

Kuhn's Kantian Dimensions

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Abstract

Two questions should be considered when assessing the Kantian dimensions of Kuhn's thought. First, was Kuhn himself a Kantian? Second, did Kuhn have an influence on later Kantians and neo-Kantians? Kuhn mentioned Kant as an inspiration, and his focus on explanatory frameworks and on the conditions of knowledge appear Kantian. But Kuhn's emphasis on learning; on activities of symbolization; on paradigms as practical, not just theoretical; and on the social and community aspects of scientific research as constitutive of scientific reasoning, are all outside the Kantian perspective. Kuhn's admiration for Kant is tempered by his desire to understand the processes of learning, of initiation into a scientific community, of experimentation using instruments, and of persuasion, drawing on the work of familiar influences, including Piaget, Koyré, and Wittgenstein, and less familiar ones, including Langer, Demos, and Frank. Both Kuhn and Kant were interested in the question: what is the status of science, and what is the role of the scientist in its development and justification? But Kuhn presents science in a much more messy, historically contingent, and socially charged way than Kant does. The paper's conclusion evaluates Kuhn's reception among researchers including Richardson and Friedman, assessing the prospects for future work.

Keywords

Kuhn, Kant, neo-Kantianism, scientific change, history of philosophy of science, sociology of science, pedagogy

Introduction: Two Questions

Two questions need to be considered when assessing the Kantian dimensions of Kuhn's thought. First, was Kuhn himself a Kantian of some sort?¹ There are neo-Kantian traditions, French and German, from which Kuhn could draw, and there are more complicated possible influences. In order to assess Kuhn's "Kantian" influences, then, we need to figure out whether Kant, Kantians, or neo-Kantians have had an influence on his work, directly or indirectly. A second question is whether Kuhn had an influence on the Kantian and neo-Kantian thought that came after him. Here, rather than looking at sources and influences, we consider a reception tradition.

While both questions are significant to the current project, it is crucial to distinguish them from each other. In particular, as I will argue, making clear distinctions here will allow us to see how recent assessments of Kuhn can be correct, within their own domain, but incorrect when applied outside it (Kant scholars will recognize this move from the Antinomies!). More and more scholars are working on Kuhn's influences, scholarly development, and reception. For instance, we might look at the competing assessments of Pihlström and Siitonen (2005) and Mayoral de Lucas (2009). Pihlström and Siitonen argue that,

Even though the logical empiricists dispensed with Kantian synthetic a priori judgments, they did maintain a crucial Kantian doctrine, viz., a distinction between the (transcendental) level of establishing norms for empirical inquiry and the (empirical) level of norm-governed inquiry itself. Even though Thomas Kuhn's theory of scientific revolutions is often taken to be diametrically opposed to the received view of science inherited from logical empiricism, a version of this basically Kantian distinction is preserved in Kuhn's thought. In this respect, as Friedman has argued, Kuhn is closer to Carnap's theory of linguistic frameworks than, say, W.V. Quine's holistic naturalism. Kuhn, indeed, might be described as a 'new Kant' in post-empiricist philosophy of science. (2005, 81)

¹ According to his own records, Kuhn did not read the *Critique of Pure Reason* in toto, at least before March 1949 (Galison 2016, 50). But in 1940 he did take a course that covered Kant, who came as a "revelation".

Juxtapose that with Juan Mayoral de Lucas's recent evaluation:

there seem to be good prospects of a reinterpretation of Kuhn's philosophical thought in terms of an intermittent conversation with Lewis (among other thinkers). The main consequence would be a change of the tradition to which we usually ascribe Kuhn's thought—from French neo-Kantianism to the American (or rather Lewisian) pragmatism and its criticism of Kant. This paper suggests to focus further examinations (and criticisms) of Kuhn's philosophical legacy from this point of view—that is, by assessing his place in the development of pragmatism and the influence of Lewis's pragmatist approach on him. (2009, 183)

Both of these are correct. Friedman, and Pihlström and Siitonen, are correct that there is much for the Kantian to mine in Kuhn. Kuhn's distinction between frameworks, or paradigms, and empirical, informal actions of inquiry and investigation, is consistent with a Kantian picture, as is his view that judgments about scientific objects (ontology), and even the 'world' in which scientists work, can be affected by higher-level decisions about paradigms, axioms, and principles. However, to argue that such a Kantian framework can be found in Kuhn is not to prove that it was Kuhn's own view, or that Kuhn acquired the view from Kant or the neo-Kantians.

Mayoral de Lucas is correct, as well, to argue that Kuhn was influenced by Clarence Irving Lewis's pragmatism and by the work of others at Harvard University at the time. In particular, Wray (2016) argues for the influence of James Bryan Conant, and Mladenović (2007) for the influence of Wittgenstein on Kuhn. That influence is interestingly complicated by Kuhn's interest in other, related figures, including his teachers and associates at Harvard. I will argue, in particular, for consideration of his philosophy teacher Raphael Demos, and for authors who Kuhn read carefully in the 1940s, including Susanne Langer and Philipp Frank, who had emigrated to Harvard in the late 1930s.

The paper that follows will examine each of the above questions in turn. We will look, first, at Kuhn's training and at his influences, and will investigate to what extent we can find a Kantian influence on Kuhn's work. The second section will examine how the reception of both Kant and Kuhn in the

nineteenth and twentieth centuries has affected scholarly evaluations of Kuhn's Kantian aspects. The third section will analyze themes that emerge from the discussion in the first two.

§1 The First Question: Kantian Influences on Kuhn?

A raft of collections on Kuhn has sailed in recently, because of the 50th anniversary of the publication of *The Structure of Scientific Revolutions* in 1962 (e.g., Kindi and Arabatzis 2012, Devlin and Bokulich 2015, Richards and Daston 2016). Possibly as a result, there is a steep increase in rigorous work on Kuhn's origins and development (Mayoral de Lucas 2009 and especially 2017, an earlier work is Andresen 1999), and on the study of his less well known texts, including the Thalheimer Lectures (Melogno 2019), his later book *Black-Body Theory and the Quantum Discontinuity* (Timmins 2019), and the influence of chemistry on Kuhn's development (Wray 2019, Chang 2012).

All this work has shed significant light on Kuhn's development: in physics and chemistry, in philosophy, in history, and in his conceptions of psychology and social science more generally. The breadth of the new scholarship emphasizes how very much there is to Kuhn, which can present a challenge. Kuhn began his career as a physicist. Still, he took philosophy courses early on. But his reading ranged from Gestalt psychology, to Jean Piaget, to Alexandre Koyré, to Susanne Langer, to John Dewey. Sorting out the influences on Kuhn is no easy task. In this section, I will limit myself to explaining what we can infer, and what we ought not to infer, about Kuhn's relationship to Kant from recent work on his origins and development as a scholar.

§1.1 What's Kantian about Kuhn?

Before we begin, I will provide a sketch of ways that we might find connections between Kuhn and Kant, and will list a number of links between them that I think are not justified.²

² The section that follows makes sweeping assertions that do not divide up Kuhn's works by time period. I have found it necessary to simplify things a bit in order for this topic to become manageable, and I recognize that there is much more nuance to be found in the changes to Kuhn's views over time.

Possibly ‘Kantian’ or neo-Kantian aspects of Kuhn include:

- The scientific paradigms of *Structure* can function as background explanatory frameworks, conditions for making sense of scientific assertions about objects and phenomena. They are, in this sense, conditions for the understanding and justification of objective knowledge, a position which has been linked directly to the Kantian tradition.
- Similarly, Kuhn argues that there are conditions for knowledge, science, and even experience, in the following limited sense. There are conditions that must be met before we can even make assertions about or have access to the phenomena, and those conditions may involve practical capacities (working with scientific instruments, for instance) or may involve reasoning about scientific laws or proof-structures. This position is not necessarily part of Kantian orthodoxy, but is quite consistent with the Kantian position.
- Changing one’s conceptual, law-governed frameworks has an impact on one’s judgments about objects and events, and even on one’s fundamental ontology. While this view usually is ascribed to thinkers influenced by Kant who were critical of Kant’s transcendental idealism (e.g., Hans Reichenbach), it is less foreign to Kant himself than one may think.
- There can be competing frameworks for scientific and epistemological explanation, which cannot be resolved by rational means. While this is often cited as an un-Kantian aspect of Kuhn, it is — of course! — very Kantian.

Elements of Kuhn’s view that cannot count as Kantian (at least, not without quite a bit of further explanation) include:

- We can be initiated into — can learn — new paradigms. Kuhn is among those who mention the ‘context of pedagogy’, that is, the context in which scientists learn how to do science, both practically and theoretically. Kuhn’s practical approach to learning, and his view about how

paradigms go beyond the merely theoretical, is much more pragmatist than it is Kantian (see, e.g., Patton 2017, Rouse 1998).

- Learning, as a way of thinking and practicing, involves being initiated into a community of practice, and even involves different standards and requirements for proof and persuasion. As we will see, Kuhn had any number of possible philosophical sources for this view, including Demos, Lewis, and Wittgenstein, not to mention scientific and sociological sources like Fleck, Polanyi, and Toulmin.

At least one aspect of Kuhn is deeply ambiguous. It is sometimes cited as a kind of Kantianism, and Kuhn seems to have acquired it, as we will see, partly from the neo-Kantian tradition. But it is not really a Kantian view:

- There is no “real” form for any given matter or event. Instead, we structure reality with concepts, serial form, and symbolization (Ernst Cassirer, Susanne Langer, Jean Piaget). In my view, this position comes more from nineteenth century psychology, including Piaget but especially Helmholtz, and associated rejections of ‘direct realism’ about perception, than it does from Kantian philosophy. In Langer’s case, this rejection of direct realism is linked to her connections with Sheffer, Lewis, and Wittgenstein, whom Mayoral (2009) cites as influences on Kuhn.

Finally, there is a Kuhnian element that is in no way Kantian, and may even be anti-Kantian. I mention it because, while it is missing in Kant, it resembles views found in the neo-Kantian tradition, and is a welcome complement to Kantian views:

- Historical explanation is not a matter of retracing the unfolding of rational principles in time. Rather, history — including the history of science — itself requires a kind of initiation and learning: for instance, about the standards for practice, proof, inference, and reasoning that held sway for a given community. We find this view especially in *The Essential Tension*.

§1.2 Paradigms as Explanatory Frameworks

In the 1940s, Kuhn studied physics and philosophy at Harvard, taking one year of philosophy as an undergraduate, including an important course with Raphael Demos (Sigurdsson 1990, 19). In that course, Kuhn said, he studied Descartes, Spinoza, Hume, and Kant.

Spinoza didn't hit me very hard, Descartes and Hume were both in the current, I could understand them easily; Kant was a revelation... I gave a presentation on Kant and the notion of preconditions for knowledge. Things that had to be the case because you wouldn't be able to know things otherwise.... It just knocked me over, that notion, and you can see why that's an important story. (Baltas et al. 2000, 264)

During the war, he read Percy Bridgman, Phillip Frank, and Bertrand Russell. In the late 40s, Kuhn began to teach in James Conant's General Education science curriculum at Harvard, which had a profound influence on his development (Wray 2016, Nye 2012).³ Following Conant's suggestion that Kuhn "go find out" about the history of mechanics, Kuhn began reading the historian Alexandre Koyré's *Études galiléennes* (1939), as well as Aristotle, which led to his famous realization that Aristotle's physics is intelligible on its own terms (Sigurdsson 1990, 20). In 1951, Kuhn gave the Lowell Lectures, which show the deep influence of Koyré (Galison 2016, 60 and n38).⁴

One clear case for an influence of Kant on Kuhn is Kuhn's view that paradigms provide rules that determine how we use concepts, and that these rules and concepts are constitutive of objects of experience and knowledge. Kant argues that "All intuitions, as sensible, rest on affections, concepts

³ "At this time the major topics in the physical sciences, and the ones mentioned by Kuhn in *Structure*, included mechanics and astronomy from Aristotle to Newton, the chemistries of phlogiston and oxygen, Daltonian atomism, eighteenth-century electrical researches, gas theories from Boyle to Maxwell, theories of heat, light, and radiation from Newton through Maxwell, X-rays, quantum mechanics, electromagnetism, and relativity theory" (Nye 2012, 558).

⁴ In 1957, Kuhn published *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought*, which also shows the influence of Koyré. In the same year, two volumes of Conant's *Harvard Case Histories in Experimental Science* were published. Kuhn's use of the 'Copernican Revolution' as a case study obviously has Kantian overtones, but Kuhn's position in the book is much more empiricist. In fact, later, Kuhn is critical of Koyré's excessively a priori take on Galileo (see, e.g., Pinto de Oliveira 2012.)

therefore on functions. By a function, however, I understand the unity of the action of ordering different representations under a common one” (1998 / 1781-87, A68 / B93). Kantian concepts and judgments are functions for the unification of representations. Those functions are on the side of the subject, and so, in Kant’s sense, are a priori: their unifying actions are independent of experience.

Kuhn’s account of how paradigms⁵ allow scientists to become aware of significant phenomena, to solve scientific problems, and to make judgments about objects is an obvious candidate for a Kantian influence. And we might see Kuhn’s claim that paradigms provide rules for scientists to follow in solving problems as a key justification for attributing such an influence to Kant (see, e.g., Richardson 2002). Paradigms are not logical functions of unity like Kantian concepts. But they do provide ways of approaching the phenomena: Kuhnian paradigms give a scientist “access to the (region of the) phenomenal world relevant to the work of his or her community” (Hoyningen-Huene 1993, 187). That access is mediated by ways of seeing and recognizing objects in terms of a background framework, the paradigm: which we could view as a kind of naturalized Kantian a priori (See §2 below for details of this notion).

There are a number of obstacles in the way of such a reading, at least in terms of assessing influence on Kuhn. The first is that it is unclear how much of the first *Critique* Kuhn had read, at least before *Structure*. He took an undergraduate course at Harvard that covered Kant, but marked in his journal that he had not read the first *Critique* all the way through, nine years later (Galison 2016, 51).

The second obstacle is that, in §§3-6 of *Structure*, and later, Kuhn qualified the role of rules in the progress of science, even under a paradigm.⁶ Kuhnian paradigms should be understood in the context

⁵ As Margaret Masterman (1970) has detailed, Kuhn uses the word ‘paradigm’ in more than 20 different ways in *Structure*.

⁶ In *Structure*, “paradigms can guide science even without rules (§ 3). ... [How?] This question is answered with recourse to Ludwig Wittgenstein’s theory of concept use via family resemblance (§§ 4–6)” (Hoyningen-Huene 2015, 186).

of scientific practice.⁷ Even in 1962, Kuhn does not see a paradigm as merely a background theoretical framework. Paradigms are based on model scientific achievements that become organizing norms for scientific communities.⁸

Kuhn does not allow for a Kantian account of perceptual experience, according to which we use concepts as schemata, or rules, for the synthesis and unification of perceptions and representations into experience and judgment. Kuhn was reading Jean Piaget⁹ in the 1940s (Galison 2016, 51). Kuhn read Piaget from very early on. In describing Kuhn's "psychologically inflected neo-Kantianism", Galison notes that for Kuhn, the process of moving from sensations to events and phenomena is

a continuing one, forged by the encounter of the psychological with the logical and scientific apparatus that brings us the physical visible world. Throughout, Kuhn followed Piaget in presenting a bilayer analysis: on the one side there was the physical world and, on the other, its not-always matched representation in the verbal-psychological. Indicating the relative autonomy of the psychological world, Kuhn pointed out, tentatively, there could be other such 'worlds' including 'the aesthetic & ethical'. (Galison 2016, 53)

Galison describes this as "psychologically inflected Kantianism (sharp division between world and representation)" (Galison 2016, 53). And the account does rely on the engagement between the mind and the "logical and scientific apparatus that brings us the physical visible world" (ibid.), which may sound something like a Kantian a priori or one of its later variants.

The process Kuhn is describing here, of learning to use tools, logical and physical, to bring about a world of phenomena that are available to scientific research, can be read in a Kantian way. But it can be read in other ways. In Piaget's work, it means that children learn about concepts, like motion and

⁷ Including Rouse (1998, 2013), Andersen (2000), Brorson and Andersen (2001), Patton (2017).

⁸ In a later interview reporting on a conversation with Masterman, who advocated that paradigms are entirely social, Kuhn even says "I can't make [what she said] work quite but it's very deeply to the point: a paradigm is what you use when the theory isn't there" (Baltas et al. 2000, 300).

⁹ "Piaget he did read... focusing on the psychologist's 1946 *Judgment and Reasoning in the Child* as well as 'Notions de vitesse et de mouvement chez l'enfant'" (Galison 2016, 51).

speed, not just by developing their psychological and logical capacities, but by being initiated into a set of practices that must mature over time. Piaget did not agree with Kant's implicit characterization of mental 'faculties' or 'capacities' as operating independently of experience and, in particular, independently of communication with others. In my view, Kuhn's account of paradigms as frameworks for constituting knowledge fits much more naturally within Piaget's perspective than it does within a Kantian account. As Kuhn remarks in a later address, Piaget's

perceptive investigations of such subjects as the child's conception of space, of time, of motion, or of the world itself have repeatedly disclosed striking parallels to the conceptions held by adult scientists of an earlier [historical period]¹⁰... Almost twenty years ago I first discovered... both the intellectual interest of the history of science and the psychological studies of Jean Piaget. Ever since that time the two have interacted closely in my mind and in my work. Part of what I know about how to ask questions of dead scientists has been learned by examining Piaget's interrogations of living children. I vividly remember how that influence [of Jean Piaget] figures in my first meeting with Alexandre Koyré, the man who, more than any other historian, has been my maître. I said to him that it was Piaget's children from whom I had learned to understand Aristotle's physics. His response — that it was Aristotle's physics that had taught him to understand Piaget's children — only confirmed my impression of the importance of what I had learned. (Kuhn 1977/1971, 21-22)

Kuhn here ascribes to Piaget his famous hermeneutical moment, of learning to understand how Aristotle's physics works on its own terms. While Piaget certainly had sympathies with Kant, his influence is not Kantian in this context.

Having said that, it is also true that Kuhn rejected any version of direct realism that would have it that we derive direct knowledge of the real concepts, patterns, and formal properties of objects and events from experience. In that sense, Kuhn's work is very much consonant with the neo-Kantian philosophers, including Hermann Cohen and Ernst Cassirer, who rejected the 'copy' theory that concepts are direct copies of sensations. Thus, there is reason for ascribing something like "neo-Kantianism" to

¹⁰ *The Essential Tension* translates this as "age", but I find that too easily confused with a person's age.

Kuhn. Richardson (2003) and Patton (2004), among others, detail the resistance to the ‘copy theory’ of concepts, according to which our concepts of things are direct copies of those things’ properties. Richardson also details the extent to which the neo-Kantian Marburg School sees the development of the mathematized science of nature as a necessary a priori condition of empirical knowledge.¹¹

And we find an influence on Kuhn in the Harvard context who was directly responding to Cassirer: Susanne Langer. Langer also engaged critically with Wittgenstein’s philosophy as early as 1926, including connections with others Kuhn was reading at the time, like Sheffer and Russell (Felappi 2017, 39-40). These early articles were worked into material found in Langer’s *Philosophy in a New Key*, which Kuhn read in toto in 1949 (Galison 2016, 51). There, Langer remarks, “The study of symbol and meaning is a starting-point of philosophy, not a derivative from Cartesian, Humean, or Kantian premises” (Langer 1951/1942, viii). Cassirer and Langer focus their attention on how meaning is symbolized in the initial, non-conceptual encounter between humans and the world, through metaphor, myth, and natural language, for instance. The ‘expressive’ element of human experience does not require prior conceptualization or symbolization: it is what is found in myth, for instance.

Langer presents an account of symbolization according to which conceptions of a thing are constructed by a process of abstraction, and “our ability to talk about” the same thing is based on recognition of the pattern in common between several abstractions (1951/1942, 68-70). Langer’s remarks are significant for the following reason. But in 1961, Kuhn circulated a draft of *Structure* now known as “Proto-Structure” (see Galison 2016; and Hoyningen-Huene 2015). In Proto-Structure, there was no mention of Wittgenstein or of concept use via family resemblance. According to Hoyningen-Huene, in the 1962 edition of *Structure*, “Rules of normal science, if existent, are derived from paradigms

¹¹ Richardson 2003, 61-2 and passim: “for Cassirer, space, time, magnitude and functional dependence of magnitudes are a priori not because we have knowledge of space, time, number, and function independently of experience but because objective experience is first possible through mathematized sciences of nature” (Richardson 2003, 62).

(§ 2). However, paradigms can guide science even without rules (§ 3) ... what does this statement mean? This question is answered with recourse to Ludwig Wittgenstein's theory of concept use via family resemblance (§§ 4–6)" (Hoyningen-Huene 2015, 186). Kuhn gave the MS of Proto-Structure to Cavell, who, Hoyningen-Huene suggests, may have recommended the Wittgensteinian move.¹² Now, "Kuhn says in a taped interview... that initially he was not aware of the parallel of his paradigms to Wittgenstein" (Hoyningen-Huene 2015, 188; see Baltas et al. 2000, 299). But Langer's account of concepts is not very far off – and she mentions symbols as possessing a "visual Gestalt" (Langer (1951/1942, 72).

In any case, Kuhn was a lifelong opponent of the view that science consists of a set of a priori rules that come pre-set, already valid for application to experience, and that do not require initiation or training into ways of seeing, perceiving, and reasoning. Marcum (2012) details how

Kuhn contrasts his approach to the approach of traditional philosophers of science who presume that the "process of attaching symbolic and verbal expressions to nature is entirely governed by definitions and rules, explicit or implicit" (1967, card 16). Although Kuhn acknowledges that definitions and rules do function in science, they cannot account completely for how scientists go about setting up problems and solving them. Often, scientists exhibit unanimity vis-à-vis practice even though they may not entirely agree on the meaning of theoretical expressions. According to Kuhn, solved problems function by allowing scientists to see their way to solving new, unsolved problems. In other words, scientists recognize a similarity relationship between the solved and unsolved problems. Important in this process, Kuhn stresses, is "the learned perception of likeness or similarity [that] is prior to and does not imply the existence of a set of criterion [sic] which would provide a basis for the judgment of likeness" (1967, card 18). (Marcum 2012, 50-1)

Despite Kuhn's famous emphasis on the priority of paradigms, this final sentence is a clear reflection of his debt to Piaget. And, in fact, Kuhn concludes his 1969 lecture, "Second Thoughts on Paradigms," "by comparing a science student's problem-solving ability to that of a child learning to assemble a puzzle,

¹² Hoyningen-Huene 2015, 188. See Stone 2018, Heilbron 1998 for Cavell and Kuhn.

thereby emphasizing the logical and psychological priority of similarity perception” (Marcum 2012, 54, see Kuhn 1974 / 1969). The appeal to a case study involving children is a clear reference to Piaget.

Kuhn’s admiration for Kant is tempered, throughout his career, by his desire to understand the processes of learning, of initiation into a scientific community, of experimentation using instruments, and of persuasion (see §1.5 below).

§1.4 Pragmatic and Conventional A Priori Reasoning

Spinoza didn’t hit me very hard, Descartes and Hume were both in the current, I could understand them easily; Kant was a revelation... I gave a presentation on Kant and the notion of preconditions for knowledge. Things that had to be the case because you wouldn’t be able to know things otherwise.... It just knocked me over, that notion, and you can see why that’s an important story... I go round explaining my own position saying I am a Kantian with moveable categories. It’s got what is no longer quite a Kantian a priori ... I do talk about the synthetic a priori. (Baltas et al. 2000, 264)

Kuhn does not allow for the possibility of a universal rational framework that proves anything like Kant’s results about the status of rational agents, or the necessity of the results of Euclidean geometry or Newtonian physics.

However, in the Harvard environment of the 1940s and 1950s, there was no lack of figures who were re-thinking the Kantian a priori. The American Pragmatist C.I. Lewis adumbrated, at the time, a ‘pragmatic a priori’ that certainly has deep similarities to Kuhn’s account expressed above: that the a priori consists of changeable orientations to experience, which one learns. Mayoral (2009) rightly cites Lewis as a possible early source of Kuhn’s ‘moveable categories’.

Another, perhaps more surprising source for Kuhn’s development was the logical empiricist Philipp Frank. Frank had emigrated to the United States, where he and Hania Frank became refugees following the invasion of Prague (see Holton 2006). He was a physicist and a philosopher (for his philosophical positions see Uebel 2012, Mormann 2017). Frank remembers, of the first Vienna Circle,

Our whole group understood and fully agreed that the human mind is partly responsible for the content of scientific propositions and theories. . . . We admitted that the gap between the descriptions of facts and the general principles of science was not fully bridged by Mach, but we could not agree with Kant, who built this bridge by forms or patterns of experience that could not change with the advance of science. (Frank 1949, 7-8)

As Uebel notes, it was this context that led Frank's Vienna Circle colleague, Hans Reichenbach, to distinguish between 'axioms of coordination' and 'axioms of connection' (Uebel 2012, 8). It is well known that Kuhn read Frank early on; they were at Harvard together in the 1940s; and they were wrestling with some of the same questions. Frank was even involved in Conant's General Education curriculum. It is entirely possible that Frank's attempt to "bring about a rapprochement between the logical empiricism of the Vienna Circle in exile and American pragmatism" had an effect on Kuhn (Mormann 2017, 56). However, if so, this would have led Kuhn away from a Kantian a priori, and toward something closer to Poincaré's conventionalism.

§1.5 Paradigms and Persuasion

This final section will be quite speculative. It will investigate "a provocative but unfortunately neglected essay by the philosopher Raphael Demos entitled 'On Persuasion' (1936)", which anticipates a number of Kuhnian themes. Demos was Kuhn's first philosophy professor, and taught a class that Kuhn says was very important for his development. In the essay, Demos argues

against sheerly relativistic ('ethnocentric') notions that theory 'creates' its facts simpliciter, and thus circularly confirms itself in a prison house not of language but of cultural practices, Demos argues both that divergent theories or worldviews may equally explain the 'facts' and that 'to explain facts is not enough, a theory must be true' (226) ... such truth is not an easy matter of superior arguments, since the very ideas of argument and reason are contested. (Jost and Hyde 1997, 10)

Page 228 of Demos's essay contains, basically, Kuhn's argument about how paradigms are overthrown:

In the end ... the theory is imperceptibly worn away by the cumulative force of minute considerations, so much so that it is impossible to put one's finger on the exact factor which led to the abandonment of the theory. There is no distinguishable straw which is the last straw. For the most part, a general pattern resists death by allowing itself to be modified; patterns grow, and even when they are seemingly discarded, they are taken up into another and wider pattern ... the victorious strength of the new elements proceeds from the fact that they adumbrate a new and alternative pattern more satisfactory than the one in use. Thus, ultimately, it is a conflict between patterns. Persuasion is not a mechanical process, but a living growth in which elements are gradually assimilated, and ultimately modify those very tissues which assimilate them; and like all growth, persuasion is unconscious in its greater part (Demos 1936, 228).

As Jost and Hyde (1997) note, Demos's account has similarities to Wittgenstein's view from *On Certainty*, that at the bottom of fundamental disagreements, one is left with only persuasion. In *Structure*, Kuhn says something quite similar about paradigm choice: it "proves to be a choice between incompatible modes of community life. Because it has that character, the choice is not and cannot be determined merely by the evaluative procedures characteristic of normal science" (1962, 94).

The conclusion of this first section, then, is that there are severe limitations to a Kantian reading of Kuhn himself. While he mentioned Kant as an inspiration, Kuhn's emphasis on learning; on activities of symbolization; on paradigms as practical, not just theoretical; and on the social and community aspects of scientific research as constitutive of scientific reasoning, are all outside the Kantian perspective. They are not, however, therefore anti-Kantian or entirely inconsistent with Kantian reasoning. In the section following, we will see how Kantian philosophers, and philosophers of science, have grappled with the Kantian themes in Kuhn's work.

§2 The Second Question: Kuhn's Reception in Kant Scholarship and in the Philosophy of Science

In order to understand how Kuhn was received in Kant scholarship of the 1980s and 90s, one should know the main trends and concerns of that period. The following sections do not constitute a complete historical or sociological analysis of that time, but gather some of the main themes and questions, and show how they may have influenced Kuhn's reception, including how Kuhn may be presented to contemporary researchers.

§2.1 Kant Scholarship

Debates between Peter Strawson and Jonathan Bennett, on the one hand, and Paul Guyer and Henry Allison, on the other, defined much of the Anglophone study of Kantian epistemology in the 1980s and 90s. Strawson and Bennett delved into the question of how much Kantian thinking could be retrieved if we also needed to maintain the progress in philosophy they saw as emerging from the analytic philosophy tradition, especially the work of Frege and Russell, as well as Quine and Putnam. In *The Bounds of Sense*, Strawson argued that the more empiricist elements of Kant — Kant's restriction of knowledge to objects of possible experience, and his rejection of a subjective, psychological basis for epistemological justification — were tenable. Strawson accepted something like Kant's empirical realism, but rebuffed transcendental idealism: in particular, he targeted Kant's arguments that space, time, and the categories are purely subjective, independent of experience, and a priori.

With *Kant's Transcendental Idealism: An Interpretation and Defense*, Allison responded to Strawson, especially, that transcendental idealism was defensible even on Strawson's own terms, and that it was supported by further arguments, as well. Allison argued that Kant saw space, time, and the categories as 'epistemic conditions' for knowledge. Epistemic conditions are hardly 'transcendental' in any mysterious sense: they are simply tools that we use to analyze the representations we are confronted

with in experience, to work up those representations into knowledge. Kant's position comes down to the claim that the tools are not themselves drawn from experience, but that any possible knowledge must nonetheless be restricted to objects of experience.

The Semantic Tradition from Kant to Carnap, a posthumously published history and analysis by J. Alberto Coffa, introduced a generation of scholars to the perceived clash between Kantianism and Frege's and Russell's thought, on the one hand, and the semantic tradition of Carnap and Quine, and the other.

The interests of Allison, Strawson, and Coffa converged on a set of key problems: objectivity versus subjectivity; the status of Kantian space and time; the status of Kant's categories (a priori concepts); and the universality and necessity Kant purportedly claimed for a priori knowledge gained through mathematical natural science. It is a somewhat uneasy business to try to assimilate Kuhn into the scholarly framework of late 20th century Kantianism. The questions mentioned just now did not markedly interest Kuhn himself. And, insofar as they did, Kuhn was more persuaded by Piaget's account of these phenomena. Moreover, there are other questions in Kuhn that should be of more interest to Kant scholars: the extent, for instance, to which the Antinomies can be viewed as incommensurable paradigms.

2.2 The Dynamics of Reason

Around the same time as the debates between Allison, Strawson, Guyer, and Bennett, researchers concerned with the history of "scientific philosophy", and with the history of philosophy of science, began to reconsider the relationships between logical positivism, logical empiricism, neo-Kantianism, and pragmatism. Among these were the students and intellectual descendants of Hans Reichenbach, including Wesley Salmon, Clark Glymour, Michael Friedman, Alan Richardson, and Alison Laywine.

Friedman began his career with *The Foundations of Spacetime Theories*, and later contributed *Kant and the Exact Sciences* and *Reconsidering Logical Positivism*. His work is marked by a deep

engagement with logical positivism, which is also true of Salmon and Glymour — but Friedman inaugurated a return, in this tradition, to the close consideration of Kantian and neo-Kantian philosophy. True to his antecedents, Friedman has not restricted himself to the consideration of what might be considered ‘internal’ questions of Kant scholarship, such as the ones raised above in the Allison-Guyer-Strawson debates of the 80s and 90s.

Instead, Friedman has focused on the question of scientific change, and on the linked accounts of space, time, and rationality we find in Kant, Kuhn, Cassirer, Carnap, and in scientific philosophy generally. Here, he focuses on how the ‘revolutions’ in science, including the transformations to the ideas of space, time, and spacetime in 19th and 20th century physics, and the changes to the notions of causality and ontology, in the quantum theory and elsewhere. Friedman has said, “In the current state of the sciences... we no longer believe that Kant's specific examples of synthetic a priori knowledge are even true, much less that they are a priori and necessarily true” (2002, 25). Friedman’s situation as a researcher of the history and philosophy of physics leads him to target Kant’s claim that there can be “a fixed and absolutely universal rationality” that grounds commonality of judgment in epistemology and in the sciences (25). In particular, Friedman’s revival of Reichenbach’s constitutive a priori, and his defense of a dynamic a priori, in *The Dynamics of Reason* are inspired, explicitly, by Kuhn’s account of changing paradigms.¹³ Friedman’s “relativized a priori principles constitute what Kuhn calls paradigms: relatively stable sets of rules of the game, as it were, that make possible the problem solving activities of normal science ... In periods of deep conceptual revolution it is precisely these constitutively a priori principles which are then subject to change” (Friedman 2008, 39).

Friedman’s account responds to the great revolutions in science in the 20th century: relativity theory and the quantum theory, and the crisis that this provoked in the philosophy of science. Because of this, it is

¹³ Mormann 2012 argues that Friedman has underestimated the role of a Lewisian pragmatic a priori in the dynamics of reason, and provides a synthesis of the two.

aimed at solving a particular set of problems, problems for which Friedman looked to Kuhn for the answer. Reciprocally, however, Friedman's account has been employed as a way to save Kant from the objection that his universal, necessary a priori was undermined by those same revolutions in science.

§3 Conclusion: The New Image of Reason in History

Kuhn presents science in a much more messy, historically contingent, and socially charged way than Kant does. Certainly, Kuhnian paradigms provide norms for pursuing science. But Kuhn would not attempt to present, as Kant does, an 'ideal history' of reason, or a 'metaphysical foundations' of the natural sciences. While it is possible to assimilate Kuhn's picture into a Kantian framework, it is crucial to see how the Kuhnian material has to be cut and hemmed first.

A question of interest to both Kuhn and Kant is: what is the status of science, and how do we account for the role of the scientist in its development and justification? Kant developed epistemic, transcendental conditions for knowledge, with the purpose of demonstrating the limits of metaphysical reasoning — of providing a critique of pure reason.

For Kuhn, in contrast, the limits of reason are given by the limits of human communication. From Piaget, Kuhn learned that we know only what we can communicate. A child may have a private notion of 'motion', or 'speed', for instance. But until she can communicate the rational basis for her knowledge, her knowledge cannot be recognized and therefore is not knowledge at all, or even conscious thought.¹⁴ This is a Kuhnian condition of knowledge, but it is not one that Kant cites.

A key question regarding the Kuhnian dynamics of reason, then, is how the capacities for recognition and communication of frameworks, concepts, ideas, and explanations are developed within

¹⁴ Piaget: "if a proposition cannot be expressed, we cannot be conscious of it. When we say that a child can handle a notion before having become conscious of it, what we mean is that there has been gradually built up in the child's mind . . . a schema which can be applied . . . but which does not yet correspond to a verbal expression. . . . The conscious realization of one's own thought is dependent upon its communicability, and this communicability is itself dependent upon social factors, such as the desire to convince" (1928, 29-30).

communities.¹⁵ Such an account requires a much more historically situated and flexible framework. It also requires, not just that we develop a relativized a priori, but that we develop an account of the development of capacities for reasoning and expression, not just within the individual, but within societies, disciplines, and communities.

The most compelling defense of a Kuhnian approach to the narration of the history of reason, and of scientific and philosophical communities, can be found in the work of Richardson (2012, 2002, 2015). Richardson shares with Kuhn a concern that many histories of science and of philosophy are un-historical.

The set of historical facts of the development of science is not, on [Kuhn's] view, primarily a source of evidence for or against a philosophy of science, or for illustration of the workings of old or new philosophical machinery. Rather, history of science as a practice engaged in by historians demands the formation of coherent and explanatory historical narratives and the practices involved in the creation of those narratives themselves demand answers to different sorts of questions than the default philosophical machinery would lead you to ask in the first place. In somewhat different words: For Kuhn, the practice of history—the development of historical understanding itself—stands in complicated but ultimately incompatible relations to the sorts of concerns and the machinery for understanding science posited in the logical empiricist philosophy of science (as he understood it) of the 1950s. (Richardson 2015, 43)

The sorts of questions one should ask, in the history of science and of philosophy, include what Richardson calls “tone-lowering” moves toward a real historical account of human endeavor, rather than an abstract, triumphalist narrative: “we concentrate on persons, organizations, schools . . . , on what they were actually doing and what they were actually motivated by; history of philosophy becomes interested in the contingent, the bounded, and human” (2012, 246-7). “Ironically”, Richardson continues, such a history will reveal that the target of our study is more interesting than we thought at first. We had thought to ‘save’ the interest of our research by showing it can be derived from a mighty tradition of impressive

¹⁵ The account of “*Structure as a Weberian Explanatory Model*” (Mladenović 2007) is perhaps along these lines.

ancestors. But regarding science, and philosophy, as human endeavours — as attempts to find recognition, to communicate one's results, to find answers to puzzles — reveals the real interest of these pursuits. They are connected vitally to human purposes.

Such tone-lowering gestures in the case of philosophy would, ironically, remind us that in various places and times philosophy has had important and complicated relations with religion, science, art, and other important human activities and endeavors. In some places and some times philosophy has really mattered to human culture. (247)

Richardson engages with the heart of Kuhn's *Structure*: the struggle against the 'image of science' as a bloodless collection of results, like lifeless butterflies, each pinned to its classifying card showing its place in a historical timeline. The value of history is that it allows the results and achievements to be seen as they really are. A good history shows, not only that an achievement was made, but that it was a real event, connected to human purposes, and linked with a much more complex situation than it may seem at first.

Richardson's work, and that of scholars working in the 'new historiography of science' including Mayoral and Pinto de Oliveira, emphasizes the requirements of the Kuhnian dynamics of reason: that it recognize the real conditions for the development of rational capacities, the recognition and dissemination of results, and the satisfaction of human and rational purposes, within scientific and philosophical communities. Such a project goes well beyond anything Kant ever imagined. But it is a contribution, one that still largely remains to be made, to Kant's project of characterizing the scope, limits, and essence of human reason and action.

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