1 Pragmatism, Perspectivism, and the Historicity of Science

Hasok Chang

1 Introduction: Humanism and Science

In this chapter, I wish to shed some light on perspectivism through the lens of pragmatism, especially in relation to scientific knowledge. The initial plausibility of this exercise lies in the fact that perspectivism and pragmatism share a deep humanist impulse, which is to regard science as a thoroughly human activity, even when it is aimed at the production of the most abstract and objective kind of knowledge. (Here I am using the terms "humanist" and "humanism" much more broadly than a strict reference to Renaissance humanism would dictate.) I will begin by outlining my interpretation of pragmatism in section 2; in fact, this is the first publication in which I attempt to lay out my view of pragmatism in any detail, so some details are necessary and this will constitute the longest part of the chapter. This will be followed, in section 3, by brief reflections on the relation between pragmatism as I understand it and perspectivism in its various guises. Afterwards, in section 4, I will explore one of the most important implications of pragmatism and perspectivism, namely the *historicity* of science and scientific knowledge. A methodological advocacy of "integrated history and philosophy of science" will naturally follow.

Humanism in relation to science is a commitment to understand and promote science as something that human agents do, not as a body of knowledge that comes from accessing information about nature that exists completely apart from ourselves and our investigations. Perhaps this humanism is not such a controversial stance (its roots go at least back to Immanuel Kant), but I think there is much value in considering its meaning and implications carefully. The most important thing about humanism as I see it is not a focus on the biological species *Homo sapiens*. For enthusiasts of artificial intelligence, animal cognition, or extraterrestrial intelligence, if we find or create serious non-human intelligence worthy of an epistemology, we might even want to call such agents "human beings" too.

In the rest of this chapter I will not speak explicitly of humanism, because I want to avoid the possibility of being mistakenly seen as advocating "human chauvinism." Also, what I want to express by "humanism" can be

adequately expressed by the designation of pragmatism, which I think is the best expression of humanism among existing philosophical traditions. The most fundamental point about pragmatism, as I take it, is that knowledge is created and used by intelligent beings who engage in actions in order to live better in the material and social world.

2 What Is Pragmatism?

2.1 Beyond Semantics: Pragmatism as a Philosophy of Practice

What is pragmatism, and what does it imply for the philosophy of science? It seems that pragmatism has largely fallen off the standard philosophy curriculum, so it may not be such a bad idea to start with a quick review of the standard meanings of pragmatism. Let us pick up from where today's students and general public are likely to begin. Google defines pragmatism as "an approach that evaluates theories or beliefs in terms of the success of their practical application."[1] In more and better detail, *Webster's Ninth New Collegiate Dictionary* (1986) defines pragmatism as

> an American movement in philosophy founded by C. S. Peirce and William James and marked by the doctrines that the meaning of conceptions is to be sought in their practical bearings, that the function of thought is to guide action, and that truth is preeminently to be tested by the practical consequences of belief.

This is in fact quite a good definition. The first part of it is a version of Peirce's "pragmatist maxim," paraphrased by James here:

> to attain perfect clearness in our thoughts of an object, then, we need only consider what conceivable effects of a practical kind the object may involve—what sensations we are to expect from it, and what reactions we must prepare.
>
> (James 1907, 46–7)[2]

The Peirce–James pragmatist maxim naturally led to the semantic interpretation of pragmatism, which is perhaps the dominant one today. Christopher Hookway says, "the pragmatist maxim is a distinctive rule or method for becoming reflectively clear about the contents of concepts and hypotheses: we clarify a hypothesis by identifying its practical consequences" (2016, sec. 2). In this way, pragmatism shares much with operationalism, the homegrown philosophy of the Harvard physicist Percy Bridgman, and with the verificationism that was widely taken as a core doctrine of logical positivism. This focus on meanings continues in the current pragmatist works of Robert Brandom, Huw Price, and others.

In a similar vein, James presented pragmatism as a "method for settling metaphysical disputes that otherwise might be interminable" (1907, 45). Unless some "practical difference" would follow from one or the other side's being correct, the dispute is idle. Hookway (2016, sec. 1) recalls "a memorable illustration of pragmatism in action" by James, which shows "how the pragmatist maxim enables us to defuse an apparently insoluble (albeit 'trivial') dispute." On a visit to the mountains, James's friends engaged in a "ferocious metaphysical dispute" about a squirrel that was hanging on to one side of a tree trunk while a human observer was standing on the other side. James described the dispute as follows:

> This human witness tries to get sight of the squirrel by moving rapidly round the tree, but no matter how fast he goes, the squirrel moves as fast in the opposite direction, and always keeps the tree between himself and the man, so that never a glimpse of him is caught. The resultant metaphysical problem now is this: *Does the man go round the squirrel or not?*
>
> (James 1907, 43)

James proposed to solve the problem by pointing out that which answer is correct

> depends on what you *practically mean* by "going round" the squirrel. If you mean passing from the north of him to the east, then to the south, then to the west, and then to the north of him again, obviously the man does go round him, for he occupies these successive positions. But if on the contrary you mean being first in front of him, then on the right of him, then behind him, then on his left, and finally in front again, it is quite as obvious that the man fails to go round him, for by the compensating movements the squirrel makes, he keeps his belly turned towards the man all the time, and his back turned away. Make the distinction, and there is no occasion for any farther dispute.
>
> (James 1907, 44)

In this manner, the "pragmatic method" promises to eliminate all apparently irresoluble metaphysical disputes, and rather more important ones, too.

Even though I completely endorse the semantic tradition of pragmatism, my own emphasis is different. My inclination follows Philip Kitcher's (2012, xii–xiv) warning against the "domestication" of pragmatism. Focusing on semantics is a very effective method of domestication, making pragmatism look like a rather innocuous and interesting variation on normal analytic philosophy. I want pragmatism to be a philosophy that helps us think better about how to do things, not just about what our words mean. Recall the second part of the dictionary definition of pragmatism:

"the function of thought is to guide action." Hearing the story of James's squirrel, one might wonder: "But isn't this just a matter of defining one's terms carefully? Does it really have anything to do with pragmatism?" My take on that question is that the disambiguation offered by James is tied closely to potential practical ends. If my objective is to make a fence to enclose the squirrel, then I have gone around the squirrel *in the relevant sense*; if the objective is to check whether the wound on his back has healed, then I have failed to go around the squirrel in the relevant sense. It is the pragmatic purpose that tells us which meaning of "going round" we *ought* to mean.

2.2 Pragmatism as Empiricist Realism

One very important reason why people often do not like to go beyond the semantic dimension of pragmatism is the fear of what happens if we go further and adopt the pragmatist theory of truth. This issue needs to be tackled head-on. It is a core part of my interpretation of pragmatism that we should reject the common misperception and prejudice that pragmatism just means taking whatever is convenient as true. The "pragmatic theory of truth" attributed to James is widely regarded as absurd, and this has contributed greatly to the disdain for pragmatism among tough-minded philosophers. Here is probably the most notorious statement by James: "*'The true,' to put it very briefly, is only the expedient in the way of our thinking, just as 'the right' is only the expedient in the way of our behaving*. Expedient in almost any fashion" (James 1907, 222). I think James's choice of the word "expedient" was unfortunate, as sounding too much like just "convenient" or "useful"—or perhaps the word had quite a different connotation back then; that is for James scholars to debate. At any rate, the statement actually continues as follows:

> And expedient in the long run and on the whole of course; for what meets expediently all the experience in sight won't necessarily meet all farther experiences equally satisfactorily. Experience, as we know, has ways of *boiling over*, and making us correct our present formulas.
> (James 1907, 222)

I want to argue that what this passage really shows is James the staunch empiricist, declaring that the source of truth is experience, and that it is futile to entertain any more grandiose notion of truth. This provides an important clue to my interpretation of pragmatism. My proposal is to understand pragmatism as a deep or thoroughgoing empiricism, which recognizes experience as the only ultimate source of learning and refuses to acknowledge any higher authority. Something does need to be said in justification of empiricism, but for now let me take it as a credo, as an article of faith; some sort of empiricism might be the inevitable

starting point of epistemology in our scientific age, as much as the presumption of God would have been the inevitable bedrock of any intellectual discourse in Europe in an earlier age.

The spirit of empiricism has been summarized rather poetically by Clarence Irving Lewis, in his review of John Dewey's 1929 masterpiece, *The Quest for Certainty*:

> Man may not reach the goal of his quest for security by any flight to another world—neither to that other world of the religious mystic, nor to that realm of transcendent ideas and eternal values which is its philosophical counterpart. Salvation is through work; through experimental effort, intelligently directed to an actual human future.
>
> (Lewis 1930, 14)

This passage is especially nice because it brings together the two pragmatist philosophers that I have found most inspiring.

On such an empiricist conception of knowledge, how might we make sense of traditional epistemic and metaphysical notions such as truth and reality? Central to my thinking is the notion of *operational coherence*, a harmonious fitting-together of actions that is conducive to a successful achievement of one's aims.[3] To put it somewhat more precisely: an activity is operationally coherent if and only if there is a harmonious relationship among the operations that constitute the activity. The concrete realization of a coherent activity is successful *ceteris paribus*; this serves as an indirect criterion for the judgment of coherence. Operational coherence pertains to an epistemic activity (or a system of practice), not to a set of propositions; it is measured against the aims of the activity (or system) in question. Coherence may be exhibited in something as simple as the correct coordination of bodily movements needed in lighting a match or walking up the stairs, or something as complex as the successful integration of a range of material technologies and various abstract theories in the operation of the Global Positioning System. It has social and emotional aspects as well as material and intellectual ones.

Coherence is the chief characteristic underlying a successful epistemic activity. It is the vehicle through which the mind-independent world is brought to bear on our knowledge. Operational coherence carries within it the constraint by nature, and in fact it is the only way in which reality can give input to our knowledge. Using this notion of coherence, I propose a new coherence theory of truth: a statement is true in a given circumstance if (belief in) it is needed in a coherent activity (or system of practice).[4] Truth understood in this way comes with a specific scope or domain attached to it in each case, which allows us to legitimize intuitive statements such as "Newtonian mechanics remains true in the domain of macroscopic objects moving at low velocities." And because coherence is a matter of degree, so is truth—and I think that is also right. J. L. Austin

noted long ago (1979, 117, 130–131) that "very true," "true enough," and such are perfectly sensible locutions. Catherine Elgin (2017) has more recently shown the pragmatic power of "true enough" accounts. It is not necessary to conceive of truth itself as a binary yes-no property,[5] and insist on speaking in terms of approximate truth or partial truth when we wish to discuss degrees of truth. The notion of (empirical) truth I propose can ground a kind of realism that is not at all contrary to empiricism.

2.3 The Empirical Learning of Methods

One salient feature of the deep empiricism that I see in pragmatism is empiricism concerning methods, which received its full articulation in Dewey's late work *Logic*, which he strikingly subtitled *The Theory of Inquiry*. According to Dewey (1938, 12), scientific methods and logical rules arise from successful habits of thinking. Content and method are learned through the same process of inquiry. Success is being "operative in a manner that tends in the long run, or in the continuity of inquiry, to yield results that are either confirmed in further inquiry or that are corrected by use of the same procedures" (13). This is how method-learning happens:

> through comparison-contrast, we ascertain *how* and *why* certain means and agencies have provided warrantably assertible conclusions, while others have not and *cannot* do so in the sense in which "cannot" expresses an intrinsic incompatibility between means used and consequences attained.
>
> (104)

And "we know that some methods of inquiry are better than others in just the same way in which we know that some methods of surgery, farming, road-making, navigating or what-not are better than others" (104).

   Dewey stressed the continuity of rules—of logic, everyday inquiry, and the scientific method (4–6). According to him, even logical rules, like any other rules, receive their justification through the success of inquiry. He considered that "all logical forms (with their characteristic properties) arise within the operation of inquiry, and are concerned with the control of inquiry so that it may yield warranted assertions" (4).[6] What he called the "fundamental thesis" of his book was that "logical forms accrue to subject-matter when the latter is subjected to controlled inquiry."[7] So it was crucial to look at the history of logic, which he regarded as a progressive discipline. Dewey argued that we needed logic to suit the modern scientific way of thinking, and lamented that logicians of his day tended to retain the form of classical logic while abandoning the metaphysical and operational underpinnings of it.[8] In chapter 5 of *Logic*, he undertook a contextual analysis of Aristotelian logic, arguing that it was a system

admirably suited for the science and philosophy of ancient Greece (perhaps only Athens), but no longer suited to the mode of scientific and philosophical thinking, which had changed dramatically since then. As some key elements of Aristotelian thinking that had been abandoned, he identified essentialism, the emphasis on quality over quantity, static classification as the form of knowledge, and the heterogeneous and hierarchical structure of the universe.

2.4 *The Empirical Validation of the A Priori*

What I am calling the deep empiricism of the pragmatists even touched upon the nature of a priori knowledge, as already indicated by Dewey's views on logic. On this point, the most eloquent exponent of pragmatism was Lewis who, according to L. W. Beck, once declared "I am a Kantian who disagrees with every sentence of the *Critique of Pure Reason*" (in Schilpp 1968, 273). The core of Lewis's disagreement with Kant was that Lewis denied the existence of synthetic a priori judgments. He did think that there was an important a priori element to knowledge, but that it was always analytic: "*The a priori is not a material truth, delimiting or delineating the content of experience as such, but is definitive or analytic in its nature*" (Lewis 1929, 231). A priori propositions are inherent in "conceptual systems," but these systems are constructed and chosen by us on "instrumental or pragmatic" grounds (x). Once we have chosen a conceptual system, within it the a priori elements are analytically true.[9]

   Lewis called his position "conceptual[istic] pragmatism" and acknowledged his debt to James, Dewey, and especially Peirce, but signaled a distance from "orthodox" pragmatism (xi). However, I think Lewis's take on the a priori deserves to be brought into the mainstream of pragmatism. It is the epitome of deep empiricism that even the adoption of the a priori is made on empirical grounds. Lewis explains:

> While the *a priori* is *dictated* neither by what is presented in experience nor by any transcendent and eternal factor of human nature, it still *answers* to criteria of the general type which may be termed pragmatic. The human animal with his needs and interests confronts an experience in which these must be satisfied, if at all. Both the general character of the experience and the nature of the animal will be reflected in the mode of behavior which marks this attempt to realize his ends. This will be true of the categories of his thinking as in other things. And here, as elsewhere, the result will be reached by a process in which attitudes tentatively assumed, disappointment in the ends to be realized, and consequent alteration of behavior will play their part.
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> (239, emphases added)

This pragmatic nature of the a priori also makes it historical, as various neo-Kantian thinkers ranging from William Whewell to Michael Friedman have emphasized: "there will be no assurance that what is a priori will remain fixed and absolute throughout the history of the race or for the developing individual"; "if the a priori is something made by the mind, mind may also alter it"; "the determination of the a priori is in some sense like free choice and deliberate action" (233–234). In this connection, Lewis pays some attention to the actual history of science:

> New ranges of experience such as those due to the invention of the telescope and microscope have actually led to alteration of our categories in historic time. The same thing may happen through more penetrating or adequate analysis of old types of experience—witness Virchow's redefinition of disease. What was previously regarded as real—e.g., disease entities—may come to be looked upon as unreal, and what was previously taken to be unreal—e.g., curved space—may be admitted to reality. But when this happens *the truth remains unaltered and new truth and old truth do not contradict*. Categories and concepts do not literally change; they are simply given up and replaced by new ones.
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> (268)

It is interesting to consider how Lewis's view on the a priori extends to logic. Lewis (vii) himself said that his pragmatist epistemology in fact arose from his work in symbolic logic, which was highly respected. There *are* different systems of logic, and anyone who wants to reason logically must start by adopting a particular system of logic. But the only plausible and non-arbitrary way of justifying the choice of a logical system would be on pragmatic grounds, because appealing to the rules of logic for this choice would clearly be question-begging. So it may actually turn out that the treatment of logic is the most convincing part of pragmatism! With Lewis's contribution, and the current proliferation of non-classical logics and their successful application in the design of intelligent systems, I think we must admit that Dewey has been vindicated in his fundamental thesis: "Logical forms accrue to subject-matter when the latter is subjected to controlled inquiry" (101). And then it was perhaps natural for Lewis to generalize such thoughts about logic to say that the justification of the choice of any conceptual system can only accrue from the experience of trying to apply the system in question to various areas of inquiry (x–xi).

2.5 The Active Nature of Knowledge

Having considered what pragmatism should mean, we can attempt an overview of the fundamental question of epistemology: what is the nature of knowledge? Pragmatism as I see it does not sit well with the

propositional conception of knowledge that forms the bedrock of episte-mology in the analytic tradition. With its emphasis on method-learning and practices of inquiry, pragmatism needs a conception of knowledge understood as an ability, the ability to achieve certain aims. The propo-sitional conception of knowledge was quite explicitly criticized by James and Lewis when they attacked the "copy theory" of knowledge. Accord-ing to James:

> The popular notion is that a true idea must copy its reality. Like other popular views, this one follows the analogy of the most usual expe-rience. Our true ideas of sensible things do indeed copy them. Shut your eyes and think of yonder clock on the wall, and you get just such a true picture or copy of its dial. But your idea of its "works" (unless you are a clockmaker) is much less of a copy, yet it passes muster, for it in no way clashes with reality. Even though it should shrink to the mere word "works," that word still serves you truly; and when you speak of the "time-keeping function" of the clock, or of its spring's "elasticity," it is hard to see exactly what your ideas can copy.
>
> (1907, 199)

Lewis was more succinct: "Knowledge does not copy anything presented. It proceeds from something given toward something else. When it finds that something else, the perception is verified" (1929, 162).[10] Here Lewis is echoing Dewey's notion of inquiry, viewed thoroughly and explicitly as a process: "*inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situ-ation into a unified whole*" (Dewey 1938, 104–105).[11] Here it may be argued that Dewey was developing a notion from Peirce, who in "The Fixation of Belief" had set out a perspective on inquiry as a process in which we "struggle to free ourselves" from a state of doubt and "pass into the state of belief" (1877, 5). Even though Peirce tended not to focus on the practices of inquiry, when he did comment on them he was clear about their processual dimension. And Cheryl Misak adds that the important thing Peirce regarded as wrong with the state of doubt is "that it leads to a paralysis of action" (2013, 33).

"The knower is an actor," declared James (quoted in Putnam 1995, 17). Dewey went on to develop this vision fully, complete with his own memorable slogan: "we live forward" (Dewey 1917, 12). Experience is active, full of expectations and reactions, contrary to the impoverished view of it in traditional empiricism as the recording of information. Experience, and knowledge too, is something taken by active agents. Inquiry is pervasive in life, an essential activity of an organism coping in its environment.

A pragmatist philosophy of science should recognize clearly that scientific inquiry is itself a kind of human experience. Learning from experience also requires learning about the nature of that experience of learning. Pragmatist philosophical attention needs to be turned to the process of knowledge-production itself in order to provide an elucidation of epistemic activities. What do we do in order to gain knowledge, to test it, to improve it, to use it? How best do we organize and support such epistemic acts that we engage in? If we conceive of pragmatism generally as a philosophical commitment to engage with practices, then pragmatist epistemology will concern itself with all practices relating to knowledge. I believe that this is something that pragmatists were seriously engaged in.

For my own thinking about scientific practice, I have devised notions of "epistemic activities" and "systems of practice" (Chang 2014). What *kinds* of things do scientists do when they do science? They engage in some very complex practices, which may be analyzed as composites of many different kinds of basic epistemic activities, such as describing, predicting, explaining, hypothesizing, testing, observing, detecting, measuring, classifying, representing, modeling, simulating, synthesizing, analyzing, abstracting, and idealizing. Many of these categories may seem like simple types of mental acts, but when we ask how any of it is actually done in particular situations, we discover that a complex network of material, mental, and social activities are involved. As an illustration, take something that would seem very far removed from actions: the definition of a concept. Consider what one has to *do* in order to define a scientific term: formulate formal conditions for its correct verbal and mathematical use; construct physical instruments and procedures for measurement, standard tests, and other manipulations; round people up on a committee to monitor the agreed uses of the concept and devise methods to give penalties to people who do not adhere to the agreed uses. In one stroke, we have brought into consideration all kinds of unexpected things, ranging from operationalism to the sociology of scientific institutions. "One meter" or "one kilogram" would not and could not mean what it means without a whole variety of epistemic actions coordinated by the International Bureau of Weights and Measures in Paris. Even semantics is a matter of doing, as Wittgenstein and Bridgman taught us long ago.

3 Pragmatism and Perspectivism

Having sketched my own interpretation of pragmatism, I now want to consider how it relates to perspectivism. As indicated at the start by reference to humanism, perspectivism has a great deal of affinity with pragmatism as I see it. They are both rooted in taking science as an activity carried out by humans or other intelligent *agents*, and scientific knowledge as a product of such an activity. Any knowledge arising from a particular activity will bear a clear contextual or perspectival stamp of its

origins. The only real difference may be in emphasis, pragmatism being more explicit than perspectivism in its action-orientation.

But what exactly is perspectivism? I start by following the recent exposition by Michela Massimi (2018), in which she consciously builds on the earlier articulation by Ronald Giere (2006). Overall, she defines perspectivism (or perspectival realism) in the philosophy of science as "a family of positions that in different ways place emphasis *on our scientific knowledge being situated*." There are two main ways of being situated:

(1) Our scientific knowledge is *historically situated*, that is, it is the inevitable product of the historical period to which those scientific representations, modeling practices, data gathering, and scientific theories belong.
And/Or
(2) Our scientific knowledge is *culturally situated*, that is, it is the inevitable product of the prevailing cultural tradition in which those scientific representations, modeling practices, data gathering, and scientific theories were formulated.

(Massimi 2018, 164)

As Massimi's definition indicates, there is no consensus on the precise interpretation of perspectivism. And what I want to do, especially in the light of various considerations made above in my interpretation of pragmatism, is to advocate a rather strong form of perspectivism—Kitcher's warning against domestication should be applied to perspectivism as well as pragmatism. Massimi goes part of the way with me here in stating that "truth-conditions for scientific knowledge claims vary in interesting ways depending on the context in which they are uttered and used" (171). I could not agree more, but I do not think it goes far enough. It is not only the truth conditions for a knowledge claim that are perspectival but the knowledge claims themselves. Even if we just take the semantic version of pragmatism, the very meanings of any concepts or terms we use are only contextually fixed. So there cannot be any knowledge claim that is not perspectival. Now, I may agree with the common notion endorsed by Massimi that "there are perspective-independent worldly states of affairs that ultimately make our scientific knowledge claims true or false"; however, I remain with Kant in insisting that such states of affairs, as such, are not expressible.[12] So it is not only "*our ability to know* these states of affairs" that "depends inevitably on the perspectival circumstances or context of use" (171), but—I further argue—the very possibility of articulating anything about the state of the world. All we can ever talk about are conceptualized objects, which are in the realm of Kantian phenomena rather than things-in-themselves.

It might be useful to lay out here the three separate layers of perspectivism that I see. This is my own perspective, as it were, on perspectivism.

Each of the three layers is compatible with some version of pragmatism. However, my own reading of pragmatism tends to go with the third and deepest layer of perspectivism.

(1) The same content can be expressed in different ways—in different languages, or using different expressions, that are not incommensurable with each other. In such cases, it can be considered that the strict meaning of the different expressions is the same. However, there will typically be different connotations attached to the different expressions, and such differences in connotation can also embody divergent expectations, and can prompt and facilitate divergent courses of action. For example, consider how classical mechanics can be expressed in the Newtonian, Lagrangian, and Hamiltonian formulations. Even though it can be shown that these formulations are formally equivalent to each other, there are very significant practical consequences in problem-solving and further theorizing that follow from the choice.

(2) Different perspectives can make us highlight and focus on different aspects of a given object, and can also blind us to other aspects. This sense of perspectivism is consonant with quite a literal reading of "perspective": if we look at a three-dimensional object in the normal human way, we will only see a two-dimensional picture whose content depends on the direction from which we are looking. Or we can project very different-looking shadows of one and the same three-dimensional object in different directions. A similar image of "viewing objects or scenes from different places" is the device with which Giere (2006, 13) initially introduces the idea of perspectivism in his book. Generalizing this thought in a metaphorical way to the role that conceptual frameworks play in our cognition, we say that we can learn about something in different perspectival ways, like the proverbial blind people feeling different parts of an elephant. On a large scale, Giere (2006, chap. 4) takes it that scientific theories or models provide such perspectival representations of the world as maps based on different projection methods do with the earth. This level of perspectivism still allows the possibility that we can build a true picture of the object, by unifying enough well-placed perspectival pictures of it, as we can similarly construct a three-dimensional image of an organ in a CT scan based on various two-dimensional cross-sections taken with x-rays. This view is perfectly compatible with the standard sort of scientific realism.

(3) Going more deeply perspectival, one can argue that the relation between our knowledge and the world cannot be spelled out in a straightforward way as given in the two above interpretations of perspectivism. Projection is a metaphor, as is "perspective" itself. The very seductive and deeply misleading aspect of those metaphors is that we take it for granted that the three-dimensional objects we are perspectively studying exist "out there" in themselves, well-formed independently of all our cognition and action. When we are facing the universe, we do not

have the equivalent of the perfectly understood three-dimensional object that we try to represent from various two-dimensional perspectives. The strong pragmatism I have articulated argues against the cogency of such a notion of ready-made reality and affirms the strong ontological perspectivism that Anjan Chakravartty warns us against: "there are no perspective-transcendent ontological facts or states of affairs" (2017, 177). People often imagine that the broadly accepted "scientific" picture of the world is the ready-made reality, rather than just one perspectival picture; this is to commit the error of "hypostatization," as Dewey named it.[13] Any phenomenon of nature that we can think or talk about at all is couched in concepts, and we choose from different conceptual frameworks (as C. I. Lewis emphasized), which are liable to be incommensurable with each other. If we take "perspective" to mean a conceptual framework in this sense, then we can see that ontology itself is perspectival. Only unspeakable noumena may be imagined to exist in an absolute sense, guaranteed to be shared between incommensurable frameworks.

The kind of realism sanctioned by the last kind of perspectivism is strongly pluralist: each good perspective offers a true account that is worth preserving and developing, without the need or sometimes even the possibility to reduce or bind it to another perspective (Chang 2018). The knowledge gained from each perspective answers to reality in its own way, but not in a way that is straightforwardly comparable to other ways. All this is not to deny that it may be possible to make productive links, sometimes even reductive or unificatory ones, between different perspectives; however, whether such links are possible is an empirical question—neither a foregone conclusion nor an inescapable imperative. The pluralism expressed here can resist the usual attack on perspectivism through the charge of relativism. A recent, well-reasoned instance of such an attack is Chakravartty's book on "scientific ontology," where he denounces the "Kant on wheels" type of ontology as incoherent (2017, 186). Yet Chakravartty actually seems to be a strong ontological pragmatist and pluralist:

> We know only about those ontological packages that have proven sufficiently successful as posits in these particular contexts . . . nothing in scientific practice precludes the existence of other packages and behaviors that are unknown to us and, indeed, the hubristic image of our own ontological powers that would be required to think otherwise should arguably give one pause.
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> (196–197)

It is in my view immaterial whether or not he likes to use the label of "perspectivism" to characterize this view.

To sum up: pragmatism, as I articulate it in this chapter, strengthens perspectivism. Not only is such pragmatism consonant with various versions of perspectivism (partly due to the humanist grounding that they both share), but it should give perspectivists the courage to see just how deeply perspectivism can and should go.

4 The Historicity of Science and the Need for Integrated HPS

If we take seriously the pragmatist or perspectivist view of knowledge and inquiry as articulated here, what follows about the nature of science? And what does that imply about how we should practice the history and philosophy of science (HPS)? Here I return to the idea of pragmatism as deep empiricism. If the only learning we can do comes from experience, then learning about how to learn can only come from a study of the history of learning. If philosophy of science concerns itself with understanding and improving the methods of science, then it can only function properly by following the history of science. So, the epistemological side of philosophy of science is inseparably tied to history of science. This is an intuition that most practitioners of HPS already have, but I believe that the intuition should be grounded in a clearer and more explicit conception of knowledge.

It is an empirical fact that humans have learned that there are some valid patterns of inquiry that are quite common in various kinds of situations. As Dewey put it, "inquiry, in spite of the diverse subjects to which it applies . . . has a common structure or pattern . . . applied both in common sense and science" (1938, 101). In Dewey's view, there is a continuity among various types of rules that govern everyday inquiry, scientific practice, and logical inference (4–6); scientific methods and logical rules arise from successful habits of thinking, and they receive their justification through the success of inquiry (12).

Another observation to add to the basic historicity of learning is that truly empirical processes of learning need to be iterative. I had acquired a dim awareness of this from my work on the development of temperature measurement standards, through which I came up with the notion of "epistemic iteration" with a little bit of inspiration from Peirce (Chang 2004, 44–48, 220–234). But Dewey had seen the iterative nature of learning in a very general light. The key question, according to Dewey, was "whether inquiry can develop in its own ongoing course the logical standards and forms to which *further* inquiry shall submit." And "one might reply by saying that it can because it has" (Dewey 1938, 5). Because there are no "standards *ab extra*" that inquiry can rely on, it must be possible to have a "self-corrective process of inquiry" if we are to get anywhere. Logical principles, at each stage of this process, are "operationally *a priori*" (14). This view is very consonant with that of Lewis about a priori principles in general.

Now consider the nature of knowledge as well as inquiry. If knowledge is the product of inquiry, and inquiry is an iterative process as we have just described, then knowledge can only be understood fully by knowing the history of inquiry, because any stage of knowledge can only develop by relying on the previous stage, and its shape is ineliminably influenced by its starting point. It is not good enough to know the current conditions of science, because present science is not only a response to present needs, but it is in large part also determined by our inheritance, which arose from answering past needs.

Learning about the past conceptions and techniques that have shaped our present science is not just a matter of description. It is actually much more crucial for a normative project. In order to re-process our inheritance intelligently, we should first understand how it came into being. Benedetto Croce once said, "only historical judgment liberates the spirit from the pressure of the past" (1941, 48). Learning the history of how scientists came to believe today's orthodoxy can not only aid our understanding of the science, but it may also reveal that what we take as evident and necessary truths today were results of past decisions that were contingent and could have gone in a different way. Such awareness of past contingency also allows the possibility of making that contingency real again in the present; thereby history of science can legitimately support normative philosophy of science too, quite contrary to common impressions of the fundamentally descriptive nature and mission of historiography.

In the converse direction of dependence, why the history of science needs the philosophy of science will perhaps be quite obvious to most perspectivist readers of this volume. No history can be written as a "view from nowhere." And no history of science can be written in a philosophy-of-science vacuum, if we take philosophy of science as a field that provides notions about the nature of scientific practice and scientific knowledge. The question is what kind of philosophy we should take as our historiographical framing device. The old internalism, which was certainly amenable to history–philosophy integration, achieved the integration only in a diminished fashion. It tended to talk of knowledge as theories and experiments existing in the service of theories. It was linked up with a truth-focused justificationist epistemology firmly based on the propositional conception of knowledge. This kind of history–philosophy integration was only made possible by impoverishing the history. Pragmatism and perspectivism offer superior alternatives.

Here I return to the broad humanist framing with which I began this chapter. If we appreciate the acquisition and development of knowledge fully in the context of human life, we need to examine the development of scientific knowledge that serves the purposes of life. Recall the humanist flourish of the Vienna Circle Manifesto:

Everything is accessible to man; and man is the measure of all things. Here is an affinity with the Sophists, not with the Platonists; with the Epicureans, not with the Pythagoreans; with all those who stand for earthly being and the here and now.

(Neurath et al. 1973, 306)

"*The scientific world-conception serves life, and life receives it*" (318). Such an outlook on science can best be framed not in terms of logical positivism as it is commonly understood, but in terms of pragmatism taken as deep empiricism.

There are many reasons to pursue integrated HPS, and many ways for doing it.[14] What has been lacking in my own advocacy of integrated HPS is a broad philosophical grounding for it, a general philosophical perspective from which integrated HPS is a crucial thing to be doing for those who concern themselves with the place of science in human life. The need for integrated HPS arises naturally if we take a humanist view of science.

Acknowledgments

Notes

1. This definition appears on simply searching for "pragmatism" in Google, and it is part of the Google Dictionary (www.google.be/search?q=Dictionary).
2. For the original formulation, see Peirce (1878, 293).
3. For some preliminary thoughts along this direction published so far, see Chang (2016, 2017, 2018). In Chang (2016), I used the phrase "pragmatic coherence."
4. A preliminary exposition of this account is in Chang (2017). The epistemic activity in question does not have to be one of explicit testing. Sometimes a true statement is explicitly verified; other times its truth consists in its involvement in other kinds of successful activities.
5. Many-valued logics are possible, and in fact seem to be flourishing.

6. Dewey references Peirce in connection with this thought, in footnote 1 on page 9.
7. That was the first of his "six theses" about logic (Dewey 1938, 14–21).
8. Dewey argued that logical principles were only "operationally a priori" at each stage of the evolution of knowledge (Dewey 1938, 14). If that is the situation even with logic, need we say much about the revisability and evolvability of the methods of science?
9. The following statements are helpful in clarifying Lewis's position: "The necessity of the a priori is its character as legislative act. It represents a constraint imposed by the mind, not a constraint imposed upon mind by something else" (Lewis 1929, 197). "The paradigm of the *a priori* in general is the definition. It has always been clear that the simplest and most obvious case of truth which can be known in advance of experience is the explicative proposition and those consequences of definition which can be derived by purely logical analysis. These are necessarily true, true under all possible circumstances, because definition is legislative" (239–240).
10. See also Lewis (1929, 165).
11. Dewey went on to dissect the inquiry process into several steps (Dewey 1938, 105–112).
12. There are, of course, intricate debates about how much Kant was willing to enter into metaphysical commitments reaching beyond the phenomenal realm. See, for example, Massimi (2017) for discussion.
13. See Fesmire (2015, 64–73) for a nice exposition.
14. See Arabatzis and Schickore (2012), and references therein, for a relatively recent assessment of the state of play in this area of work.

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