. The Appendix teaches us that we can employ the regulative ideas of reason in order to extend the rule that we infer from given particular cases to all possible experience: this use of reason necessarily contributes to the formation of any universal empirical concept. And since scientific cognition has to do with such concepts, it also follows that the hypothetical use of reason is necessary to transform any given experience into scientific knowledge.

Kant presents the ideas projected by reason in its hypothetical use as perspectival focal points of unity. This function of reason—which Kant later in the text also calls the “logical principle of genera” (A654/B682) or of “homogeneity” (A658/B686)—is regulative, yet indispensable. It is regulative because reason is farther removed from objects and ideas cannot stand for actual things. In other words, it is not a metaphysical principle that constitutes nature as objectively unitary. Nevertheless, reason’s principle of unity necessarily regulates the conceptualization activity of the understanding. In particular, it projects the universality of given particulars, thus enabling the formulation of universal empirical concepts: an activity which is an integral part of science.

3.3 *Second perspectival feature: plurality of points of view*

¹⁵ It is worth noting that, for Kant, all concepts are universal (“In kind, all concepts are universal and can always hold of other things in a certain way”; see *Vienna Logic*, Ak. 24: 909 (Kant 1992a: 352). Empirical concepts are no exception. Kant often uses ‘empirical concept’, ‘common concept’, and ‘universal concept’ interchangeably in his lectures on Logic: see, e.g., *Blomberg Logic*, Ak. 24: 269 (Kant 1992a: 208). In the Appendix, Kant also reminds that “each species is always a concept that contains within itself only what is common to different things” (A655/B683).

The characterization of ideas as focal points might incline us to think that, for Kant, there is as much science as there is unity. This is, however, only one side of the story. Kant's theory of theoretical reason includes a principle of unity but is not limited to that. As Kant puts it:

To the logical principle of genera there is opposed another, namely that of *species*, which needs manifoldness and variety in things *despite their agreement under the same genus*, and prescribes to the understanding that it be no less attentive to *variety* than to agreement. This principle (of discrimination, or of the faculty of distinguishing) severely limits the rashness of the first principle (of wit). (A654/B682; my emphases)

The principle of "species" ("*variety*"; A657/B685; or "*specification*"; A658/B686) prescribes to look for variety in things despite their being unified under the same genus. I propose to look at this principle as the second perspectival feature of Kant's theory of reason. While the first feature tells us that ideas are focal points of unification, this second principle limits the first one and prescribes to specify each concept in a plurality of points of view.

If this is correct, I contend that Kant's principle of specification is similar enough to contemporary empirical pluralism to draw an interesting comparison between the respective cases. Recall that empirical pluralism has a negative part (i. avoidance of monist assumptions) and a positive part (ii. admission of plurality of accounts). As concerns i., to follow the principle of specification does imply avoiding monist assumptions. One may take Kant's principle of specification to be subordinated to the principle of unity (as a species is subordinated to its genus). But note that Kant's principle of specification is more radical than that:

Here reason shows two interests that conflict with each other: on the one side, an interest in the *domain* (universality) in regard to genera, on the other an interest in *content* (determinacy) in respect of the manifoldness of species; for in the first case the understanding thinks much *under* its concepts, while in the second it thinks all the more *in them*. This expresses itself in the very different ways of thinking among students of nature; some of whom (who are chiefly speculative) are hostile to differences in kind, while others (chiefly empirical minds) constantly seek to split nature into so much manifoldness that one would almost have to give up the hope of judging its appearances according to general principles. (A654–5/B682–3)

While unification universalizes the domain of a concept, this second principle tells us to find variety in the content of a concept. Specification does not merely express the subordination of species *under* genera, but it directly opposes to unification inasmuch as it *disunifies* the content of any universal concept. In Kant's words, "chiefly empirical minds" do not simply specify a given unitary concept into species and subspecies, but they "split nature into so much manifoldness that one would almost have to give up the hope of judging its appearances according to general principles". The two principles therefore result in interests that conflict with each other—a conflict that seems very much alive even today.

What about the positive requirement of admitting multiple accounts of phenomena (ii. above)? Here there seems to be a difference for, while Kant's principle results in the

specification of particular phenomena, a contemporary pluralist welcomes different *accounts* of phenomena. Let's take a typical example of contemporary pluralism: the concept of species. There are different concepts of species: the biological species concept (based on interbreeding), the phylogenetic species concept (based on ancestry), the ecological species concept (based on ecological niches), etc. Pluralists think there is no best account of 'species' and all these concepts are legitimate representations of particular aspects of the complex 'species' phenomenon. Although Kant's terminology differs from the one used in the contemporary debate, I do not see any reason not to regard this and similar cases as contemporary applications of Kant's principle of specification. After all, different concepts of species are nothing but particular aspects of a complex phenomenon and ultimately, they are all based on particular phenomena (interbreeding, ancestry, ecological niches, etc.). Empirical pluralists can therefore be seen as contemporary "chiefly empirical minds" who "split nature" as much as possible by replacing unitary concepts with a variety of concepts of particular aspects of phenomena.

There is, however, a lingering worry, namely that the kind of pluralism resulting from Kant's principle of specification may be closer to what is known in the literature as 'modest pluralism' than to a genuinely perspectival take on scientific investigation (see Kellert et al. 2006: xii–iii).¹⁶ According to modest pluralism (of which Mitchell is perhaps the best-known advocate; see, e.g., Mitchell 2003), scientists must indeed engage in a plurality of accounts, but such accounts are meant to contribute to a single, integrated picture of a complex phenomenon. For an empirical pluralist, no such commitment to 'integration' is necessary. On the contrary, different perspectives (for instance, different accounts of species) may be inconsistent with each other and still enhance our understanding of nature. To answer to this worry, it is important to point out that Kant's principle of specification is uncommitted as to whether the 'particulars' resulting from it contribute to an integrated account of a phenomenon. All the principle *does* prescribe is, instead, to indefinitely split nature into more and more particular phenomena. But if this is the case, one may wonder if it still makes sense to talk about an integrated picture of a complex phenomenon rather than just a plurality of particular accounts. Even for a Kantian "empirical mind" then, the investigation of particular phenomena may not contribute to any single, integrated account of a complex phenomenon.

I have suggested that Kant's principle of specification can be read in a way that invites the evolution towards contemporary perspectivism. We should not forget, however, that in Kant's view this principle, exactly as the principle of homogeneity, can be only *regulatively* employed. This has two key implications that I will fully explore in the following section. First, as a regulative principle, specification does not metaphysically assert that nature is an irreducible manifoldness or variety of things. It is instead a regulative principle that is only meant to promote the empirical investigation of nature. As such, it can be made compatible with an equally regulative principle of unity: indeed, the two opposite principles mutually complement

¹⁶ Thanks to Luigi Caranti for pressing me on this point.

each other.¹⁷ Second, as a non-objective principle, it can legitimately prescribe not just plurality of species, but indefinite specification of concepts.

Reason demands in its entire extension that no species be regarded as in itself the lowest; for since each species is always a concept that contains within itself only what is common to different things, this concept cannot be thoroughly determined, hence it cannot be related to an individual, consequently, it must at every time contain other concepts, i.e., subspecies, under itself. (A655–6/B683–4)

The process of specification can thus be held as indefinite, or potentially infinite.¹⁸ This means that a Kantian “empirical mind” should not be satisfied with a given plurality of concepts of phenomena. Rather, she should constantly seek to further specify and disunify any postulated universal concept.

Kant concludes his account of principles of reason by introducing a third principle—“*continuity*” (A658/B686) or “*affinity*” (A660/B688)—resulting from the combination of the first two.

The last arises by uniting the first two, according as one has completed the systematic connection in the idea by ascending to higher genera, as well as descending to lower species; for then all manifolds are akin one to another, because they are all collectively descended, through every degree of extended determination, from a single highest genus. (A658/B686)

The systematic interconnection of concepts according to unity and disunity results in continuity of concepts, or “continuous transition from every species to every other” (*ibid.*). In other words, reason’s combined presuppositions of conceptual unification (leading to a highest genus) and of (potentially) infinite specification give rise to a unified picture in which, as Kant puts it, all different genera are only “partitionings” of a single genus and there cannot be any “leap” between species (A659/B687). Interestingly, Kant illustrates this principle with an example from astronomy: the highly elliptical path of comets. Empirical observation, explains Kant, does not show us their paths in their entirety, yet we guess at a “parabolic course for them since it is still akin to the ellipse and, if the major axis of the latter is very long, it cannot be distinguished from it in all our observations” (A662/B690). We thereby presuppose an affinity of the paths of comets with those of planets. This is only possible on the basis of the combination of the previous principles. In this specific case, as Kant explains, we conceive the “world system” as both “unbounded” (infinitely specified) and “connected through one and the same moving force” (supremely unified) (A663/B691): such a system allows us to presuppose “continuous transition”

¹⁷ The concepts of genus and species are mutually related. See *Jäsche Logic*, Ak. 9: 97: “Like higher and lower concepts, *genus* and *species concepts* are distinguished not as to their nature, then, but only in regard to their relation to one another (*termini a quo* or *ad quod*) in logical subordination” (1992a: 594).

¹⁸ Kant, however, explicitly rejects the Leibnizian idea of “actual infinity” for, he explains, that would determine the conceptual sphere of division. The logical principle of species only asserts the “*indeterminacy*” of conceptual specification (A656/B684).

in the paths of celestial bodies in general. As for the previous principles, continuity should not be read in constitutive terms either. This last principle does not tell us that the world *is* a continuum: no actual continuity, as Kant explains, can be found in experience (see A661/B689). Continuity is instead a regulative principle which, however, is “legitimate and excellent” inasmuch as it “points the way toward systematic unity” (A668/B696).

3.4 Third perspectival feature: the space of reason

I can now elucidate the third perspectival feature of Kant’s system of knowledge. We saw that the principle of unity and disunity are *perspectivally* characterized in Kant’s theory of reason. The logical principle of unity postulates identity under concepts that allows us to project ideas as *foci imaginarii*. By contrast, the logical principle of variety postulates a potentially infinite specification of concepts that grounds the opposite rational interest of specifying ideas into ever finer-grained parts. Now, I further contend that these two principles (together with the third principle that results from their combination: continuity) make up a perspectival space—Kant’s space of theoretical reason. Within this perspectival space, it is possible to pursue unity as well as disunity of cognition. I will first clarify why I think this is a perspectival feature and then comment on the passages that suggest this interpretation.

Perspectivism is generally presented as the view that there are different standpoints from which we ‘frame’ the world. As the term exploits the metaphor of experientially different perspectives, the emphasis is very much on the plurality and potential disagreement among different points of view. It is in this sense that the term ‘perspectivism’ is generally used in the current debate. But this usage fails to portray another crucial aspect of perspectivism, namely the fact that different perspectives or points of view presuppose—and are only possible within—the same space of representation. It might be instructive to take a brief look at the history of perspective in the arts. Perspective—once a synonym for optics¹⁹—acquired a specific artistic meaning during the Renaissance when artists and theorists (first and foremost, Brunelleschi and Alberti) started applying optical and geometrical studies to the construction of an artistic representation. The art of perspective subsequently spread as allegedly the most accurate representation of reality. As recognized by several art critics, however, this kind of representation was based on a precise conception of space, namely a perfectly homogeneous, infinite, and continuous mathematical space.²⁰ The assumption of this space is the first logical premise in any perspectival construction.

We can apply this consideration to our present case. As perspectival representations are only possible within a precise system of geometrical assumptions about the topology of space, attempts at conceptual unification and specification of phenomena are only possible within a perspectival system or space of representation. Quite remarkably, Kant says that reason “prepares the field for the understanding” by presupposing unity, variety, and continuity of

¹⁹ The Latin word *perspectiva* comes from *perspicere* meaning ‘to see clearly’. It thus amounts to a literal translation of the Greek word *optikḗ*; See Panofsky 1991: 75–6.

²⁰ See, for example, Panofsky 1991: 31. According to Panofsky perspective is a kind of representation in which “bodies are absorbed into a homogeneous and infinite system of dimensional relationships”, that is a “*quantum continuum*” (ibid.: 44). Similar remarks are easy to find throughout the secondary literature (see, e.g., Belting 2011).

concepts (A657/B685). In other words, it presupposes a systematic conceptual framework within which scientific knowledge is possible. Kant goes on to illustrate this ‘conceptual space’ by using once again specifically perspectival metaphors:

Systematic unity under the three logical principles can be made palpable in the following way. *One can regard every concept as a point, which, as the standpoint of an observer, has its horizon, i.e., a multiplicity of things that can be represented and surveyed, as it were, from it. Within this horizon a multiplicity of points must be able to be given to infinity, each of which in turn has its narrower field of view; i.e., every species contains subspecies in accordance with the principle of specification, and the logical horizon consists only of smaller horizons (subspecies), but not of points that have no domain (individuals). But different horizons, i.e., genera, which are determined from just as many concepts, one can think as drawn out into a common horizon, which one can survey collectively from its middle point, which is the higher genus, until finally the highest genus is the universal and true horizon, determined from the standpoint of the highest concept and comprehending all manifoldness, as genera, species, and subspecies, under itself.* (A658–9/B686–7; my emphases)

As the perspectival space is made up of infinite points, each of which potentially represents a point of view, the logical space of reason is made up of concepts as points. Every concept can be regarded as a viewpoint with its horizon, that is, to quote Kant, “a multiplicity of things that can be represented and surveyed, as it were, from it”. This horizon is also a multiplicity of points and each of these points in turn has its own “narrower field of view”. On the one hand, conceptual specification is potentially infinite as there is no such a thing as a species which includes only an individual within its horizon.²¹ On the other, the presupposition of unity leads us to a highest genus encompassing all concepts that must be presupposed as the “universal and true horizon”.

This system of concepts is not, to be sure, how scientific knowledge looks like according to Kant. Indeed, we may never be able to construct such a system. It is, however, the ideal framework according to which empirical cognition can be progressively systematized—that is, unified as well as in(de)initely divided. It is, as it were, a ‘blank’ space which leaves the content of experience completely undetermined. Kant specifies that the unity of reason is “in itself *undetermined* in regard to the conditions under which, and the degree to which, the understanding should combine its concepts systematically” (A665/B693). Reason cannot constitute the content of cognition, yet it provides an ordering template of maximal unity and division of concepts—in Kant’s word, an “*analogue* of a schema” (A665/B693)—that is necessary for us to transform disparate and particular empirical cognitions into scientific knowledge. In other words, the two principles of theoretical reason (unity and specification) together with the principle that results from their combination (continuity) act as the ‘axes’ of an ideal conceptual space within which each “student of nature” is able to systematize empirical cognition according to her inclination (A655/B683). Within such a space, as I will argue in the

²¹ The nature of a concept is such that it can only contain what is common to different things.

next section, we can reconsider the contemporary principles of unification and pluralism as mutually consistent meta-scientific guidelines.

4. A Kantian solution to the ‘antinomy’ between pluralism and monism

In this section, I want to elaborate on how Kant’s theory of systematic unity might illuminate the contemporary debate on monism and pluralism. Needless to say, Kant’s theory is grounded on specific assumptions that might not be shared by contemporary discussants.²² But even taking into account inevitable disanalogies between Kant’s approach and the contemporary status of the debate, one might doubt the very possibility of a comparison between Kant’s treatment of scientific rationality and the current debate for at least two reasons. First, Kant seems to take for granted that systematic unity characterizes scientific knowledge—a characterization that seems to beg the very question at stake in the debate. I already suggested that this is not fully accurate. Indeed, Kant defines scientific knowledge as systematic cognition.²³ But systematic unity is not mere unity, it is a systematic organization of concepts in which unity and plurality play equally important roles and express opposite interests of reason. If this is correct, Kant’s systematic unity should not be merely equated with a regulative ideal of unification or integration of multiple accounts. Since we do not know whether nature is really a unity or a plurality, we should not only aim to unify and integrate our theories as much as possible. Rather, we should pursue *both* maximal unity and maximal plurality as epistemic principles leading to systematic cognition.²⁴

Second, one might find Kant’s taxonomic terminology—‘genera’, ‘species’, ‘transition among species’—ill-suited to be used in the contemporary discussion. While we will probably use neither the image of an all-encompassing genus to describe the ideal of unity nor the idea of an indefinitely specified series of species to illustrate the principle of pluralism, it is not difficult to adapt Kant’s terminology to the present debate. Kant himself suggests a very broad interpretation of those principles. Not only he equivalently uses more general terms like “identity” or “variety” to describe how the principles of genera and species are supposed to work, he also explicitly specifies that these principles concern “not merely things, but even more the mere properties and powers of things” (A662/B690). Interestingly, Kant uses the principles of reason to explain how we implement geometrical and mathematical abstractions in modelling phenomena: for instance, we employ the principle of genera to infer the elliptical path of planets, while the principle of continuity is used when “conceiving hyperbolic paths for comets in which these bodies leave our solar system entirely” (A663/B691). These considerations suggest

²² One, for instance, might question the nature of the Kantian faculties or the logical approach to the investigation of nature to begin with.

²³ “Systematic unity is that which first makes ordinary cognition into science, i.e., makes a system out of a mere aggregate of it” (A832/B860).

²⁴ Cf. Breitenbach and Choi 2017 on this point. They argue that “ideal science” may turn out to be a single theory of everything or a “unity constituted of heterogeneous parts”; “we have to wait nature to tell us” (ibid.: 398). Note, however, that empirical pluralism denies that scientists should aim for the integration of heterogeneous accounts (see 3.3). Such alternative may therefore be too ‘unificationist’ for the empirical pluralist. On my reading, the alternative is not between a single and an integrated unity of nature, but between a unified and a disunified (i.e., non-integrated) account of nature.

that Kant's principles should be read as meta-scientific norms rather than mere taxonomic guidelines.²⁵ A principle of genera, for instance, is invoked not only when we classify different species of things under the same genus (say, 'oak' and 'chestnut' under the genus 'Fagaceae'), but also when we presuppose that the same geometrical or mathematical abstraction describes a property of various phenomena.

What are then the advantages of this comparison and the insights in Kant's account of reason we can exploit? In Section 2, I presented the debate over pluralism. I argued that the contemporary discussion implies that pluralism and monism are incompatible principles. Pluralism is generally interpreted as a self-sufficient principle which either excludes any principle of unity or is complemented by a weak form of monism when it comes to the desire of unifying different theories. I already suggested that both solutions are unsatisfactory, for they do not recognize the role unification plays at any level of science—from 'basic' theory formation to 'higher' theories unification. Moreover, an empirical form of pluralism does not fully express the prescriptive urge that motivates pluralism itself. Kant provides us with a useful meta-scientific framework for thinking about these two principles in a new, possibly more promising way. In what I take to be Kant's variation on perspectivism, unity and pluralism do not give rise to an antinomy but are compatible principles that essentially complement each other. I will now show how each of these two principles and their combination can be reconsidered according to the Kantian framework.

4.1 Regulative unity

We saw that contemporary pluralism tends to neglect the significance of a principle of unity in science. Pluralists only admit a principle of plurality, yet they do not go as far as to affirm that unity of nature is impossible. It is an open question, they argue, whether there *is* unity in nature. From this insight, however, it does not follow that unity should not play any epistemic role in science. From a Kantian perspective we can perfectly agree with the claim that we do not know whether nature is actually a unity—indeed, this is why Kant presents unification as a regulative principle. The rejection of a principle of unity is instead grounded in a misleading characterization of the very same principle. This characterization is parasitic on what Kant would call a metaphysical reading of the principle of unity. According to this reading, the nature of the world is such that can, at least in principle, be fully explained by a single account. In Kantian terms, as we saw, that would mean to be deceived by an 'optical illusion'. To be guided by a perspectival principle of unity is not to determine the nature of the world. It is, instead, to use ideas in order to universalize what is only particularly given to us in experience. Unity, if thought along the Kantian lines, is only a regulatively employed principle and, as such, can be maintained without posing any threat to a principle of plurality.

The regulative status of the principle should not, however, incline us to consider unity as a mere additional desideratum of science. We saw that some forms of pluralism—most notably, Giere's perspectivism—allow weak forms of unification provided that pluralism remains the only necessary requirement when we do science. I suggested, however, that the exclusion of a

²⁵ Guyer 2017: 56–7 makes a similar point.

principle of unity at the ‘basic’ level of science poses an additional challenge. For epistemically situated perspectives are themselves instances of unity: Newton’s theory of motion, Maxwell’s theory of electromagnetism, Einstein’s special theory of relativity are all clear examples of perspectives as brilliant unificatory achievements. Although Giere introduces his methodological principle of unity as an anti-Kantian move (Giere 2006b: 36), Kant would not only agree with the need of a principle complementing pluralism, he would also have internal resources to address the above-mentioned challenge.

In Kant’s perspectivism, unity does not merely play an auxiliary function but is an integral part of the formation of a perspective—each perspective results from an ideal projection and is itself a form of theoretical unity. Furthermore, we saw that the presupposition of identity has not merely a taxonomic import but is equally employed in geometrical and mathematical representations of phenomena. This different kind of perspectivism can therefore inspire an integration of unity into the perspectival picture we are familiar with. If we look at how scientific theorizing works across different perspectives, unification indeed plays an important role. Scientific theories typically contain general and abstract principles that are supposed to *unify* seemingly different cognitions of phenomena and properties of phenomena. As Morrison has shown, this is commonly obtained through the mathematical elaboration of general and abstract frameworks. Such frameworks usually contain “a theoretical parameter, quantity or concept that ‘represents’ the unifying mechanism—that is, a parameter that functions as the necessary piece of theoretical structure that either facilitates or represents the unification of distinct phenomena” (Morrison 2000: 4). In Maxwell’s electrodynamics, for instance, this theoretical unifier is represented by electric displacement together with the Lagrangian formalism.

Granted that unification plays a role in the process of scientific theorizing, one might still ask *why* that is the case. In other words, what is precisely the epistemic function of unification? The answer that unifying our cognitions of phenomena affords a deeper understanding of them is intuitively appealing but needs further clarification. Kitcher and Friedman have proposed influential epistemological models according to which unification is essential to scientific explanation (see Friedman 1974; Kitcher 1981). To put it in Friedman’s word, “science increases our understanding of the world by reducing the total number of independent phenomena that we have to accept as ultimate or given. A world with fewer independent phenomena is, other things equal, more comprehensible than one with more” (Friedman 1974: 15). Despite their plausibility, these models have been faced with a plethora of objections in the last decades. Convincing counterexamples suggest a more cautious distinction between unification and explanation. For example, it has been shown that in some cases unification provides us with little or no explanation—a possible example being the derivation of Mendelian rules of inheritance within molecular cell biology: even if possible, such a derivation would not enhance our understanding.²⁶ More generally, it is commonplace in contemporary science to obtain a deeper understanding of phenomena by pursuing disunity rather than unity at the explanatory level.

The need to problematize the relation between unification and explanation, however, does not undermine the explanatory value of unifying cognitions and theories. Newton’s

²⁶ Example taken from Kitcher 1999: 337.

mechanics, Maxwell's electrodynamics, Einstein's special relativity all successfully explain phenomena by recognizing them as instances of general principles.²⁷ The challenge is rather to understand why there is no simple identification between unity and explanation. This—I argue—is perfectly understandable from the Kantian approach here suggested. It is true that Kant's principle of unification follows a model of explanation in which the universal explains the particular. But crucially, unity is only a *regulative idea* that neither determines the content of cognition nor gives us any assurance that our attempts will succeed. Such an idea only *prescribes* to search, for any given cognitions, for higher explanatory principles.²⁸ Scientists might simply not find truly explanatory universal principles, and, as we saw, universals are only hypothetically postulated—therefore, revisable through further empirical evidence.

As a result, our epistemic necessity to presuppose unity in order to elaborate general principles is compatible with the admission of a gap between unification and explanation. Indeed, given that unity does not commit us to a metaphysical thesis of unity nor to the realizability of a unified system, we have no reason to expect this relation to be otherwise. Explanatory unification may simply be out of reach and we may be better off relying on a plurality of explanations as in the case of non-derivation of Mendelian rules within molecular cell biology. Even when available, theoretical unities should be best understood as “starting points” for further explanation: one might, for instance, argue that Einstein's general relativity offers a better understanding of gravitation than Newton's mechanics (Morrison 2000: 33). In neither case, however, is unity undermined as an explanatory valuable idea that scientists should strive to realize as much as possible—from ‘basic’ theory construction to ambitious theories unification.

4.2 *Regulative pluralism*

Since regulative unity does not posit the existence of a unity of nature, nothing prevents us from also embracing a principle of plurality. Importantly, the use of this principle should not be interpreted in constitutive terms either. The principle of specification does not correspond to the metaphysical assertion that nature is an infinite and irreducible variety or manifoldness. Nor is it the mere epistemic satisfaction with a given plurality of models and theories. As we saw, an unqualified form of pluralism does not fully portray the motivation behind pluralism itself—it is too weak a principle. Regulative pluralism amounts instead to the presupposition of a maximally specifiable system of concepts describing phenomena. While following this principle, scientists are not simply satisfied with a plurality of ‘local’ unities as empirical pluralists seem to suggest. Scientists are instead interested in the progressive, indefinite diversification of phenomena according to ever finer-grained perspectives.

As mentioned in the previous subsection, the explanatory role of pluralism can be as beneficial as that of unification. Since the current system of knowledge is incomplete and hypothetical, unified explanations may be unavailable or too general to be explanatorily satisfactory. This is why it is not uncommon to find disunity at the level of explanation in many fields of contemporary science. We can generalize from this fact. Given that unification is an on-

²⁷ For a discussion of how theory unification does not necessarily imply loss of explanation, see Rueger 2005.

²⁸ Following Willaschek 2018: 66–7.

going process that does not metaphysically reduce particulars to universals, we necessarily need to rely on specific theories to explain particular phenomena or particular aspects of phenomena. To regulatively presuppose pluralism of cognition amounts to the demand to seek for ever more specific theoretical approaches. And such prescription allows us to account for the explanations of phenomena that unified theories are not able to provide us with.

Thinking about unity and pluralism in regulative terms finally answers our initial question on the apparent incompatibility between these two principles in contemporary debates. As Kant argues, an antinomy is taking place between unity and pluralism only when these principles are interpreted as “constitutive” or “objective” principles:

If merely regulative principles are considered as constitutive, then as objective principles they can be in conflict; but if one considers them merely as *maxims*, then it is not a true conflict, but it is merely a different interest of reason that causes a divorce between ways of thinking [...] In this way the interest in *manifoldness* (in accordance with the principle of specification) might hold more for *this* sophisticated reasoner, while *unity* (in accordance with the principle of aggregation) holds more for that one. *Each of them believes that his judgment comes from insight into the object*, and yet he grounds it solely on the greater or lesser attachment to one of the two principles, neither of which rests on any objective grounds, but only on the interest of reason, and that could better be called ‘maxims’ than ‘principles’. (A666–7/B694–5; my emphasis)

As soon as we stop regarding these principles as insights into the nature of objects, the antinomy between them disappears. We are left instead with different “maxims” that, although in conflict with each other, can be reunited as compatible “ways of thinking” in the larger framework of reason. One reasoner may be inclined towards finding unity in nature; another may instead be interested in empirical variety. Although each of them *believes* that her judgment is objectively motivated—that is, constitutive of nature—their conflict does not result from rational incompatibility. It only regards their “attachment to one of the two principles”. I contend that the present debate on pluralism and unity presents us with a similar ‘antinomy’. Monism and pluralism are both legitimate and compatible ‘axes’ of the same conceptual space of scientific thinking. Conflicts arise only when at least one of these two principles is held as an objective insight. Classic metaphysical monism holds unity as an objective truth about the natural world. Empirical pluralism does not fare better than the classic view for it recognizes unity *only* as an objective claim about the world and rejects it altogether. These judgements, however, are mistaken about the very rationale of these two principles. As we saw, both principles, if regulatively employed, are needed to successfully promote the scientific investigation of nature.

4.3 *The space of theoretical reason*

The resolution of the antimony, however, still leaves us with a lingering problem. For if monism and pluralism are regarded as compatible subjective maxims, we seem to have lost the necessary status Kant also attaches to these epistemic principles. Indeed, several interpretations have been misled by Kant’s terminology and suggest a weak reading of the principles of reason as mere maxims (e.g., Guyer and Walker 1990: 227–8; Pickering 2011). As we saw, however,

unity and pluralism are not just welcome epistemic rules, they are necessary, meta-scientific principles. Together they make up a perspectival space in which scientific knowledge is possible. Are scientific maxims compatible with Kant's overall picture? And if this is the case, how can this inspire the contemporary debate? First, Kant's language should not mislead us. The previous passage seems to suggest that objective principles should be replaced by merely subjective, individual maxims. In this way, an antinomy turns out to be a mere conflict between opposed interests. This is correct as far as it goes. However, Kant clarifies:

Reason has in fact only a single unified interest, and the conflict between its maxims is only a variation and a reciprocal limitation of the methods satisfying this interest (A666/B694).

I take reason's "single unified interest" to mean the systematization of empirical knowledge that results from the combination of the principles of reason.²⁹ Maxims are not mere synonyms for the "indispensably necessary" regulative principles as the previous passage may seem to suggest. Instead, they only express the individual attachment each scientist has to one principle rather than to the other. They are therefore merely alternative, yet compatible "methods" and together satisfy the only real interest of reason, namely the construction of the system of knowledge. If this is correct, the fact that scientists may be individually interested in following just one maxim does not undermine the necessity of both unity and disunity as epistemic principles. Although each principle can be isolated as a maxim, systematic unity requires the presupposition of both unity and plurality of cognition for its construction. These principles make up the conceptual space *within* which any individual attempt to maximise either unity or disunity of cognition is possible.

We can finally apply this insight to the contemporary debate. Pluralism and unification should not be regarded as merely compatible methodological maxims. 'Pluralists' are more interested in empirical variety and privilege the axis of plurality; 'monists' are more inclined towards rational unity and therefore pursue unification of cognition. Despite individual conflicts of interests, however, they ultimately share the same meta-scientific conceptual space of investigation. Perspectivism can therefore be reconsidered not just as the place of conflict among perspectives nor as a form of pluralism opposed to monism, but as the common space where different perspectives can always be further unified and disunified. The space of theoretical reason does not, to be sure, prescribe or determine the content of phenomena. Yet, it provides scientists with a template of maximal systematicity of knowledge which grounds the possibility of different, compatible perspectives—either aimed at unity or at disunity of scientific cognition.

Conclusion

I suggested that the current conflict between pluralism and monism is based on a misrepresentation of those epistemic principles. The conflict ultimately resides in a metaphysical characterization of unity in science that does not fully capture the epistemic significance of

²⁹ For a similar suggestion, see Watkins 2017: 26.

monism in scientific theorizing. Looking at Kant's perspectivism in the *Critique of Pure Reason* not only allows us to resolve this apparent antinomy, but also to rethink unity and pluralism as necessary regulative principles. These principles together make up a meta-scientific space of reason, within which each scientist can follow her inclination towards unity or disunity of cognition.

There are several important issues this paper leaves open. Let me conclude by mentioning one which is particularly pressing. I focused on the epistemic function of unity and pluralism within a perspectival framework. I therefore bracketed the question of whether perspectivism may deliver a form of realism in science (and if so, what kind of realism). The two problems are, however, very tightly connected. The problem of realism is indeed prominent in the work of many proponents of perspectivism (see, e.g., Rueger 2005; Massimi 2018). And it is also present in Kant's discussion of systematicity of science. To investigate this issue from a Kantian perspective would require looking more closely at the transition from logical to transcendental principles of systematic unity Kant presents in the Appendix. Kant has a fairly complex story regarding whether and how this transition might be justified. A story that would well be worth investigating in parallel with current debates in contemporary science. As such, however, it falls outside the scope of this paper.³⁰

³⁰I wish to thank Michela Massimi, Alix Cohen, and the audience at the *Multilateral Kant Colloquium* held in Catania in October 2018 for helpful comments on earlier versions of this paper. Special thanks go to Luigi Caranti and Alessandro Pinzani for organizing this volume and the opportunity to submit my contribution. This paper is part of a project that has received funding from the European Research Council under the European Union's Horizon 2020 research and innovation program (European Consolidator Grant H2020-ERC-2014-CoG 647272, *Perspectival Realism: Science, Knowledge, and Truth from a Human Vantage Point*).

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