

Four Kinds of Perspectival Truth

MICHELA MASSIMI

University of Edinburgh

In this paper, I assess recent claims in philosophy of science about scientific perspectivism being compatible with realism. I clarify the rationale for scientific perspectivism and the problems and challenges that perspectivism faces in delivering a form of realism. In particular, I concentrate my attention on truth, and on ways in which truth can be understood in perspectival terms. I offer a cost-benefit analysis of each of them and defend a version that in my view is most promising in living up to realist expectations.

I. Introduction

Among the many varieties of realism and antirealism in science, perspectival realism is the latest attempt at bypassing dichotomous divisions. Perspectival realism promises to be a house with two mansions where realists can find shelter from relativism, while Kuhnians may find refuge against ‘objectivist’ realism.¹ Central to the view thus stated is the metaphysical tenet that states of affairs about the world are *perspective-independent*; whereas our scientific knowledge claims about these states of affairs are *perspective-dependent*. That there are electrons is a state of affair about nature and its ultimate constituents. But that electrons have half-integral spin (as opposed to being structural features of an elastic ether) depends (in some sense to be clarified) on our currently accepted scientific perspective.

Can our scientific knowledge claims be *perspectival*, while also being claims about the world as *it is*? The perspectival realist seems hard-pressed to elucidate the *prima facie* attractive distinction between perspective-independent states of affairs *versus* perspective-dependent knowledge claims. After all, either electrons are structural elements of an elastic ether. Or, they are not. And scientific knowledge claims about electrons should stand true or false accordingly (independently of any scientific perspective in which they might be couched). The missing link between perspective-independent states of affairs and perspective-dependent knowledge claims is a notion of *perspectival truth*, my topic here. What is it like to be *true within a scientific perspective*? Is perspectival truth a coherent notion in the balancing act between realism and relativism in science?

The prospects of defending a suitable version of perspectival truth are not as unpromising as they might seem. For perspectival truth—I argue—is neither truth

¹ See Giere (2006).

indexed to a scientific perspective; nor truth relative to a scientific perspective. It is instead still the realist's truth, tracking perspective-independent states of affairs. Yet, it is perspectival because it meets contextual truth-conditions, which I understand as standards of performance-adequacy laid out by any given scientific perspective. For perspectival truth to become then a live option in the realism debate in philosophy of science, the perspectival realist owes us an account of how meeting standards of performance-adequacy pertinent to a given scientific perspective may be compatible with tracking perspective-independent states of affairs. Such an account is expected to take care of perspectival truth understood not just as truth across *diachronic* (Kuhnian-like) scientific perspectives, but also across *synchronic* (model-based) scientific perspectives.² I argue that when faced with pressing metaphysical questions about the properties of water, electrons, atoms, or else, the perspectival realist should not waver. For it is possible to be realist about science, while also taking on board the situated and perspectival nature of our scientific knowledge claims.

This paper attends to this task. Section II clarifies the nature of both the realist and the perspectivalist considerations at play in a viable notion of perspectival truth. Section III presents three main kinds of perspectival truth that in different ways aim to reconcile the realist and the perspectival rationales. Their respective problems are assessed in Section IV. A fourth way of thinking about truth within a perspective is defended in Section V, where its prospects are scrutinized vis-à-vis mounting challenges coming from realist and antirealist quarters.

II. The normativity of realism and the perspectival threat

What is it like to be *true within a scientific perspective*? And why does this question matter? Consider a scientist, for example J.J. Thomson, at the end of the nineteenth century, working on cathode rays within a broadly Lorentzian electromagnetic worldview. On this worldview, electrons were the minimal unit of electric charge embedded in an elastic ether. With his experiments on cathode rays, J.J. Thomson concluded that cathode rays consisted of corpuscles with a certain mass-to-charge ratio. Thomson did not identify his 'corpuscles' with Lorentz's or Larmor's 'electrons', for after all his corpuscles were not features of an elastic ether.

What is to be said about J.J. Thomson's scientific knowledge claims? To an extent, they did track perspective-independent states of affairs (e.g., the mass-to-charge ratio of the entity at work in cathode rays). Yet, they were so intertwined with the scientific perspective of the time (in terms of ether vs. corpuscles) that to the eyes of a contemporary

² In what follows I use the term "scientific perspective" loosely to refer to the actual—historically and intellectually situated—scientific practice of any real scientific community at any given historical time. I understand scientific practice broadly to include: (i) the body of *scientific knowledge claims* advanced by the scientific community at the time; (ii) the experimental, theoretical, and technological resources available to the scientific community at the time to *reliably* make those scientific knowledge claims; and (iii) second-order (methodological-epistemic) claims that can *justify* the scientific knowledge claims so advanced. Diachronically, in the history of science, Ptolemaic astronomy, Newtonian mechanics, and so forth are examples of what I call a scientific perspective. Synchronically, at any given time in the history of science, rival modeling practices for the same target system are also examples of what I call a scientific perspective. Despite important dissimilarities between the diachronic and the synchronic notion of scientific perspective, for my present purpose in this paper I will not make a distinction between the two, and I will use the term "scientific perspective" to refer to both interchangeably.

scientist, they would hardly qualify as still *true* about electrons. When stated thus and so, the problem is not new. It has been the battleground of real realism, semi-realism, and structural realism for decades.³ It has even triggered historiographical disputes about *who* really discovered the electron.⁴

But the question that is still wide open—my meta-question here—does not concern *what* we can be realist about (e.g. electrons as opposed to the ether). But instead, *how* we can be realist at all, once we take seriously the lesson coming from the history of science. *Truth within a perspective* invites us to pause and think about how it may be possible for our scientific knowledge claims to track perspective-independent states of affairs within the ever-changing bounds of scientific perspectives.

The scientific realist is not going to be too impressed by this perspectival move. For the one true theory about the electron (or the atom, or anything else) is regarded as an asymptotic limit towards which scientists are marching across centuries of heroic efforts, building on their predecessors, and getting some things right (and some other things wrong) about the object under investigation.⁵

This irenic realist picture, sadly, flies in the face of the epistemic pluralism that is so distinctive of scientific inquiry. Both across historical periods, and in any given historical period, science witnesses a plurality of models, theories, experimental techniques, and measurement apparatuses—all designed to investigate the very same target system. It is not just that our theories of the electron have shifted remarkably over a century to the point that one can ask whether J.J. Thomson's electron is the same as Bohr's electron, or Dirac's electron, or QED electron.⁶ But also within the current scientific perspective, thirty inconsistent models of the atomic nucleus, four main families of incompatible models for the atom, three different experimental procedures (in vitro, in vivo, in silico) for protein folding can be found.⁷ The scientific realist's temptation to sweep this epistemic pluralism under a rug in the name of the One True Theory faces a reality check.

Scientific practice forces us to take on board the ubiquitous phenomenon of epistemic pluralism in science, and to re-think accordingly the epistemological tenet behind scientific realism that acceptance of a theory involves the *belief that the theory is true*. Our beliefs about which theory is true do change over time and across scientific perspectives. Epistemic pluralism and perspectival considerations of this kind should shake the realist's

³ See Kitcher (2001), Chakravartty (1998), French (2014).

⁴ Falconer (2001).

⁵ For example, a scientific realist might think that J.J. Thomson's scientific knowledge claims are either true or false. Some of them (i.e. the mass-to-charge ratio) turned out to be true. Others (i.e. the so-called plum-pudding model of the atom) were simply false. A scientific realist would then insist that there are *perspective-independent states of affairs* that count as the final tribunal for the truth or falsity of scientific claims and that is all there is to be said about truth in science, perspectivism notwithstanding. Or better, a scientific realist would insist that the situated nature of our scientific knowledge does not affect what can be said about which knowledge claims count as true and which count as false. But the main problem with this scientific realist view is that it explains away the ubiquitous phenomenon of incompatible or even inconsistent scientific perspectives, a phenomenon that—as we are going to see—cannot be easily dismissed.

⁶ See Bain and Norton (2001).

⁷ See Morrison (2011), Chakravartty (2010), Mitchell and Gronenborn (forthcoming).

epistemological tenet about believing *the theory to be true*.⁸ For, after all, if our scientific knowledge is situated, perspectival, and hence inevitably pluralistic, how can *anyone* ever be in the position of knowing whether *her belief that the theory x is true* is indeed correct? How could J. J. Thomson ever know that his belief about the electron as a corpuscle with a certain mass-to-charge ratio was indeed true (as opposed to Joseph Larmor's belief about the electron being a structural element of an elastic ether)? Moreover, both scientists couched their scientific knowledge claims in the language of 'corpuscles' and 'ether' (respectively) that is no longer ours, and it does not map onto what we take to be perspective-independent states of affairs about the electron *by our own lights now*.

Perspectival truth becomes then an invitation to pause and think about *how* we may still be realist about science *despite* this epistemic pluralism and the ever-changing bounds of our scientific perspectives (historical and not). One may then ask what is the minimal realist commitment that should be upheld in cashing out a viable notion of perspectival truth. And, vice versa, why perspectivalism poses a hurdle to it. This Section addresses these two related questions.

Minimal realist commitment, first. A minimal realist commitment can be found, a commitment that proves resilient to mounting challenges from the history of science, or rival inconsistent models in contemporary science. *Getting things right* is not a disposable commodity, nor a matter for voluntaristic stances. Getting things right is at the heart of the realist programme: constructive empiricists, instrumentalists, relativists, and constructivists do not share the same commitment, because they do not share with the realist a suitable notion of 'rightness'. *Getting things right* is not the aim of science, because it is not what science should *aspire to* (assuming one has realist leanings). Instead, it is what science *ought to do* by realist lights. Science *ought* to map onto reality in a truthful way. Thus, to judge a scientific theory or model as *true* is to judge it as one that 'command our assent'. It is this normative dimension (implicit in the epistemological component: i.e. *believing that theory x is true*) that antirealist views typically lack (imagine a constructivist intimating that scientific theories ought to make facts; or a conceptual relativist prescribing that scientific facts ought to be relative).⁹ Getting things right is a *norm* about what we take science to be about; i.e. mapping onto nature in a truthful way, in the simple-minded sense of making our scientific knowledge claims correspond to

⁸ Of the three distinctive components of scientific realism (metaphysics, epistemology, and semantics), it is only the epistemological component that is here under question (for this threefold definition of scientific realism, the *locus classicus* is Psillos 2000). Perspectival realism, as I like to understand it, shares with scientific realism the metaphysical component (i.e. mind-independent and perspective-independent states of affairs) and the semantic component (i.e. the language of science must be read literally). But it parts its way from scientific realism because it understands the epistemological component (*belief in the truth of the theory*) as subject to the aforementioned perspectival question (i.e. how can *anyone* ever be in the position of knowing whether *her belief that the theory X is true* is indeed correct?). Thus, my goal in this paper is to re-think this epistemological component so as to make progress on the broader issue of perspectival realism, as a live contender in the debate over realism in philosophy of science. It is not my intention to come up with a new theory of truth that bypasses the classical correspondence theory of truth, or alternative theories of truth (i.e. coherence or warranted assertibility or else). Instead, my goal is to clarify what it is like to be a realist about science while also acknowledging that our beliefs in the truth of any scientific theory are inevitably situated and perspectival.

⁹ A possible exception here is constructive empiricism, which might intimate that scientific theories ought to be empirically adequate, as opposed to getting things right, where being empirically adequate does not commit to any truthful mapping of a mind-independent reality. Yet this possible normative dimension seems at odds with van Fraassen's (2002) empirical stance and voluntarism.

perspective-independent states of affairs that can adjudicate their truth or falsity. Thus, a notion of perspectival truth that wants to be kosher to the realist programme must fulfill this minimal realist commitment, in the first instance.

However, perspectival considerations pose a hurdle to the prospect of fulfilling this minimal realist commitment. After all, *how* can anyone ever know that she/he is indeed *getting things right*? The default realist answer to this question takes the form of an *argument from success*. For it would seem that scientific knowledge claims are true (or get things right) to the extent that they are either *explanatorily* or *predictively* successful (or both). Hence, justification for the belief that theory *x* is true (or gets things right) seems to accrue via a suitable notion of scientific success—what I am going to call success *from nowhere*. A scientific knowledge claim that lacks the distinctive mark of *success* (in explanation or prediction) is false, on pain of miracles and cosmic coincidences, no matter in which perspectival idiom might be couched. *Let success be our guide!*

Yet critics have not failed to note that this realist notion of success is problematic. For either it is all-inclusive, by the standards of success of each historical period (be it nineteenth-century ether theory, or ancient Greek crystalline spheres). Or, it is exclusive, at the cost of having to provide an *ex post facto* justification for what counts as success in science (electrons-qua-leptons are successful, but Thomson's corpuscles or Larmor's electrons were unsuccessful).¹⁰ *Whose* success (the perspectivalist asks)? And *by whose lights*? Surely, Thomson's corpuscles (and his belief in their truth) proved successful in the late nineteenth century scientific perspective, as much as belief in electrons-qua-leptons is successful in our own current scientific perspective. The scientific realist's notion of success harks back to an implausible *view from nowhere* that is at odds with historical records and epistemic pluralism.

On the other hand, perspectival considerations (and the epistemic pluralism that accompanies them) seem to force the argument from success to buy into a view of success either *from everywhere* or *from here now*, neither of which is promising in delivering on the minimal realist commitment.¹¹ It is the very *normative* dimension of realism that is in fact threatened by perspectival considerations, in their historical form and not. In their historical form, scientific perspectives seem to shun universal rules and cross-perspectival norms. For core to the perspectivalist project is the Kuhnian idea that different professional communities, as "producers and validators of scientific knowledge"¹² disagree about the tools and norms relevant to their scientific inquiry. In their non-historical form, scientific perspectives—qua rival incompatible models for the same target system—seem to preclude the very possibility of cross-perspectival evaluation (e.g. What is the right model for the atomic nucleus, among the thirty available ones? What are the right properties of water in between hydrodynamics and statistical mechanics?).

Perspectival considerations of this kind might invite us to embrace a view of success *from everywhere*, i.e., by the different standards and interests of different communities of inquirers. But going down this route would jeopardize the very possibility of cashing out a viable notion of perspectival truth, a notion that could serve the purpose of perspectival realism qua a form of realism. The fortune of perspectival truth would be entangled with the fortune of standards of rightness idiosyncratic to scientific perspectives. Success *from*

¹⁰ For a move along these lines, see for example, Stanford (2006) and (2009).

¹¹ For more details about these various notions of scientific success, please see Massimi (forthcoming).

¹² Kuhn (1962, p. 178).

everywhere would deliver an impoverished perspectival truth incapable of tracking nature, getting things right, and ultimately grounding scientific knowledge claims as *true*, i.e. as commanding our assent.

Prospects are not rosier for success *from here now*. Despite the temptation to retrieve a privileged epistemic platform to assess scientific success—unsurprisingly perhaps, *ours now*—such view would be too chauvinistic to do justice to knowledge claims of different scientific perspectives. Moreover, such view would be self-defeating. After all, the indexical nature of success *from here now* would entitle Aristotelians, no less than Medieval Scholastics, to reclaim as their own a notion of success *from there then*, from which conflicting truths would ensue. A view of success *from here now* would produce a tensed version of perspectival truth, whereby scientific knowledge claims true *here and now* become false *there and then* as soon as new scientific perspectives come to the fore. Should we safely conclude that the prospects of cashing out a viable notion of truth within a perspective are doomed?

Not so fast. In the next Section three kinds of perspectival truth are presented. Each of them, in different ways, promises to reconcile the minimal realist commitment of mapping onto nature *truthfully* with perspectival considerations about our scientific knowledge claims being always cast *within the bounds of specific scientific perspectives*.

III. Three kinds of perspectival truth

Perspectival truth, with its minimal realist commitment and perspectival considerations, needs be probed deeper. A good starting point is the exact nature of perspectival considerations. What is it at stake in the platitude that scientific knowledge is always *from a particular vantage point*? Perspectivalism in science is usually understood as capturing the following view:

(P) *Perspective-dependence*. Knowledge claims in science are dependent on a given historically and/or intellectually situated scientific perspective.

(P) is an epistemic view about scientific knowledge claims and their being historically and/or intellectually situated.¹³ (P) is not a metaphysical view about reality. As such, there is nothing in the perspective-dependence captured by (P) that is *prima facie* at odds with the aforementioned normativity of realism, whereby theories *ought to be true* in the simple-minded sense of corresponding to, or mapping onto (perspective-independent) states of affairs in nature. Unsurprisingly, perspectivalism is usually presented as being compatible with realism, and at a distance from relativism. Yet, (P) is a rather unqualified claim, and in what follows I spell out three possible ways of understanding (P).¹⁴ A first natural way of understanding (P) is as follows:

¹³ Namely, their being situated in the historical context, say the caloric theory of the early nineteenth century; or, in a particular intellectual context, for example Boltzmann's statistical mechanics at the end of the nineteenth century, or the current Standard Model in particle physics. Our task ahead is then to clarify the ways in which (P) might be integrated with the epistemological component (i.e. *belief that theory x is true*) typical of scientific realism, to produce a viable notion of perspectival truth (see footnote 8 above).

¹⁴ Perspectivalism has recently attracted attention in a variety of different fields in philosophy, where the need of clarifying exactly what is at stake in the platitude of perspective-dependence has arisen. For perspectivalism in metaethics, see Schafer (2014); for causal perspectivalism, see Ismael (2016).

(P₁) *Perspective-dependence*₁. Knowledge claims in science are perspective-dependent₁ when their *propositional contents* depend on the scientific perspective in which such claims are made.

(P₁) captures what might be called a form of *perspective-indexicality*, following John MacFarlane's terminology.¹⁵ On this first way of thinking about (P), scientific claims such as <The Earth is orbiting the Sun>, or <The electron has half-integral spin>, or any other, are akin to sentences such as <It is sunny here>. Such sentences have indexical nature and express different propositional contents, depending on whether it is me uttering the sentence <It is sunny here> today, 18th March 2016, in Edinburgh; or my friend Mary today in Chicago. Similarly, on the 18th March 2016 the sentence <The Earth is orbiting the Sun> expresses the proposition that the Earth is orbiting the Sun on the 18th March 2016. But on the 8th September 1638 this sentence expressed a different proposition, namely that the Earth was orbiting the Sun on the 8th September 1638.

Expressing different propositional contents implies that different states of affairs (about the Earth orbiting the Sun on the 18th March 2016 and on the 8th September 1638, respectively) make these two propositions, respectively, true. Thus, perspective-dependence₁—understood as a form of *perspective-indexicality*—implies a first kind of perspectival truth whereby (historically or else) scientific perspectives can be regarded as providing different *truth-makers* for seemingly identical knowledge claims. The indexicality at play in (P₁) needs not be understood as a *temporal* indexicality (as in the example above). It is instead, first and foremost, indexicality with respect to a given scientific perspective (hence the temporal aspect of it, since scientific perspectives are temporally situated). *Perspective-indexicality* seems to be a distinctive feature of the scientific representation that models afford.¹⁶ On this view, scientific representation (like cartographic representation) is always perspectival and indexical because it is always from a well-defined vantage point, i.e. that of the model employed for representing the target system. Although these discussions are not usually framed in terms of propositional contents and truth-makers, the perspectival and indexical nature of scientific representation can be understood in terms of different contents/truth-makers that make model-based knowledge claims in science true.

But there is also a second way of understanding perspective-dependence:

(P₂) *Perspective-dependence*₂. Knowledge claims in science are perspective-dependent₂ when their *truth-values* depend on the scientific perspective in which such knowledge claims are made.

¹⁵ See MacFarlane (2009).

¹⁶ See Bas van Fraassen (2008, pp. 85–86, emphasis added): “Perspectivity and indexicality are closely related but the distinction is of equal importance. The terms ‘perspective’ and ‘perspectival’ are central to how we understand scientific representation. (...) a visual perspective has an origin—the painter’s eye in one-point perspective being the paradigm example. Secondly, it has an orientation: the direction in which this eye or camera is looking. Thirdly, *the content of this visual perspective is expressible in an indexical judgment* ‘that is how it is from here, looking in this direction, with that my left, this my right, yonder my above...’ The question is least simple when it comes to verbal description. When is a description perspectival? When it is a description from a certain point of view—but ‘point of view’ is subject to the same fluctuations in use as ‘perspective’. A hallmark we can look for in the case of language is the occurrence of indexical terms or phrases. Among these I include demonstratives such as ‘this’, ‘those yonder’, as well as the more obvious ‘I’, ‘you’, ‘here’, and ‘now’. (...) On the other hand I would resist calling a description perspectival on the sole ground that some reference to the individual or communal users’ experience is indispensable to understanding its terms”.

(P₂) captures a form of *perspective-relativity* whereby, by contrast with (P₁), the propositional content expressed by a given scientific knowledge claim is the same in every scientific perspective, but it takes different truth-values in different perspectives. On this second way of thinking about perspective-dependence, scientific claims expressed by sentences such as <The Earth is orbiting the Sun>, or <The electron has half-integral spin>, or any other, express the same propositional content in every perspective (namely, that the Earth is orbiting the Sun, and that the electron has half-integral spin). But while, say, the first proposition is deemed true in our perspective and in Galileo’s one, the same proposition is deemed false in the Ptolemaic perspective.

Thus, perspective-dependence₂—understood as a form of *perspective-relativity*—implies a second kind of perspectival truth whereby different scientific perspectives ascribe different *truth-values* to the same (perspective-invariant) content of a given knowledge claim. (P₂) *relativises* truth-values: it is a form of *relativized truth*. (P₂) can capture perspectival considerations about truth being relative to scientific perspectives¹⁷ while also maintaining that nature consists of well-defined and perspective-invariant states of affairs. On this view, that the Earth is orbiting the Sun, or that the electron has half-integral spin are claims amenable to being either true or false in different scientific perspectives, because of the specific way in which each perspective may define how perspectival models *fit* (or do not fit) the relevant states of affairs in the world.

Finally, here is a third possible way of thinking about (P):

(P₃) *Perspective-dependence*₃. Knowledge claims in science are perspective-dependent₃ when their *truth-conditions* depend on the scientific perspective in which such claims are made.

(P₃) captures a form of *perspective-sensitivity* whereby the propositional content expressed by a given knowledge claim is neither indexed to perspectives (pace P₁), nor invariant across perspectives with *truth-values* relativised to perspectives (pace P₂). (P₃) delivers instead a form of *contextualism*: scientific perspectives provide the *circumstances* or *context of use* defining the *truth-conditions* for knowledge claims in science.¹⁸ (P₃)

¹⁷ I read Ron Giere, (2006, p. 81, emphasis added), along the lines of P₂: “Is perspectivism itself true or false? If it is true, then there is at least one claim that is non-perspectivally true. So if perspectivism is true, then it is false (. . .) So perspectivism is false. As I see it, this argument simply begs the question. It assumes that truth has to be understood in objectivist terms, which is just what perspectivism denies. *For a perspectivist, truth claims are always relative to a perspective.* (. . .) I focus on the physical characteristics of instruments (including the human visual system) and principles defining generalized models”. Giere understands this as a claim about the physical characteristics of scientific instruments and principles defining what he calls “generalized models” so that “Claims about the truth of scientific statements or the fit of models to the world are made within paradigms or perspectives” (ibid., p. 82).

¹⁸ Apropos of DeRose’s contextualism, MacFarlane has pointed out the variety of meanings captured by the idea that *truth-conditions depend on context*: “There are at least six different things that might be meant by ‘truth condition’ here: (i) function (in the mathematician’s extensional sense) from contexts to truth values, (ii) rule for determining truth values based on features of context, (iii) function from circumstances of evaluation to truth values, (iv) rule for determining truth values based on features of circumstances of evaluation, (v) function from possible worlds (and perhaps times) to truth values, (vi) rule for determining truth values based on features of possible worlds (and perhaps times). All of these notions can come apart. Because it is rarely clear which of them is meant by ‘truth condition’, that term is best avoided altogether” (MacFarlane 2009, p. 236, ft 7). In what follows, I take truth-conditions to refer to “rules for determining truth values based on features of the context” understood as context of use (i.e. the context in which the scientific claim is made and employed). And the key idea is that such rules are laid out by the context of use.

cashes out a different kind of perspective-dependence by making the truth-conditions for any knowledge claim vary with the *context of use*.¹⁹ For example, the sentence <The Earth is orbiting the Sun> can be taken as having truth-conditions that vary with the context of use, depending on whether the sentence is uttered by me today (in which case its value would be true); or it is uttered by Bellarmine in the context of Galileo's trial (in which case its value would be false). On this reading, scientific perspectives *contextualize truth-conditions* for knowledge claims in science.²⁰ Perspectival truth₃ becomes then *contextualized truth* within the bounds of partial, conflicting, idealized representational schemes or *contexts of use* (to use my terminology here). Consider the following example:²¹

a. <Water is a liquid with viscosity>

The truth-conditions for this scientific knowledge claim are sensitive to the perspectival *context of use*. If the context of use is hydrodynamics, which treats water as a fluid having fundamental properties such as density and viscosity, then a. is certainly true. If the context of use is statistical mechanics, which treats water as a discrete statistical collection of molecules, then a. is false. Perspectival truth₃ so defined still abides by the minimal realist commitment of *getting things right*; but it does not treat the propositional content of our knowledge claims as fixed and well-defined *independently of the context of use*. Truth with capital T recedes instead into an inaccessible and unspeakable realm. In its place stand many scientific perspectives, each providing an access—partial, idealized, and imprecise that it may be—to a world of perspective-independent states of affairs.

¹⁹ Perspective-sensitivity is akin to what MacFarlane would call *use-sensitivity* (see MacFarlane 2005). As a result, (P₃) entails (P₂) because it makes the truth-values of scientific knowledge claims depend on the specific circumstances or truth-conditions typical of a given *context of use*. But (P₂) does not in turn entail (P₃). For (P₂) assumes that the propositional content of a given knowledge claim is always well-defined and invariant across perspectives (even if its truth-value varies with perspectives). By contrast, (P₃) buys into the contextualist view that the propositional content of a given knowledge claim is *undetermined* until the truth-conditions inherent in the context of use have been specified. Thus, (P₃) involves a kind of indeterminacy in the propositional content that is alien to both (P₁) and (P₂), where the propositional content is always well-defined (i.e. it is either indexed to perspectives, or invariant across perspectives).

²⁰ Recently, Paul Teller has advocated a view seemingly close to what I here call perspective-dependence₃. According to Teller, scientific perspectives should be understood as *idealized representational schemes*, or idealized interpretations of the world that do not get things exactly right: "To attribute truth to a statement is to evaluate it for success in its representational function. But in our messy world, such a success is an exceedingly complex affair. As with any complex subject matter the best we can do is to offer idealized models that get part of it 'right', which models we then evaluate for their strengths and weaknesses. This, in practice, is the best that science has to offer" (Teller 2011, p. 467). Teller argues that we can transform false precise statements (e.g. "John's height is six feet precisely") into true yet imprecise ones (e.g. "John's height is six feet close enough"), where the latter can still function as a *true* representation of a real state of affair. In the suitable *conditions of applications*, both sentences count as true: the first despite its inaccuracy, and the second despite its imprecision. Teller call them "semantic alter-egos" and compare what he calls the "conditions of applications" (i.e. the conditions under which the sentences apply) to context-sensitive truth-conditions with two important caveats: (a.) no completely determined, contextual fill-in truth-conditions can *in practice* ever be identified; (b.) even if there were in practice a mechanism to fill in truth-conditions, no such mechanism would count as "executing a completely determined set of truth conditions" (Teller 2011 p. 469).

²¹ See again Teller (2011) for a similar example.

How promising are these three different kinds of perspective-dependence in delivering a viable version of perspectival truth? Their respective problems and prospects are reviewed in the next Section.

IV. What prospects for perspectival truth?

Can (P₁) deliver on the promise of *truth within a perspective*? (P₁) invites us to regard scientific knowledge claims as indexed to scientific perspectives, when their propositional contents, or better their *truth-makers* depend on the scientific perspective in which such claims are made. Following Armstrong's truth-maker theory,²² let us take truth-makers to be states of affairs that make a truth such <p> true in the sense of providing an *ontological* or *metaphysical ground* for it.²³ Central to perspectival truth₁ are two key ideas: (i) that truth is *ontologically grounded* in worldly states of affairs; and (ii) that the worldly states of affairs that act as ontological grounds for scientific knowledge claims are *perspectival*, i.e. inherent in a scientific perspective. Thus, *indexing* truths to scientific perspectives means finding worldly states of affairs that can both *act as ontological grounds*, and *be inherent in a given scientific perspective*. What worldly states of affairs are eligible candidates for perspectival truth₁ so understood?

A major problem affects perspectival truth₁. For we are left with the conundrum of explaining how in a different perspective (say, the Ptolemaic perspective), a knowledge claim that in our current perspective is regarded as true (e.g. <The Earth is orbiting the Sun>) may in fact be *false*. Simply saying that <The Earth is orbiting the Sun> is not a truth in the Ptolemaic perspective would not do. A defender of perspectival truth₁ owes us an example of a worldly state of affair that can *act as the truth-maker* of the presumed Ptolemaic truth <The Earth does not orbit the Sun>_p. A defender of perspectival truth₁ is faced with two horns of a dilemma when trying to explain falsehood. Either to concede that there may be knowledge claims in a given scientific perspective, which while held true by a community of practitioners (e.g., Ptolemaic astronomers), are in fact *tout court* false—i.e. there is no truth-maker for <The Earth does not orbit the Sun>_p. Or, to insist that scientific knowledge claims held true by a community of practitioners (e.g., Ptolemaic astronomers) are indeed true, and then the burden is on defenders of perspectival truth₁ to identify possible truth-makers for such claims.

Neither of these two options is promising. The former collapses perspectival truth₁ in the simple-minded correspondence theory of truth dear to scientific realism. In so doing, it undercuts the original motivation for perspectival truth as a distinctive middle ground (if scientific knowledge claims of past or rival perspectives are simply false *by our own current light*, what is the point of pursuing perspectival truth?). The latter option of searching for a potential truth-maker for <The Earth does not orbit the Sun>_p, seems to land the defender of perspectival truth₁ with an impossible task. What worldly state of affairs can *ontologically ground* such Ptolemaic truth? Maybe, with some sophistry, an argument could be made to the effect that states of affairs (qua truth-makers) are molded by the scientific perspective in which they feature. But such move would place a

²² According to Armstrong (1997), a truth such as <*a* is *F*> should be understood as having as its truth-maker the state of affair that [*a* is *F*], whereby such a state of affair, in Armstrong's original formulation, is not understood as the mereological sum of an individual *a* and universal property *F*-ness.

²³ In what follows, I leave aside the issue of how to best understand *states of affairs*, i.e., whether in terms of tropes, or particular objects instantiating universal properties instead.

defender of perspectival truth₁ on the slippery slope of fact-constructivism. Once on that slope, it is hard to see how a defender of perspectival truth₁ could possibly deliver on the realist promise of *getting things right*.

Moving then away from the treacherous ground of truth-makers for perspective-indexicality, perhaps perspective-dependence₂ faces rosier prospects. After all, (P₂) treats the propositional content expressed by scientific knowledge claims as invariant across scientific perspectives, whilst relativizing the *truth-values* of such propositional content to different perspectives. Perspectival truth₂ so understood seems in a good position to explain disagreement in science. For it is possible that scientists endorsing different scientific perspectives genuinely disagree about a shared subject matter, without talking past each other (since the propositional content of their respective knowledge claims is the same). Thus, perspectival truth₂ seems more promising than perspectival truth₁ in delivering on the Kuhnian idea behind perspectivalism that scientists may effectively be ‘living in different worlds’ by attaching different truth-values to the same knowledge claims.

Yet truth-relative-to-scientific-perspectives proves itself problematic. We are reminded here of Goodman’s familiar discussions about how different worlds (or scientific perspectives that we may want to call them) bring along with them conflicting truths.²⁴ Despite being prima facie contradictory, the following two sentences

1. <The Earth is orbiting the Sun>
2. <The Earth is not orbiting the Sun>

are in fact both true within an appropriate scientific perspective. To reconcile conflicting truths 1. and 2., one may follow Goodman’s suggestion and expand them as follows:

- (1.i.) *In the Ptolemaic perspective*, the Earth is not orbiting the Sun.
- (2.i.) *In the Copernican perspective*, the Earth is orbiting the Sun.

The problem with this classic move—as Goodman originally pointed out—is that the resulting knowledge claims (1.i) and (2.i) are no longer in conflict with each other (and hence cannot be the source of genuine disagreement) because they are noncommittal as to the Earth’s motion itself. They do not tell us whether the Earth moves or not, unless we add a further clause that says that what each perspective claims is in turn *true*. Thus, despite invariant content, perspectival truth₂ ends up being noncommittal as to what worldly states of affairs ultimately obtain. This means that perspective-relativity fails to deliver on the normativity of realism. Scientific theories with their knowledge claims cannot be expected to *get things right* if they are non-committal about worldly states of affairs. Or, to echo Goodman, scientific theories cannot be expected to get things right if no cross-perspectival notion of *rightness* is within their grasp. Moreover, perspectival truth₂ so understood fails to deliver also on the Kuhnian dictum because the disagreement between communities is explained away by relativizing knowledge claims to perspectives. Can we improve on perspectival truth₂?

Recall (P₃) captures a form of *perspective-sensitivity*, whereby scientific perspectives can be regarded as providing the *circumstances* or *context of use* defining the *truth-conditions* for knowledge claims in science. For example, we can interpret scientific models (with their inaccurate idealizations of the target system) as filling in contextual truth-

²⁴ Goodman (1978).

conditions. Perspectival truth₃ is then truth within the limits (afforded by rival scientific models or rival historical perspectives) of inaccurate-yet-successful scientific representations of a perspective-independent world.

Perspectival truth₃ has a seductive appeal. It is kosher to the normativity of realism in getting (at least part of) things right via the representational success of our modeling practices. At the same time, it accommodates the Kuhnian stance against the God's eye view by delegating to scientific perspectives (qua families of models) the task of offering idealized, inaccurate, and yet still true perspectival images of an independent world. What better prospect for truth within a perspective?

Here is a worry, and a possible way forward. The worry first. Perspectival truth₃ evokes the Kantian stereotype of a noumenal reality receding beyond the realm of appearances (i.e. water-as-an-object-in-itself is not amenable to scientific knowledge; water-as-an-object-of-experience is the subject of different scientific models, none of which can claim to represent the properties of water *as they are in themselves*). If accuracy is a never-achievable goal, all we are left with are idealized, perspectival images of a target system. Scientific inquiry, like cartography, becomes a mapping exercise (with incomplete and partial maps) of a world we never made. Perhaps this is all we can reasonably expect from science. Perhaps we should not ask for more from perspectival truth.

Yet, I want to conclude with a note of optimism, and suggest that there is more that we can expect from a notion of perspectival truth. If scientific perspectives display the *circumstances* defining the *truth-conditions* for knowledge claims in science, one might expect different perspectives to disagree about the truth-conditions, and yet to allow for cross-perspectival assessment. Should this intuition prove correct, a more promising way of thinking about perspectival truth may be available to the perspectival realist. I pursue this intuition in the next final Section.

V. A fourth kind of perspectival truth

Let us take stock. Among the three kinds of perspectival truth analyzed so far, perspectival truth₃ was found the most promising in delivering on the normativity of realism within the ever-changing bounds of scientific perspectives. Perspectival truth₃ does not incur into either the hefty metaphysical price of perspectival truth₁ (whereby truth-makers are indexed to perspectives), or into the non-committal approach of perspectival truth₂. Yet, perspectival truth₃ still falls short of delivering on the normativity of realism (science *ought* to get things right). It relegates reality into the Kantian realm of things-in-themselves; and it leaves scientific knowledge claims with the task of mapping onto an (in principle) unknowable world of states of affairs. The goal of this final section is to go back to the contextualist motivation behind perspectival truth₃, elucidate some of its key aspects, and move perspectival truth forward in a new direction. A good starting point is the common distinction in epistemology between context of use and context of assessment.²⁵

To see how this distinction can be helpfully deployed to cash out a fourth kind of perspectival truth, let us return for a moment to the aforementioned example of water, with

²⁵ See MacFarlane (2005) for this distinction as functional to his defense of relativized truth. In what follows, I take on board the distinction between context of use and context of assessment but not with an eye to defending relativized truth. Instead, I make use of this distinction to elucidate the contextualist component at play in a fourth way of thinking about perspective-dependence.

which the case for perspectival truth₃ was illustrated. The truth-conditions for the sentence:

a. <Water is a liquid with viscosity>

were said to be sensitive to the perspectival *context of use*: if the context of use is hydrodynamics, then a. is certainly true. But if the context of use is statistical mechanics, then a. is false. Perspective-sensitivity—understood as sensitivity to the context of use defined, as in this case, by perspectival modeling practices—seems then not only to preclude knowledge of the properties of water *in and of themselves*. It ultimately opens the door again to a form of relativized truth, akin to the one at play in perspectival truth₂. But—I argue—the contextualist motivation behind perspective-sensitivity can be vindicated without either giving up on knowing the properties of water in and of themselves, or falling back onto relativized truth. Here is a possible way forward:

(P₄) *Perspective-dependence*₄. Knowledge claims in science are perspective-dependent₄ when their *truth-conditions* (understood as rules for determining truth-values based on features of the context of use) depend on the scientific perspective in which such claims are made. Yet such knowledge claims must also be assessable from the point of view of other (subsequent or rival) scientific perspectives.

If we switch from the context of use, to the context of assessment, we can imagine a cross-perspectival assessor, who may be able to judge the truth-evaluable content of a., despite the different truth-conditions in hydrodynamics and statistical mechanics. For such an assessor would be able to tell that although viscosity is indeed a fundamental property of water in hydrodynamics,²⁶ such property still features in statistical mechanics, but this time as a derivative property (i.e. as the property of momentum transport across laminae of mean flow).²⁷ Thus, in the context of assessment, it would not be the case that a. is true in one perspective, but false in the other, depending on the context of use defining different perspectival truth-conditions for it.

Such an assessor would have rules that allow her to translate knowledge claims from the context of hydrodynamics to the context of statistical mechanics so that she would conclude that there is no loss in the truth-evaluable content of a. during the perspectival shift from hydrodynamics to statistical mechanics. More precisely, it may be possible to retrieve true knowledge claims about what appears as a primitive property of water (viscosity) in hydrodynamics from the statistical properties of molecules' mean flow in the statistical-mechanical perspective.

I suggest that we understand contextual truth-conditions in terms of *standards of performance-adequacy*²⁸ that a scientific knowledge claim (such as a.) has to satisfy. For a.

²⁶ Viscosity features as a dimensionless variable, either as dynamic viscosity qua measure of internal resistance, or as kinematic viscosity qua ratio of dynamic viscosity to the mass density.

²⁷ I am grateful to Jed Buchwald for drawing my attention to this point.

²⁸ The expression *standards of performance-adequacy* comes from Jay Rosenberg (2002, ch. 4), where it is used for a defense of a perspectivalist theory of epistemic justification. I use the expression *standards of performance-adequacy* in a different way, to indicate the standards that must be met by scientific knowledge claims for them to be retained across scientific perspectives, i.e. for their ongoing performance to be judged as adequate by practitioners of different scientific perspectives. Hence, *standards of performance-adequacy* capture the properly contextual, perspectival, and pragmatic features of the notion of truth within perspectives that I am cashing out.

to be true, for example, one would expect samples of water to satisfy the following standards of performance-adequacy: e.g. to obey the Navier-Stokes equations; to pass tests involving measurements and calibrations involving other fluids; to feature in projectible generalisations that can in turn be used to build steam-engines and improve on their efficiency.²⁹ *Accuracy* with respect to fundamental mathematical equations; *empirical testability* within the limits of well-defined tests; *projectibility* and *heuristic fruitfulness* across a variety of engineering practices, are just a few examples of the kind of standards of performance-adequacy that perspectival contexts of use may put in place for determining the truth-conditions of scientific knowledge claims. For <Water is a liquid with viscosity> to be true within the perspective of hydrodynamics then, it is necessary that water is indeed a liquid with viscosity *and* that it satisfies the appropriate standards of performance-adequacy defined by hydrodynamics.³⁰ But there is more.

Despite their contextual nature, truth-conditions defined by perspectival standards of performance-adequacy (in any given context of use) must also be evaluable from the point of view of other scientific perspectives. It is indeed possible to assess the performance-adequacy of knowledge claims in hydrodynamics (e.g. <Water is a liquid with dynamic viscosity of $1.983 \times 10^{-5} Pa s$ >) from the point of view of non-equilibrium statistical-mechanics, where dynamic viscosity (η) can be retrieved from chaotic microscopic dynamics using various approaches (e.g. the thermostated dynamical systems approach or the escape-rate approach, for example).³¹

Things get more complex when it comes to scientific perspectives understood diachronically, i.e. in historical terms. Consider the following two knowledge claims:

- b. <The electron is a structural element of an elastic ether>
- c. <The electron has half-integral spin>

Both are perspective-sensitive: their truth-conditions depend on the context of use. For example, b. was deemed true in the late nineteenth century perspective of Lorentz and Larmor. But it is deemed false in the contemporary quantum electrodynamics perspective. Scientific knowledge claim c. was, in turn, deemed true in the perspective of the old quantum theory (when Pauli originally introduced the electron spin in 1924 as a non-classically describable ‘twofoldness’), and it is still true in the contemporary perspective

²⁹ For an enlightening and up-to-date list of relevant features for water viscosity, the reader may want to refer to International Association for the Properties of Water and Steam (IAPWS 2008): <http://www.iapws.org> (last accessed 18 March 2016).

³⁰ The realist would at this point ask: why do we need to add the second clause about satisfying the appropriate standards of performance-adequacy? Would not the first clause, i.e. that water is indeed a liquid with viscosity, be enough for the purpose of establishing the truth of <Water is a liquid with viscosity>? The first clause, while indeed sufficient to establish that there are perspective-independent states of affairs that make the knowledge claim true, would not answer our key question here: i.e., *how* can anyone ever be in the position of knowing that she/he is getting the properties of water right when advancing that knowledge claim? Consider what would happen to a lone researcher, who gets things right about some object *x* and its properties without yet meeting the standards of performance-adequacy of her community at the time (perhaps because such community has not quite got to the stage of precisifying standards able to capture the truth of what the lone researcher has just discovered). Should we conclude that the researcher has contributed to the advancement of knowledge about object *x*? Here, I cannot help but sharing Richard Boyd’s (2010, pp. 217–218) negative answer to this question, although I give a perspectival gloss to what Boyd portrays as the social dimension of scientific inquiry. For more details on this point, please see Massimi (forthcoming).

³¹ For a mathematical analysis of both these approaches, see Gaspard (1998).

of particle physics. What makes us believe that c. is still true (despite perspectival changes about how we think about the electron spin, i.e. no longer as a spinning top), whereas we no longer believe b. to be true? Here is where the scientific realist would reply that the electron spin is a real property of the electron, and in contrast the elastic ether simply does not exist—end of the story.

Yet, the problem with this realist story, as explained in Section II, is that it presupposes a Nagelian *view from nowhere* from which such judgments of truth and falsity can be made. We go back to the problem of success *from nowhere* vs success *from here now*, and neither of them is very promising. Thus, a viable notion of perspectival truth should be able to tell the difference between b. and c. without having to rely on any dubious scientific realist's notion of success *from nowhere* or *from here now*. And this is where the Kuhnian-sounding standards of performance-adequacy enter the scene. While being perspective-sensitive (i.e. the truth-conditions for these knowledge claims are, respectively, sensitive to the nineteenth-century electromagnetic world view, the old quantum theory, or the contemporary Standard Model), both these knowledge claims ought to be assessable from the point of view of scientific perspectives other than the original ones.

And, from our own current scientific perspective, we no longer believe b. to be true because we now believe that b. has failed to satisfy the very same standards of performance-adequacy it was meant to satisfy. For example, by being a structural element of an elastic ether, the nineteenth-century electron was meant to explain, among others, phenomena such as electric displacement (as in Maxwell's honeycomb model of the ether, where electric displacement was represented by tiny wheels moving across the ethereal vortices allegedly at work in the phenomenon of electromagnetic induction). Momentous scientific efforts by the best minds of the nineteenth-century physics (from Cauchy to MacCullagh, among others) tried to tackle the problem of coming up with good engineering models of the ether for the transmission of electrical, magnetic, and optical phenomena.³² The whole programme of ether dynamics reached an impasse by the end of the nineteenth century precisely because these momentous efforts could not deliver models of the ether that were accurate with respect to the experimental data, consistent with engineering practices, able to feature in projectible generalisations and so on.

By contrast, scientific knowledge claim c. about the electron spin (despite significant perspectival changes from Pauli, to Dirac, to contemporary Standard Model), it is still believed to be true because it continues to perform adequately with respect of standards of performance-adequacy that it was meant to satisfy. For example, it features in projectible generalizations (e.g. the Pauli exclusion principle, which is regarded as a fundamental law of nature). It was and still is consistent with other accepted scientific theories (e.g. it can be deduced from Dirac's relativistic equation for the electron); and it is accurate in fitting available experimental data about particle classifications. Thus, despite their contextual nature, truth-conditions defined by perspectival standards of performance-adequacy (in any given context of use) must also be evaluable from the point of view of other scientific perspectives.

Each scientific perspective—I suggest—functions then both as a *context of use* (for its own knowledge claims) and as a *context of assessments* (for evaluating the ongoing performance-adequacy of knowledge claims of other scientific perspectives). *Qua contexts of*

³² For details about the history of ether theories, see Cantor and Hodge (1981).

use, scientific perspectives lay out truth-conditions intended as standards of performance-adequacy for their own scientific knowledge claims. *Qua contexts of assessments*, scientific perspectives offer standpoints from which knowledge claims of other scientific perspectives can be evaluated. This double role of scientific perspectives is important in cashing out a fourth version of perspectival truth that does not fall prey of any of the aforementioned problems.

For meeting standards of performance-adequacy fixed by the original context of use is, of course, not sufficient to establish the truth of any scientific knowledge claim. If scientific perspectives were allowed to sanction the truth of their own knowledge claims by their very own lights and standards, perspectival truth₄ would be bankrupt. Every scientific perspective could legitimize its own knowledge claims in the name of its own (genuine or presumed) standards of performance-adequacy. Ancient Greek crystalline spheres could be said to satisfy *explanatory* standards for the generation and corruption of entities in the sub-Lunar sphere; as much as phlogiston could be said to satisfy standards of *predictive power* for combustion and calcination. Contextual truth-conditions (*qua* standards of performance-adequacy) must be bridled to avoid perspectival truth₄ to accrue too easily.

Contexts of assessment can help with the task. For the same claim that meets truth-conditions (*qua* standards of performance-adequacy) in a given context of use must also be evaluable from the point of view of another scientific perspective. Insofar as knowledge claims about, for example, properties of water previously identified (e.g. viscosity in hydrodynamics) can be assessed and evaluated in the light of another scientific perspective (e.g. statistical mechanics), then <Water is a liquid with viscosity> can legitimately be regarded as true. Mechanisms for cross-perspectival assessment do, of course, vary in remarkable ways. Sometimes a knowledge claim true in a given scientific perspective becomes a limiting case of a more general true knowledge claim in the new scientific perspective. In other cases, appropriate inter-reduction rules between the two perspectives may be found. In any case, insofar as knowledge claims about, say, properties of water, of electrons, or planetary motion continue to be found (*from the point of view of a new scientific perspective*) as still performing adequately, such knowledge claims can be said to be *true across scientific perspectives*. This is perspectival truth₄—combining a contextualist, yet still *bona fide* realist account of *truth within a perspective*.

Thus, pace the perspective-sensitivity behind perspectival truth₄, we can still be reasonably optimistic about our partial, idealized, incompatible models getting the properties of water (of atomic nuclei, of electrons, and so forth) right. This is, after all, good news for perspectival realism for it shows how perspective-sensitivity does not have to be in conflict with the realist plea for ‘getting things right,’ properly understood. To conclude, central to perspectival truth₄ are the following two main features:

(i)*Perspective-sensitivity revisited*: knowledge claims in science are sensitive to the perspectival context of use putting in place appropriate standards of performance-adequacy for defining their truth or falsity.

(ii)*Realist normativity revisited*: knowledge claims in science that have been *retained on the basis of their ongoing performance-adequacy* from the point of view of other (either

synchronically rival or diachronically subsequent) perspectives, can justifiably be regarded as ‘getting things right.’³³

Is perspectival truth₄ *truth enough*? Is not the normativity of realism demanding a more robust take on ‘getting things right,’ one that does not rely on a commitment on behalf of epistemic agents to retain scientific knowledge claims that continue to meet standards of performance-adequacy? Cross-perspectival agreement on the ongoing performance-adequacy of knowledge claims might seem like a pyrrhic victory. After all, the metaphysical quest for tracking perspective-independent states of affair is ultimately *complemented* (not replaced) by an epistemic stance about agents, and their ability to assess the continuing performance of other agents’ scientific knowledge claims.

Is perspectival truth₄ closer to Putnam’s warranted assertibility than to the realist notion of truth as correspondence? I do not think so. Correspondence with perspective-independent states of affair remains central to perspectival truth₄. The standards of performance adequacy do not fulfill the task of warranting what we can assert about the electron or the properties of water; nor do they claim to replace truth as correspondence. Instead, their task is simply to allow us to evaluate the ongoing performance of our scientific knowledge claims across time and perspectival shifts, because we simply do not possess a God’s eye view to do that otherwise.

Perspectival truth may well be our best bet of *getting things right* from a human vantage point—a vantage point we equally share with our historical predecessors and contemporary rivals. This is the only vantage point we can legitimately reclaim as our own.

Acknowledgments

I thank audiences at Chicago, Edinburgh, Leeds, Manchester, Stirling, Munich for very helpful comments on earlier versions of this paper. Special thanks to Ron Giere, Paul Teller, and Ana-Maria Çretu, for helpful conversations on the topic. This article feeds into a larger project that has received funding from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme (grant agreement European Consolidator Grant H2020-ERC-2014-CoG 647272 *Perspectival Realism. Science, Knowledge, and Truth from a Human Vantage Point*).

Bibliography

- Armstrong, David. (1997) *A World of States of Affairs* (Cambridge: Cambridge University Press).
- Bain, Jonathan and Norton, John. (2001) ‘What should philosophers of science learn from the history of the electron?’, in A. Warwick and J. Buchwald (eds.), *Histories of the Electron: The Birth of Microphysics* (Cambridge, MA: MIT Press), 451–465.

³³ This way of thinking about perspectival truth₄ in terms of a commitment of a community to justifiably retain claims from other perspectives when satisfying standards of performance-adequacy takes its cue from MacFarlane’s (2005) helpful distinction between withdrawing vs. retaining a claim in the light of new available evidence. As mentioned in footnote 25, MacFarlane defends relativized truth. By contrast, I contend that it is the epistemic commitment of a community to justifiably retain scientific knowledge claim, whose ongoing performance continues to be deemed adequate, which ultimately secures the ability to track truth across perspectives (despite perspective-sensitivity).

- Boyd, Richard. (2010) 'Realism, natural kinds and philosophical method', in H. Beebe and N. Sabbarton-Leary (eds.), *The Semantics and Metaphysics of Natural Kinds* (London: Routledge), 212–234.
- Cantor, G.N. and Hodge, M.J.S. (1981) *Conceptions of Ether: Studies in the History of Ether Theories 1740–1900* (Cambridge: Cambridge University Press).
- Chakravartty, Anjan. (1998) 'Semirealism', *Studies in History and Philosophy of Science*, 29: 391–408.
- . (2010) 'Perspectivism, inconsistent models and contrastive explanation', *Studies in History and Philosophy of Science*, 41: 405–412.
- Falconer, Isobel. (2001) 'Corpuscles to electrons', in J. Buchwald and A. Warwick (eds.), *Histories of the Electron: The Birth of Microphysics* (Cambridge, MA: MIT Press), 77–100.
- French, Steven. (2014) *The Structure of the World* (Oxford: Oxford University Press).
- Gaspard, Pierre. (1998) *Chaos, Scattering, and Statistical Mechanics* (Cambridge: Cambridge University Press).
- Giere, Ron. (2006) *Scientific Perspectivism* (Chicago: University of Chicago Press).
- Goodman, Nelson. (1978) *Ways of Worldmaking* (Indianapolis: Hackett Publishing Co.).
- Ismael, Jenann. (2016) 'How do causes depend on us? The many faces of perspectivalism', *Synthese*, 193: 245–267.
- Kitcher, Philip. (2001) 'Real realism: The Galilean strategy', *Philosophical Review*, 110: 151–197.
- Kuhn, Thomas S. (1962) *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press).
- MacFarlane, John. (2005) 'Making sense of relative truth', *Proceedings of the Aristotelian Society*, 105: 321–339.
- . (2009) 'Nonindexical contextualism', *Synthese*, 166: 231–250.
- Massimi, Michela. (forthcoming) 'Bringing real realism back home: A perspectival slant', in M. Couch and J. Pfeifer (eds.), *The Philosophy of Philip Kitcher* (Oxford: Oxford University Press).
- Mitchell, Sandra and Gronenborn, Angela. (forthcoming) 'After 50 years why are protein X-ray crystallographers still in business?', *British Journal for the Philosophy of Science*.
- Morrison, Margaret. (2011) 'One phenomenon, many models: Inconsistency and complementarity', *Studies in History and Philosophy of Science*, 42: 342–351.
- Psillos, Stathis. (2000) 'The present state of the scientific realism debate', *British Journal for the Philosophy of Science*, 51: 705–728.
- Rosenberg, Jay. (2002) *Thinking about Knowing* (Oxford: Oxford University Press).
- Schafer, Karl. (2014) 'Constructivism and three forms of perspective-dependence in metaethics', *Philosophy and Phenomenological Research*, 89: 68–101.
- Stanford, Kyle. (2006) *Exceeding Our Grasp* (Oxford: Oxford University Press).
- . (2009) 'Author's response', *Metascience* 18: 379–390.
- Teller, Paul. (2011) 'Two models of truth', *Analysis*, 71: 465–472.
- van Fraassen, Bas. (2002) *The Empirical Stance* (Yale: Yale University Press).
- . (2008) *Scientific Representation: Paradoxes of Perspective* (Oxford: Oxford University Press).