Thomas Kuhn and Perspectival Realism

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ABSTRACT

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In this paper I discuss Giere's reading of Kuhn as affirming perspectival realism and I present evidence demonstrating that this reading of Kuhn is correct. I consider several scientific realist theses that Kuhn rejects and discuss whether and to what extent perspectival realism may be regarded as a scientific realist position. I suggest adding Kuhn's account of incommensurability, understood in its later form, to Giere's account of perspectival realism. I conclude by providing a definition of perspectival realism that incorporates Kuhn's incommensurability thesis as well as the specific claims of scientific realism that are compatible with perspectival realism. Perspectival realism thus understood is, at most, a weak form of scientific realism.

TABLE OF CONTENTS

Page

1. INTRODUCTION

It is well known that Thomas Kuhn's *The Structure of Scientific Revolutions* (1962) sparked a considerable degree of controversy and debate in both the scientific and philosophical communities. While Kuhn spent much of his career responding to charges of relativism—such as Imre Lakatos' critique that Kuhn made theory choice a matter of "mob psychology" (Lakatos, 1970)—and other issues raised by his critics, his later views on the topic of realism have received comparatively little attention. Recently Ronald Giere has argued that Kuhn's later views on realism, such as those expressed in the essays included in *The Road Since Structure* (Kuhn 2000; hereafter, *RSS*), can be regarded as affirming perspectival realism. Giere avoids drawing a comparison between perspectives and the paradigms of Kuhn's *The Structure of Scientific Revolutions* (henceforth: *Structure*) and instead focuses on Kuhn's later development of lexical taxonomies or lexicons within scientific communities. As Giere notes, "By the time most of the essays in *RSS* were written, Kuhn himself had ceased talking about paradigms, preferring instead the more explicitly linguistic notion of a theoretical lexicon" (2013, 53). While Giere's retrospective interpretation[1] is brief, he makes a case for why Kuhn may be regarded as a perspectivist, why Kuhn is a realist of some sort, and thus why Kuhn may be regarded as a perspectival realist. What perspectival realism entails, and the extent to which it is a realist position, will both be considered in greater detail below, in

[1] Giere makes it clear that he doesn't "mean to imply that Kuhn himself ever held, or even contemplated, such a view" (2013, 53).

sections 2 and 5 respectively. However, Giere offers the following summary of perspectival realism in Giere (2013) that will suffice as a starting point: "some claims generated by scientific practice are claims about the world…that is the realism part. Second, these claims are not unconditional, but relative to a set of humanly constructed concepts…That is the perspectival part" (2013, 53).

In what follows I will bolster Giere's claim that Kuhn may be regarded as a perspectival realist while challenging the idea that perspectival realism is a scientific realist position in any substantive sense, despite its name. Specifically, in section 2 I will outline Giere's account of perspectivism and perspectival realism and challenge some of his central claims. I will also take into consideration some critiques of perspectivism offered by Anjan Chakravartty in (Chakravartty, 2010). In Section 3 I will outline Giere's claim that Kuhn may be regarded as a perspectival realist, taking into account the similar conclusion reached by Paul Hoyningen-Huene (2012). In section 4, by focusing both on Kuhn's essays in *RSS* and some of the secondary literature, I will argue that it is correct to regard the later Kuhn as a perspectivist. Additionally, I will argue that the identification of Kuhn's later views as affirming perspectivism provides a clearer picture of what perspectivism entails when added to Giere's account. In section 5 I will argue that Kuhn should not be regarded as a scientific realist if 'scientific realism' is to be understood in anything like the familiar way in which it is standardly used. By considering several theses of realism I will argue that Kuhn and Giere, as perspectivists, should not be regarded as scientific realists. However, identifying Kuhn as a perspectival

realist allows us to clearly formalize the central claims/commitments of perspectival realism.

2. GIERE'S *SCIENTIFIC PERSPECTIVISM*

In his book, *Scientific Perspectivism* (2006), Giere sets out to synthesize two opposing views regarding the truth-status of scientific claims: objectivism and social constructivism. Objectivism, which can be thought of as a strict scientific realism, is the position that scientific claims are true or approximately true and scientific knowledge is thus knowledge regarding the objective matters of fact about the world. In contrast, social constructivism is the thesis that scientific claims are not true claims about the world and scientific knowledge is really just a consensus reached by scientists within the scientific community. Giere's synthesis of these two disparate viewpoints is "a version of *perspectivism*… [and] mediates between the strong objectivism of most scientists, or the hard realism of many philosophers of science, and the constructivism found largely among historians and sociologists of science" (Giere 2006, 3). Giere begins his discussion of perspectivism by focusing on color science, so I will begin by outlining his main points on this topic.

2.1 Color Science

Giere discusses color science, in order to demonstrate how subjective and objective components interact in scientific observation, by focusing on how our understanding of color is best understood as an interaction between the human visual system and the environment. We perceive things as colored because light reflects off of objects and travels to our eyes with a given wavelength. Different wavelengths are perceived as different colors. Part of the reason objects appear colored is thus due to the wavelengths of light that reflect off of these objects. Light reflects off of different

surfaces based on their molecular structure, and the characterization of how a given surface will reflect light is called the spectral reflectance of that surface. Since the spectral reflectance of different surfaces can be accounted for based on optical science, one could argue that an objective account of colors can be given: "In principle, a specification of the molecular structure of a surface provides all the information needed to determine how that surface would reflect light of any spectral reflectance" (Giere 2006, 25). However, to define the colors of different objects based solely on their different spectral reflectances would be to ignore the subjective aspect of color science and the role that the human visual system plays in our designation of color names.

To assign different spectral reflectances different color names would be completely arbitrary in a world in which there were no humans or a world in which most humans weren't trichromats[2]. Humans are only sensitive to colors to a certain degree because the range of wavelengths which humans are able to detect is limited (400-700 nanometers), and the ability of humans to distinguish between specific wavelengths is imperfect and varies as a function of wavelength and intensity of light. Moreover, not all human trichromats perceive the wavelengths with the same degree of precision and some humans are dichromats. As Giere explains, "There is a range of genetically based color vision deficits that correspond to variations in the basic *trichromatic* structure of the

[2] Most humans are trichromats, "their retinas contain three different types of receptors (called cones…) with three different pigments sensitive to three different ranges of the visible spectrum" (Giere 2006, 18-19).

human visual system…More serious is loss of either the M- or the L- sensitive cones altogether…The result is *dichromatic* color vision" also known as total red-green colorblindness (Giere 2006, 28). Color science thus has a subjective component, then, because while there may be a specific surface spectral reflectance value for any given object, there is a limitation in the ability of humans to discern between the wavelengths reflected off of different surfaces and thus our ability to categorize different objects by color is limited based on our perceptual capabilities. The common agreement that we have reached regarding the classification of colors can be explained by the fact that most humans are normal trichromats meaning that most humans perceive wavelengths in roughly the same way and to roughly the same degree. It would thus be a mistake to think that a purely objective account of colors can be given.

Giere also explains why a purely subjective or culturally relativistic account of colors fails to fully capture color science[3] and argues instead that an interactionist account of color science best captures scientific knowledge regarding colors. Specifically, "Colors are the product of an *interaction* between aspects of the environment and the evolved human visual system" (Giere 2006, 32), and from this it follows that our understanding of colors is best understood in terms of the objective (the molecular makeup of objects and their resulting surface spectral reflectance) interacting with the subjective (the perceptual characteristics of normal human trichromats). The above discussion regarding color science thus exemplifies perspectivism because, as Giere

[3] In particular, Giere cites Berlin and Kay (1969).

notes, “Given our differing biological natures, we naturally interact with different aspects of the world. In this sense, we view it from different perspectives. But we should regard them all as perspectives on a single world” (2006, 35). The perspective of a normal trichromat is the perspective from which we understand color science; however, this understanding is still characterized by certain objective facts and thus perspectivism is best understood as a view that characterizes scientific observation as an interaction between a given perspective and the world.

One might be skeptical of Giere’s focus on color science because colors are commonly thought to be secondary properties and secondary properties can be explained in terms of primary properties. Since Giere aims to show that all scientific knowledge is perspectival in a way analogous to how scientific knowledge of colors is perspectival, he may have a problem drawing the analogy if colors can simply be given a non-perspectival, dispositional account due to their status as secondary qualities. In response to this, Giere says that he is “confident…that it would be misleading (if not an outright mistake) to identify a relational view of colors with the claim that colors are merely “secondary” properties” (Giere 2006, 37). His reason for thinking this partially has to do with the ambiguity in historical accounts of color, primary qualities, and secondary qualities given by philosophers such as Locke. Giere also notes that it’s unclear what the underlying primary properties, which lead to the secondary properties of color, would be; however this contention is at odds with Giere’s discussion of surface spectral reflectances. Giere says that, generally, it is “scientifically correct that…the physical constitution of the light together with the physical operations of the human visual system

determine the color experience of a normal viewer" (Giere 2006, 37). If we add the surface spectral reflectance of an object to this picture, then we could argue that the light and the surface spectral reflectance of a given object are the primary properties, and they result in a certain corresponding secondary property that is perceived in roughly the same way by a normal human trichromat. If this is right, then Giere is unjustified in saying that "there is… no property recognized by modern physical science that can play the role of hypothesized "powers"" (Giere 2006, 37). In any case, the fact that Giere aims to argue that all scientific knowledge is perspectival by drawing an analogy to color science should be viewed with a healthy dose of skepticism.

2.2 Observational Perspectives

The example of color science is meant to provide a basis from which scientific knowledge in general can be understood as perspectival. According to Giere, his aim in *Scientific Perspectivism* "is to show that, from within a general scientific framework, scientific knowledge is perspectival in ways strongly analogous to the way our knowledge of colors is perspectival" (2006, 36). Before turning to the issue of scientific knowledge, Giere focuses on scientific observation more generally, and he pays particular attention to scientific observation in astronomy. Regarding the observation of the Milky Way, Giere discusses two different methods which involve gamma ray detection. The Imaging Compton Telescope (COMPTEL) and the Oriented Scintillation Spectrometer Experiment (OSSE) are both instruments used by scientists to observe the Milky Way and are both able to detect gamma rays. The two instruments differ with respect to the energy levels of the gamma rays they are able to detect and the manner in

which detection of the gamma rays occurs. However, both instruments are able to produce images of the Milky Way. Since these two instruments operate differently and detect different gamma rays, the images they produce are also different. Regarding the image produced by COMPTEL, "A surprising feature of this image is the apparent "halo" of 1.8 MeV gamma rays, shown in blue in the image, surrounding the galactic center" whereas the image produced by OSSE, "indicated the existence of a quite intense plume of positrons extending asymmetrically at right angles to the plane of the galaxy" (Giere 2006, 47). The images provided by the COMPTEL and the OSSE were both images *of* the Milky Way, but they differed with respect to which aspects of the Milky Way were detected.

All scientific instruments are able to detect only certain aspects of the world, from which it follows that all scientific observation is partial. Scientific instruments provide a perspective from which the world is observed and it is in this sense that all scientific observation is perspectival. This all seems obvious. But Giere also says that "claims about what is observed cannot be *detached* from the means of observation. Observation… reveals the intensity and distribution of gamma rays *as indicated by COMPETEL or OSSE*" (Giere 2006, 48), and this point is worth disputing. Just because the COMPETEL was the instrument used to detect the intensity and distribution of gamma rays, doesn't mean that these properties of gamma rays aren't a part of the world. Since different scientific instruments detect different aspects of the world, shouldn't Giere's point here be that different scientific instruments give us knowledge of different aspects of the world? Otherwise we'd be committed to the idea that we only have

knowledge of perspectival facts arrived at solely from different observational perspectives, and we'd be unable to say anything beyond what we could directly conclude from these perspectives. Giere foresees this objection: "surely, it will be objected, scientists draw conclusions going beyond their instrumentation. Indeed they do. But do so only by moving to a broader *theoretical* perspective" (Giere 2006, 49).

2.3 Theoretical Perspectives

Giere's discussion of theoretical perspectives largely focuses on the use of models in scientific practice, employing what he calls an agent-based understanding of models in science. He says, "Scientists use models to represent aspects of the world for various purposes" (Giere 2006, 63). This includes physical (concrete) models as well as abstract models such as Newton's 2nd Law. Abstract models vary in terms of how general or specific they are and thus whether or not they can be directly applied and tested against a particular aspect of the world. For example, Newton's 2nd Law is a very general abstract theoretical model that includes general Newtonian principles of mechanics, whereas Hook's law is a more specific application of Newtonian principles, and Hook's law combined with a specification of x as the displacement of a real particular mass on a spring is more specific still.

On Giere's view, the abstract model and its accompanying theoretical principles determine the perspective from which scientific claims are made and tested and thus scientific claims are perspectival in a way that is analogous to how scientific observation is perspectival. In the case of both scientific models and scientific observation, certain aspects of the world are investigated and other aspects of the world are ignored. By using

the COMPTEL or the OSSE, scientists are able to observe the Milky Way by detecting and measuring gamma rays of certain energy levels while ignoring gamma rays of other energy levels and ignoring many other physical features of the Milky Way. Analogously, a scientific claim regarding the motion of a spring utilizes Newtonian principles of mechanics which themselves ignore certain physical features of a system such as friction and wind resistance. More specifically, to test whether a spring behaves in a certain way by employing Hook's law is to empirically test whether or not a specific system behaves in the way predicted by the theoretical principles included in a Newtonian perspective. On Giere's view, "The principles of Newtonian Mechanics, for example, help to interpret the terms *force* and *mass* within a Newtonian perspective by showing their relationships with the terms *position*, *velocity*, and *acceleration*" (2006, 62). Giere's main idea, then, is that all scientific claims are made and tested from the standpoint of a theoretical perspective and thus perspectivism captures not only the observational component of the scientific enterprise, it captures the scientific enterprise as a whole.

When considering the role of truth in science on Giere's view, it is important to keep in mind Giere's focus on scientific modelling. Giere takes models to be non-linguistic entities which means that models aren't the type of things that can be true or false. Only claims about whether or not a model *fits* the world may be true or false. However, it is also understood that scientific models never exhibit a perfect fit to the world in all respects:

> [T]he only way any particular model could exhibit an exact fit to the world is if it were a complete model that fits the world exactly in every respect. To see this, suppose we have a model that is not complete. That means that there are some things in the world not represented in the model. These unrepresented things may

> be expected to have some (perhaps remote) causal connections with the things that *are* represented. But since these interactions are not represented in the model, the model could not be expected to be exactly correct about the things it does represent. (Giere 2006, 66).

This ultimately leads Giere to embrace a view of realism that he calls perspectival realism. According to this view, scientific claims may be true or false relative to a theoretical perspective. Due to Giere's model-based focus on scientific practice, all such claims are claims evaluating whether or not a particular model sufficiently fits a particular aspect of the world. Here "sufficiently" is understood to be dependent upon the purposes for which a given model is being used. Giere notes that, regarding the fit between models and the world, "Different fields of inquiry may adopt different conventions about what are the proper ways of judging goodness of fit. These conventions may have a pragmatic rationale within that field" (2006, 69). Thus, truth seems to have an pragmatic role under Giere's conception of perspectival realism and functions as describing whether or not a model sufficiently fits an aspect (or aspects) of the world.

It is important to note that, in his discussion of perspectival realism, Giere distinguishes between scientific realism and what he calls "objective realism." Giere thinks that van Fraassen's definition of *scientific* realism, that "Science aims to give us, in its theories, a literally true story of what the world is like; and acceptance of a scientific theory involves the belief that it is true" (van Fraassen 1980, 8), should actually be thought of as defining *objective* realism. In contrast, Giere thinks that he can provide a limited version of scientific realism that better captures realism in scientific practice. Giere calls this view perspectival realism. According to Giere, "For the perspectival

realist, the strongest claims a scientist can legitimately make are of a qualified, conditional form: "According to this highly confirmed theory (or reliable instrument), the world seems to be roughly such and such" (Giere 20006, 5-6). So on Giere's account, perspectival realism holds that the truth of a theory cannot be unconditionally claimed. The extent to which perspectival realism is a scientific realist position will be considered in more detail in section 5.

2.4 Some Problems for Perspectival Realism

In dispensing with laws and theories and focusing on the fit between models and the world, Giere seems to reject a traditional correspondence theory of truth as relevant to scientific knowledge. However, this seems to be in conflict with one of Giere's earlier comments on color science: "It is in general scientifically correct that…the physical constitution of the light together with the physical operations of the human visual system determine the color experience of a normal viewer" (Giere 2006, 37). Here, "scientifically correct" could be replaced with "true" or the more qualified, "true relative to the theoretical perspective of color science." But it is unclear why we should be committed to the qualified formulation rather than the unqualified formulation.

The point here is that general scientific claims oftentimes do not seem to be claims about the specific fit of a model to a particular aspect of the world. Consider the statement, "silver has a melting point of 1763.2ºF." This fairly straightforward claim does not seem to be a claim about the fit between a specific model and the world, it is simply a

true[4] statement. Giere would likely respond that such a statement is only true or false relative to a theoretical perspective—it is not a statement about an objectively natural kind. On Giere's view, regarding the elements of the periodic table, there seems to be "no way of deciding whether the objective natural kinds are those determined by atomic number, atomic weight, or even neutron number…There does not seem to be anything that we might find out about the elements that would determine which are the objective natural kinds" (Giere 2006, 86). Giere thinks such elements should be understood merely as theoretical kinds and thus he seems to reject the notion that theoretical kinds genuinely refer. In Giere's terms, then, "silver has a melting point of 1763.2ºF" is a claim that can be understood as asserting that, from a chemical theoretical perspective, a chemical element with atomic number 47, atomic mass 107.8682 g/mol, etc. will melt at 1763.2ºF with an emphasis on the notion that atomic number and atomic mass are fully understood only after a theoretical perspective is assumed.

Compared to the minor objections I've raised thus far, Anjan Chakravartty provides some more substantive arguments against perspectivism in "Perspectivism, Inconsistent Models, and Contrastive Explanation," (2010). First, regarding Giere's contention that "the only way any particular model could exhibit an exact fit to the world is if it were a complete model that fits the world exactly in every respect" (Giere 2006, 66), Chakravartty replies that "nothing about excluding potentially causally relevant aspects of a system rules out the apprehension of non-perspectival facts regarding how

[4] Fine's 'homely truths' comes to mind here (Fine, 1984).

those features *described* may be related, causally or otherwise" (Chakravartty 2010, 408). In other words, just because a model doesn't tell you everything about a system doesn't mean that the model doesn't tell you anything about that system. Chakravartty thinks that a model that posits some causal interactions, but not others, still yields non-perspectival facts about the causal interactions it does posit. For example, that a body will accelerate towards the earth at 9.82 m/s^2 is a non-perspectival fact on Chakravartty's account even though the model that posits this is likely excluding potentially causally relevant aspects of the world such as wind resistance. If this is correct, then Giere is incorrect that all scientific knowledge is perspectival. Of course, Giere would likely reply that the terms 'accelerate,' 'earth,' and 'body,' can only be fully understood once a theoretical perspective is adopted. However, if what seem to be non-perspectival facts can be given a perspectival construal in even the most straightforward examples (silver melts at 1763.2ºF) then perhaps Giere's claim is far more modest than it initially seemed to be. Since we need concepts to make claims about the world and concepts are related to one another in particular ways, then perhaps it is a trivial point that all claims about the world, and all scientific knowledge, are perspectival.

Chakravartty also discusses inconsistent models and argues that inconsistent models don't necessarily indicate that all scientific knowledge is perspectival, rather, inconsistent models indicate dispositional non-perspectival facts about a real world system. Chakravartty discusses how the 19^{th} century wave theories of light are inconsistent with modern-day field theory in which light is represented as photons. Says Chakravartty, "The picture of light as a classical wave and the picture of it as an

excitation of a field are perspectives, one might suggest, well established in their own domains and described appropriately by different theoretical tools" (Chakravartty 2010, 410). However, light can also be understood as having dispositional properties that are independent of either theoretical perspective. According to Chakravartty, "When light is subjected to certain kinds of detection, wave-like effects are registered in our instruments. Different models of light allow one to see how its properties are manifested in different circumstances" (Chakravartty 2010, 410). Thus, Chakravartty continues, we have non-perspectival knowledge of how light behaves, which means we have non-perspectival scientific knowledge.

Giere could respond by arguing that there is some sort of theoretical perspectival underlying dispositional facts, or that dispositional facts are too general to count as scientific facts. In any case, it should be clear that there are some general problems with Giere's perspectivism including whether or not color science requires an interactionist account, whether general scientific claims are always made from a theoretical perspective, and if they do, whether or not perspectivism is trivially true. Despite some of the problems with Giere's view I've pointed out above, I will proceed with perspectival realism as the view that asserts "some claims generated by scientific practice are claims about the world…[and] these claims are not unconditional, but relative to a set of humanly constructed concepts" (2013, 53). Perspectival realism according to this formulation is not without its own problems—it is unclear in what sense scientific claims are *about* the world—but before turning to them, I will outline Giere's account of Kuhn

as a perspectival realist (section 3) and strengthen Giere's claim that Kuhn is a perspectivist (section 4).

3. KUHN AS A PERSPECTIVAL REALIST

3.1 Kuhn and Perspectivism

The evidence of Kuhn's perspectivism that Giere presents is fairly straightforward. Giere focuses on Kuhn's discussion of Charles Taylor's views on the natural and the social sciences which is included in Chapter 10 of *RSS*. The main idea is that while Taylor thinks that the claims and discoveries of the natural sciences are the same for all cultures and do not require interpretation, Kuhn disagrees. Citing the differences between Greek and modern astronomy, Kuhn argues that the claims regarding the same natural objects such as the stars, planets, comets, etc. require interpretation because the claims make use of terms differently if one is working in the framework of Greek astronomy (such as Ptolemaic astronomy) compared to modern astronomy. These two scientific communities have incommensurable lexicons such that understanding one from the viewpoint of the other requires interpretation. According to Kuhn, "No more in the natural than in the human sciences is there some neutral, culture-independent set of categories with which the population—whether of objects or of actions—can be described" (2000f, 220). Giere notes that this seems to indicate that Kuhn is a scientific perspectivist because here Kuhn is arguing that the natural sciences (as well as the social sciences, of course) are only understood when a theoretical perspective, i.e. lexicon, i.e. a set of humanly constructed concepts, is in place.

Giere also discusses Kuhn's account of scientific revolutions in *RSS* which further reinforces the idea that Kuhn may be regarded as a perspectivist. Giere cites Kuhn as concluding, after a discussion of several examples of revolutions in the history of science,

that “Violation or distortion of a previously unproblematic scientific language is the touchstone of revolutionary change” (Kuhn 2000b, 32). For Kuhn, scientific claims are claims made using a particular lexicon. When a revolution occurs in science, such as the chemical revolution of the 18th Century, the lexicon is altered such that not all the terms from the old lexicon may be directly translated into the new one. As Giere notes, when a scientific revolution occurs, “the lexicon is radically reorganized so that things that were once grouped together no longer are, and things previously not thought to be fundamentally similar now are” (Giere 2013, 54). A fuller account of both lexical change and Kuhn’s notion of the lexicon in general will be given in section 4; however, it seems prima facie reasonable to suggest that Kuhn’s lexicons are identifiable with Giere’s theoretical perspectives.

3.2 Kuhn and Realism

Giere acknowledges that identifying Kuhn as a realist is more problematic than identifying him as a perspectivist. However, there is a straightforward comparison that can be made between the role of truth in Giere’s theoretical perspectives and in Kuhn’s lexicons. According to Kuhn, “Each lexicon makes possible a corresponding form of life within which the truth or falsity of propositions may be both claimed and rationally justified, but the justification of lexicons or of lexical change can only be pragmatic” (Kuhn 2000g, 244). For Giere truth only plays a role relative to a theoretical perspective, from the standpoint of which one is determining the fit between a model and the world, while for Kuhn there is truth only within a lexicon. To say that a lexicon is true is meaningless in the same way that it is meaningless to claim that a model is true. Since, as

Giere claims, "models are more like predicates than like statements" (2006, 64-5), it makes absolutely no sense to say that a model is true or false, and in the same way it makes no sense to say that a predicate is true or false. By the same reasoning, it makes no sense to say that a lexicon is true or false.

Giere points out several claims of scientific realism that Kuhn rejects. These include the notion that science is progressing towards the truth, the notion that science aims to progress towards the truth, and the idea that there is one true theory that provides a literally true description of the way the world is "independent of time, language, and culture" (Kuhn 2000c, 77). For Kuhn, scientific progress is characterized by increased puzzle-solving capacity which primarily occurs during periods of what he calls "normal-science" or non-revolutionary science. There is no progress towards the truth on Kuhn's account[5]; moreover, on Kuhn's view, the idea of there being a literally true account of the way the world is seems flawed. Giere identifies the following passage as the best expression of Kuhn's views on realism in *RSS*:

> Evaluation of a statement's truth values is…an activity that can be conducted only with a lexicon already in place, and its outcome depends on that lexicon. If, as standard forms of realism suppose, a statement's being true or false depends simply on whether or not it corresponds to the real world—independent of time, language, and culture—then the world itself must be somehow lexicon-dependent. Whatever form that takes, it poses problems for a realist perspective, problems that I take to be both genuine and urgent (Kuhn 2000c, 77).

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[5] Kuhn also points out that characterizing science as progressing towards the truth is problematic when some examples in the history of science are considered. For example, as Hoyningen-Huene notes, "in a certain sense the ontology of relativity theory is closer to that of Aristotle than to that of Newton" (Hoyningen-Huene 1993, 263).

Giere doesn't go into detail concerning this passage because, according to Giere, Kuhn doesn't further address the above-mentioned "problems for the realist perspective." However, it seems that Giere takes Kuhn's position to be a realist position in the sense that scientific claims are claims about the real world[6], but the evaluation of such claims is limited to the lexicon in which they are made. Since Giere sees Kuhn's lexicons as identifiable with his perspectives, he moves on to suggest that Kuhn accepts perspectival realism. Specifically, Giere says that "to claim that evaluation of the truth of a statement presupposes a lexicon is already to embrace a form of perspectival realism. A lexicon defines a "perspective" within which to formulate truth claims" (Giere 2013, 55).[7] Thus, Giere reasons as follows: if (1) Kuhn is a perspectivist, as he seems to be, and if (2) truth on his account functions only as relative to a lexicon, it seems that Kuhn may well be regarded as a perspectival realist. I will argue, in section 5, that if (1) and (2) entail perspectival realism, then perspectival realism of the Kuhn/Giere variety is only a scientific realist position to a very limited extent.

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[6] Whether or not the real world is identifiable with the mind-independent world will be considered in section 5.3.

[7] There may be forms of perspectival realism that are compatible with scientific realism to differing degrees.

3.3 Hoyningen-Huene on Perspectival Realism

Paul Hoyningen-Huene, in a recent public lecture (2012), also endorsed a perspectival realist reading of Kuhn that closely resembles his own Neo-Kantian reading[8] of Kuhn. Hoyningen-Huene first discusses color science in which both subjective and objective components are at work, he then points out that colors can be thought of as secondary qualities and then says "imagine that all (observable and theoretical) properties of things were secondary qualities, as robust as colors, but *without any access to their purely object-sided components*…we would probably take them as simply real, as really real (Hoyningen-Huene 2012). This is a rough expression of Kuhn's view, on Hoyningen-Huene's account, and at first glance it already looks like Giere's perspectivism at least with regard to scientific observation—the world is always observed from some perspective or another and never from a purely objective, perspective-free stance. Hoyningen-Huene then states that this reading of Kuhn's view is "indistinguishable from the position of perspectival-realism…as developed by Ron Giere…basically [this view says that] all humanly accessible reality is reality under a certain perspective" (Hoyningen-Huene 2012). Hoyningen-Huene suggests that perhaps some combination[9] of Giere's perspectival realism and the Neo-Kantian reading of Kuhn

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[8] Hoyningen-Huene (1993).

[9] Michela Massimi (2015) has also discussed combining the Neo-Kantian reading and Giere's perspectival realist reading of Kuhn. I do not discuss the Neo-Kantian reading of Kuhn in this paper.

will best capture Kuhn's views on realism (and specifically on world changes and incommensurability); however, at this point it seems clear that Giere's perspectival-realist reading of Kuhn has a high degree of plausibility and will be worth further investigating. In fact, as I will argue, Giere's perspectival realism *does* correctly characterize Kuhn's views on scientific realism.

4. LEXICONS AND PERSPECTIVES

In this section I will begin by discussing the large degree of overlap between Giere's theoretical perspectives and Kuhn's lexicons. The notion that scientific observation is always perspectival seems completely non-controversial and is thus a view that any historian of science or philosopher of science, such as Kuhn, would accept. What is more controversial is the idea that scientific claims are always made and evaluated from within a specific theoretical perspective and the subsequent claim that all scientific knowledge is therefore perspectival. After demonstrating that Giere's theoretical perspectives and Kuhn's lexicons are on par (section 4.1), I will discuss the latest version of Kuhn's incommensurability thesis and argue that it actually strengthens Giere's account of perspectivism (section 4.2).

4.1 Lexicons as Theoretical Perspectives

Despite the role they played in *Structure,* paradigms are hardly mentioned by Kuhn in *RSS*—Kuhn instead focuses on developing a view of lexical taxonomies or lexicons that function as a sort of shared language within a scientific community. In response to much of the criticism Kuhn received for the ambiguous and multifaceted applications of "paradigm" in *Structure,* Kuhn for the most part stopped talking about paradigms as early as his 1969 Postscript and instead began using the ideas of a disciplinary matrix and a shared exemplar to account for the global and local uses of "paradigm," respectively. However, the best case for arguing that Kuhn's later views affirm perspectivism lies in the account Kuhn gives of lexicons in *RSS*. As Stefano Gattei points out, "while the notion of a paradigm is too wide to allow for talking about the

lexicon of a paradigm, it is perfectly meaningful to speak about the lexicon of a theory" (2008, 142) and so Kuhn's lexicons, and their application to scientific theories, will be shown to closely resemble Giere's theoretical perspectives. More specifically, I will point out some important features of Kuhn's account of the lexicon by focusing on how a student might learn the lexicon of Newtonian mechanics. Kuhn discusses this idea in "Possible Worlds in History of Science" (1989) and it will be useful to consider the Newtonian example since Giere also discusses interpreting Newtonian terms within a Newtonian perspective. Additionally, I will argue that the very idea of a lexical taxonomy, specifically as Kuhn presents it in "The Road since *Structure*" (1990)[10], largely exemplifies Giere's theoretical perspectives.

For Kuhn, scientists work and communicate by using a lexical taxonomy—basically a common language in which some terms have the same meaning as they do in day-to-day life and other terms have very specific meanings that are dependent upon the field or sub-discipline within that field. Kuhn claims that "knowing what a word means is knowing how to use it for communication with other members of the language community within which it is current" (Kuhn 2000c, 62), which means that to learn the terms of a scientific lexicon is to learn how its terms are used by the relevant community.

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[10] Not to be confused with the book (2000), the essay called "The Road since *Structure"* was originally Kuhn's presidential address to the biennial meetings of the Philosophy of Science Association in October 1990, as noted by James Conant and John Haugeland, the editors of *RSS*. This essay was included as chapter 4 of *RSS*.

Kuhn's description of the way in which students learn Newtonian Mechanics provides a good demonstration of what learning a lexicon entails. According to Kuhn, "Before exposure to the Newtonian terminology can usefully begin, other significant portions of the lexicon must be in place. Students must, for example, already have a vocabulary adequate to refer to physical objects and to their locations in space and time," (Kuhn 2000c, 66). Additionally, Kuhn notes that students must also have a sufficiently developed knowledge of mathematics before Newtonian concepts of velocities, accelerations, etc. can be learned. Thus, one must be sufficiently familiar with an "antecedent vocabulary" (Kuhn 2000c, 66) before Newtonian mechanics and its terms can be learned. After this antecedent vocabulary is in place, "The other lexical items required…most notably 'force', 'mass', and 'weight' in their Newtonian senses—can only be acquired together with the theory itself" (Kuhn 2000c, 66). Adopting a scientific lexicon, then, doesn't require the wholesale abandoning of one language for another since many terms in one lexicon function in roughly the same way[11] as they do in another. The basic idea is that in order to learn Newtonian terms and Newtonian mechanics one must first be familiar both with the way certain contemporary day-to-day terms are used and the relevant mathematical concepts. For example, Kuhn notes that in Aristotle's time the term "motion" referred to all types of change that had a starting point and an ending point. In other words, a person who is sick at one time and is healthy at a later time would

[11] However, on Kuhn's account, different lexicons are still incommensurable with one another. I will return to this in section 4.2.

exemplify “motion” in Aristotle’s sense. If one were to try and learn Newtonian mechanics with this definition of motion in mind, they would be very confused with something like Newton’s First Law.

After the antecedent vocabulary is in place some of the Newtonian terms can be learned. This usually happens via examples, or as Kuhn says, “the learning process requires the juxtaposition of statements involving the terms to be learned with the situations drawn directly or indirectly from nature” (2000c, 69). None of the Newtonian terms are learned in isolation; moreover, a full understanding of all the terms arises by stipulating the definitions of some terms and learning the others empirically. Kuhn gives an example in which he describes two possible ways to learn Newtonian mechanics and notes, “On the first route the second law enters stipulatively, the law of gravitation empirically. On the second, their epistemic status is reversed” (2000c, 71). Once a student has fully learned the basics of Newtonian mechanics, they are able to use the Newtonian lexicon to communicate with others who know the lexicon.

We now have a direct point of comparison: the Newtonian lexicon for Kuhn functions much as the Newtonian perspective functions for Giere. On Giere’s account, if someone wants to adopt a Newtonian perspective, certain Newtonian terms such as “force” and “mass” need to be interpreted as referring to elements of an abstract model before the theoretical principles of Newtonian mechanics can be understood. These terms have no meaning outside of a theoretical perspective, in this case the Newtonian perspective. In the same way, as Kuhn describes it, theoretical terms are learned and understood within the context of a lexicon. The lexicon constitutes a theoretical

perspective in that it combines an antecedent vocabulary, some stipulated definitions (laws in some cases), and some empirically derived theoretical terms into a *perspective* from which scientific claims can be made, and more specific scientific claims can be tested. Just as "force" only has the meaning we take it to have from within the Newtonian perspective, "force" only has the meaning we take it to have if we've learned the Newtonian lexicon in a certain way (with the contemporary non-Aristotelian vocabulary in hand, the proper mathematical concepts understood, etc.). To be able to communicate with other users of a lexicon in a given scientific community is, analogously, to be able to "see" things from the same theoretical perspective as other members of that scientific community. All scientific claims are made with the assistance of language and the meaning of kind terms on the one hand (Kuhn) and certain abstract models and theoretical principles that constitute a theoretical perspective (Giere) on the other.

In addition to scientific communities operating and communicating within common lexicons, Kuhn also discussed the importance of kind terms, their role in lexicons, and their referents in the world. As Gattei points out,

> Kuhn now emphasizes the point that every scientific theory is a taxonomically ordered web of kind terms and kind concepts…kinds, to which kind terms refer, populate the world and at the same time divide it up into categories that establish mutual relationships that together make up the structure of the lexicon (2008, 142).

This is the general idea behind the latest version of Kuhn's notion of a lexical taxonomy or lexicon.[12] Importantly, the terms and structure of a lexicon set the bounds on what can

[12] Henceforth, I will use "lexicon" and "lexical taxonomy" interchangeably.

be said and evaluated by a specific scientific community. For any scientific community, descriptions of the world—the observations and conclusions of scientific inquiry for our purposes—are made only after a lexicon is in place. Moreover, since scientific claims are made using the kind terms defined within a given lexicon, scientific claims are, in some sense, relative to that lexicon. That is, scientific claims are understood and sometimes evaluated from within that lexicon. On Kuhn's view, then, scientific claims cannot be made outside the bounds of a lexicon.

In "The Road since *Structure*," Kuhn clarifies his notion of the lexicon by comparing it to a conceptual scheme, which definitively confirms Giere's reading of Kuhn as a perspectivist. Specifically, Kuhn says, "What I have been calling a lexical taxonomy might, that is, better be called a conceptual scheme…of a particular operating mode or mental module prerequisite to having beliefs, a mode that at once supplies and bounds the set of beliefs it is possible to conceive" (Kuhn 2000d, 94). It is clear that a "mental module" is identifiable with what Giere calls a perspective. Here Kuhn is saying that prior to knowing or believing anything about the world one has to have some sort of module that sets the bounds on which beliefs can be had. Giere would say that humans have a unique perspective on the world: "the typical human experiences the world from a colored perspective. We humans have a particularly human perspective on the world" (Giere 2006, 32). While in this passage Giere is making a point about how our knowledge and belief concerning colors is perspectival, Kuhn is saying that all of our knowledge and

beliefs concerning the world operate and are limited in this way[13]. Thus, Kuhn can be regarded as endorsing Giere's theoretical perspectivism.

Kuhn's account of scientific lexicons also bolsters Giere's account of theoretical perspectives in at least one important way: Kuhn's view is able to account for disagreements between scientists working in the same field. For example, if anomalous results are obtained by some scientists, both of whom are working within the same lexicon/theoretical perspective, they may disagree over which part of a scientific theory could be wrong and they may disagree over which part or parts of a theory are more fundamental. We can account for this disagreement to some extent by recalling Kuhn's discussion of the two different ways of learning the Newtonian lexicon in which some terms of a theory are introduced as stipulations and others are learned empirically. Depending on how someone learned a lexicon, they may treat certain terms as "built in to the lexicon" (Kuhn 2000c, 71) and others as dispensable (or at least less integral) to the lexicon. If two scientists disagree as to which part of a theory should be tossed out, one potential reason for this disagreement is based on the different ways in which each scientist learned the lexicon and the theory in the first place. This is one important way in which Kuhn's lexicons add to Giere's account of theoretical perspectives, because Giere doesn't provide an account of scientific disagreement.

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[13] This is roughly the same conclusion arrived at by Hoyningen-Huene (2012), which I discussed in Section 3.3.

4.2 Incommensurability

Since Kuhn's incommensurability thesis and his stance on realism are closely related, it will be useful to look at Kuhn's incommensurability thesis before discussing whether or not he is a scientific realist. Despite Giere's contention in Giere (2006), that perspectivism does not entail incommensurability, Kuhn's later version of incommensurability makes it easy to identify him as a perspectivist, in agreement with the conclusion reached in section 4.1. The radical incommensurability of *Structure* in which, as critics interpreted Kuhn, different scientific theories could not be rationally compared and thus science could not be said to be a rational activity, was not the view Kuhn intended to put forth. He says as much in the 1969 postscript and in "Objectivity, Value Judgement, and Theory Choice" (1977). This latter work provides further evidence that Kuhn's views closely line up with Giere's overall project of wanting to unite the subjective and the objective since Kuhn spends a good deal of time establishing an acceptable role that subjectivity plays in science[14]. However, Kuhn still held that

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[14] On Kuhn's account, the values (accuracy, scope, fruitfulness, etc.) upon which scientific theories are judged are objective values, but scientific theory choice is not *completely* objective because the decision process for picking one theory over another includes the subjectivity associated with scientists weighing each value differently when they conflict. This is a general way in which the subjective and objective viewpoints come into conflict on Kuhn's account and may serves as a general point of comparison between Kuhn's views and Giere's project in *Scientific Perspectivism*.

incommensurability plays a role in scientific inquiry. His latest version of incommensurability was stated in terms of his notion of the lexicon, as discussed above; however, it will be helpful to say a bit more about what this entails because Kuhn's view concerning the role of truth in science relies heavily on incommensurability understood within the context of lexicons.

Hoyningen-Huene (2015) includes a rough overview of Kuhn's latter-most views—views that would have been expressed in a book[15] that remains unpublished—including a brief account of Kuhn's developing notions of a lexical taxonomy and incommensurability. According to Hoyningen-Huene, "The *structure* of a hierarchy of kind terms is the totality of the relationships among the extensions of the terms in the hierarchy; it is also called the structure of the respective *lexicon* (of kind terms)" (Hoyningen-Huene 2015, 192). As long as the lexicon has a stable structure—as long as unpredicted results do not provide cause for concern that there is something seriously wrong with a given scientific theory—normal science can proceed and members of the scientific community can communicate with one another. However, if anomalous results are obtained while working within a given lexicon (setting aside the assumptions made

[15] Hoyningen-Huene (2015) notes that Kuhn had been working on a new book since the 1980s up until his death in 1996. Hoyningen-Huene: "Unfortunately, only Chaps. 2 through 6 exist (in manuscript form)…The book manuscript is not publicly available" (Hoyningen-Huene 2015, 191).

by auxiliary hypotheses), then the lexicon becomes no longer stable[16] and a restructuring and/or altering of the lexicon may occur. More specifically, Hoyningen-Huene further notes that "The result of a successful revolutionary development is a lexicon whose structure is somewhat modified in comparison to the old lexicon; in addition, some new kind terms may have been introduced and some old kind terms are abandoned" (Hoyningen-Huene 2015, 192). Thus the difference between the old and new lexicons is twofold: there's a difference in which kind terms are included in each lexicon and there's a difference in how the terms are related because the structure of one lexicon may differ from that of another.

Kuhn also discusses something called the "no-overlap" principle which is closely related to his latest development of the incommensurability thesis. The no-overlap principle can be understood as a limiting feature of lexical taxonomies: "no two kind terms, no two terms with the kind label, may overlap in their referents unless they are related as species to genus." (Kuhn 2000d, 92). If the kind terms used by two different lexical taxonomies violate this principle, they are said to be incommensurable on Kuhn's account. According to Gattei, "What gives rise to incommensurability and therefore prevents complete communication between theories is the lack of identity among lexical

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[16] This is what Kuhn referred to as a crisis in *Structure*. Revolutionary science, then, consists in the progress from one lexicon to another. It consists in the restructuring of a lexicon in which new terms may be added, old terms may be discarded, and the relationships between terms may change.

structures" (Gattei 2008, 143). What incommensurability does not entail, however, is incomparability between scientific theories. Kuhn stressed that there is an important and often overlooked distinction between interpretation and translation and that incommensurability only signifies that one lexicon is not fully *translatable* into another lexicon. Kuhn defines translation as follows: translation is "done by a person who knows two languages. Confronted with a text, written or oral, in one of these languages, the translator systematically substitutes words or strings of words in the text in such a way as to produce an equivalent text in the other language" (Kuhn 2000b, 38). On the other hand, interpretation is an activity "practiced by historians and anthropologists, among others…If the interpreter succeeds, what he or she has in the first instance done is learn a new language…or perhaps an earlier version of the interpreter's own language" (Kuhn 2000b, 38). Interpretation thus involves, to some extent, learning the language or the terms/structure of a different lexical taxonomy. The interpreters' native language and their newly learned language may violate the no-overlap principle. Two theories can be compared[17] because members of one lexical taxonomic community can learn the lexicon of their competitor even if the two theories are incommensurable—even if the two theories are not inter-translatable and have different lexical structures and refer to different sets of kind terms.

[17] Moreover, two theories can be compared in terms of their relative success in making predictions and solving puzzles (as Kuhn would say). I'll return to this in section 5.3.

This distinction between translation and interpretation given by Kuhn thus bolsters Giere's notion of perspectivism. It bolster's Giere's account because, on Kuhn's view, members of one scientific community can become members of another scientific community and "learn the language" or adopt the perspective of the new community. Kuhn thus provides a more complete picture of how different scientific communities—different theoretical perspectives—can co-exist and communicate with one another even if their basic assumptions, models, and theories are inconsistent with one another. More specifically, Kuhn's notion of the lexicon seems to add to our understanding of scientific practice based on the following claim made by Giere: "Comparing perspectives and switching from one to another are a normal part of scientific practice. We don't need a *theory* of language to recognize this practice, but it would be nice if there were such to deepen our understanding of it" (2006, 84). On Giere's view, scientific practice includes the use of many theoretical perspectives whose participants/members can somehow communicate with one another and thereby collaborate. If we bring Kuhn's notion of the lexicon into the picture, including the distinction between translation and interpretation, then it becomes clear that scientists from one sub-discipline can communicate with scientists from another sub-discipline by being bilingual in some sense. As Kuhn notes, "Communication breakdowns are…inevitable, and it is to avoid them that the bilingual is forced to remember at all times which lexicon is in play, which community the discourse is occurring within" (2000d, 100). Any given scientist may be able to communicate in a variety of lexicons but the strict translation from lexicon to lexicon is limited to the extent that their lexical structures and inclusion of kind terms are similar.

Kuhn's incommensurability thesis thus adds clarity to Giere's account of perspectivism. It should be clear from the examples mentioned in section 2.2 that scientific observation is perspectival because different scientific instruments detect different aspects of the world and scientists can utilize different instruments for different purposes. The issue of communication across perspectives doesn't come up in the case of observation; however, communication does come up in the case of theoretical perspectives, when scientists are in the business of employing theoretical principles and abstract models to make claims about the world. The analogy Giere draws between observational and theoretical perspectives, while helpful, fails to account for the fact that in the case of theoretical perspectives, scientists often communicate across theories and interpret one theory from the perspective of another. Kuhn's incommensurability thesis tells us how such communication is possible and why communication is limited.

5. PERSPECTIVAL REALISM IS NOT SCIENTIFIC REALISM

5.1 Kuhn is Not a Scientific Realist

We are now in a position to determine whether and to what extent Kuhn may be regarded as a scientific realist. It should be clear that Kuhn cannot accept anything like the epistemic thesis of scientific realism. In "A Confutation of Convergent Realism," Larry Laudan outlines several claims of epistemic scientific realism including the claim that "Scientific theories (at least in the 'mature' sciences') are typically approximately true and more recent theories are closer to the truth than older theories in the same domain" and the claim that "there are substances in the world that correspond to the ontologies presumed by our best scientific theories" (Laudan 1981, 1109). Kuhn would reject both of these claims out of hand. On Kuhn's account, science progresses away from practices and theories that run into anomalies or other significant problems, but this does not mean that science progresses towards the truth. Thus, the successful progression of science is not evidence for the truth of its theories. In Kuhn's words, "Justification does not aim at a goal external to the historical situation but simply, in that situation, at improving the tools available for the job at hand" (Kuhn 2000d, 96). Thus, for Kuhn, scientists are justified in believing that one theory is superior to another in terms of its ability to solve a particular puzzle or account for a particular phenomenon but this does not mean that scientists are justified in believing that one theory (rather than another) is true of the world. In general, Kuhn doesn't think that scientific theories converge on the truth and he rejects the correspondence theory of truth "except in the most trivial sense"

(Kuhn 2000d, 95)[18]. Laudan presents two other claims of the scientific realist: "Successive theories in any mature science will be such that they 'preserve' the theoretical relations and the apparent referents of earlier theories…[and] Acceptable new theories do and should explain why their predecessors were successful insofar as they were successful" (Laudan 1981, 1109). Kuhn's views on incommensurability, even in its later form, prevent him from accepting either of these claims. If an earlier scientific theory is incommensurable with a later scientific theory, then the theoretical relations and referents in one theory are fundamentally different from those of the other theory—one theory cannot be translated into the other. The success of later scientific theories, on Kuhn's account, has to do with their ability to solve puzzles that the earlier theories failed to solve which means that later theories may not necessarily preserve theoretical relations or apparent referents and later theories may not be able to explain the success of earlier theories. Thus, Kuhn rejects each of the scientific realist claims that Laudan presents.

Is there *any* sense in which Kuhn may be regarded as a scientific realist? In the introduction to *Scientific Realism: How science tracks truth*, Stathis Psillos (1999)

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[18] More specifically, Kuhn says that "if the notion of truth has a role to play in scientific development, which I shall elsewhere argue that it does, then truth cannot be anything quite like correspondence to reality. I am not suggesting, let me emphasize, that there is a reality which science fails to get at. My point is rather that no sense can be made of the notion of reality as it has ordinarily functioned in philosophy of science" (Kuhn 2000e, 115).

provides two additional realist theses, the metaphysical thesis and the semantic thesis, that will serve to supplement Laudan's formulation of the epistemic thesis. The metaphysical thesis claims that the world is mind-independent and has a definite structure. The semantic thesis "takes scientific theories at face-value, seeing them as truth-conditioned descriptions of their intended domain, both observable and unobservable… So, if scientific theories are true, the unobservable entities they posit populate the world" (Psillos 1999, xix).

It seems as if Kuhn would partially accept the metaphysical thesis of scientific realism. The metaphysical thesis makes two distinct claims: (a) The world exists independently of what we think about it; (b) The world has a definite structure independently of what we think about it. On the issue of whether the world is mind-dependent, Kuhn says the following: "the metaphors of invention, construction, and mind-independence are in two respects grossly misleading. First, the world is not invented or constructed" and perhaps more importantly, "that world, furthermore, has been experientially given…As such it is entirely solid…quite capable of providing decisive evidence against invented hypotheses which fail to match its behavior" (Kuhn 2000d, 101). From this it seems clear that Kuhn accepts (a).

In contrast, there is strong evidence that Kuhn would reject (b). This follows from the fact that on Kuhn's view, different groups (of scientists) structure the world differently according to their practice, and while the world itself is not mind-dependent, there is a significant limitation on what can be said of the world and it's structure. According to Kuhn, "It is groups and group practices that constitute worlds (and are

constituted by them)… The primary unit through which the sciences develop is thus…groups, and groups do not have minds" (Kuhn 2000d, 103). While this quote reinforces the conclusion that Kuhn would accept (a), it presents some confusion because it's unclear what Kuhn means by 'world'. What is clear is that Kuhn thinks we can only speak of the world (a constituted world, the mind-independent world) from the standpoint of a lexicon. Whichever world we speak of, its structure will be partially determined by the structure of the lexicon from which we are speaking. Since different scientists work within different—and sometimes incommensurable—lexicons, and these lexicons shape our understanding concerning the structure of the world, the structure of the world does not appear to be definite on Kuhn's account. Says Kuhn, "like the Kantian categories, the lexicon supplies preconditions of possible experience. But lexical categories, unlike their Kantian forebears, can and do change, both with time and with the passage from one community to another" (Kuhn 2000d, 104). Scientific practice, as constituted by groups, investigates and makes claims about a mind-independent world but they do so from within the theoretical perspective of a lexicon which has supplied the preconditions of experience. Since Kuhn accepts that there is a mind-independent world but thinks that its structure can change with time and from one community to another, Kuhn may be regarded as a weak metaphysical realist. This is the view that holds (a) to be true, but not (b).

Concerning the semantic thesis, there is strong evidence that Kuhn cannot accept Psillos' formulation, but he can partially accept a qualified version of it. Moreover, there is an important sense in which Kuhn does not reject the semantic thesis. The typical anti-

realist who rejects the semantic thesis does so on reductive empiricist or eliminative instrumentalist grounds. According to Psillos, "eliminative instrumentalism is the position that the 'cash value' of scientific theories is fully captured by what theories say about the observable world" (Psillos 1999, xx). In other words, the eliminative instrumentalist holds that theoretical claims—claims that posit theoretical entities—lack truth conditions and thus may be regarded as neither true nor false. Reductive empiricism, on the other hand, holds that theoretical scientific claims are translatable to (are able to be reduced in terms of) an observable vocabulary. According to Psillos, reductive empiricists "treat theoretical discourse as disguised talk about observables…[and] Reductive empiricism is consistent with the claim that theoretical assertions have truth values, but it understands their truth conditions *reductively*" (Psillos 1999, xx). Even though Kuhn doesn't hold an eliminative instrumentalist or reductive empiricist position, he cannot directly accept this thesis because he doesn't view scientific theories as being truth-conditioned in the right sort of way (Kuhn doesn't think the traditional correspondence theory of truth applies to assessing scientific theories). This is because, for Kuhn, scientific claims cannot be made until after a lexicon is in place and thus scientific claims are always relative to a lexicon. Since a lexicon is constructed by a scientific community, it doesn't seem right to say that scientific theories could be taken at "face-value" because that term seems to imply a meta-lexicon from which claims can be evaluated. This is not to say that Kuhn is an eliminative instrumentalist or a reductive empiricist. Kuhn isn't committed only to the parts of the scientific theories that make claims about observables and he doesn't hold that all

scientific theories are reducible to claims about observables. Scientific claims are always made from within a lexicon, there are many lexicons in which scientists work, many of these lexicons are incommensurable with one another, and from these three points it follows that scientific theories can't be said to be truth-conditioned in a completely unqualified way. Yet, truth does play a role because the discovery of contradictory results in scientific inquiry can lead to lexical change, as discussed in section 4.2.

A reformulated semantic thesis is a potential candidate for Kuhn to accept. This thesis says the following: (i) scientific theories are to be taken at face-value within their relevant lexicons, (ii) these theories are truth-conditioned descriptions of their intended domain—both observable and unobservable, and (iii) if scientific theories are true relative to their lexicon, the unobservable entities they postulate populate the world. Kuhn can accept (i) but he cannot wholly accept (ii) or (iii). Since Kuhn does not think that the traditional correspondence theory of truth is applicable to scientific theories, (ii) needs to be understood as employing a different role for truth—perhaps a pragmatic role. On Kuhn's view, scientific theories are evaluated in terms of their abilities to solve practical and theoretical puzzles and in their abilities to make accurate predictions. Moreover, their failure to solve puzzles and make predictions can lead to the rejection of these theories. Truth still plays a role in the following types of statements: *It's true that theory x successfully predicted observation y. It's false that theory z provides a consistent account of observations a, b, and c.* From statements like these scientists can decide whether to accept, continue using, or reject different scientific theories. So if by "intended domain" (ii) can be understood as asserting something about the puzzle-solving

and prediction-making capabilities of different scientific theories, then (ii) can be accepted by Kuhn. This seems to indicate the Kuhn would accept a role for truth that parallels the pragmatic role for truth that Giere would accept as discussed in section 2.3. Kuhn can accept (iii) to the extent that he can accept (ii). Truth plays a different role on Kuhn's account but this doesn't mean that the parts of theories that posit unobservables are to be understood differently than the other parts of a theory. The main difference is that the truth of scientific claims can only be evaluated as relative to their lexicons. Needless to say, such a position hardly seems to be one that can meaningfully be called 'realist.'

5.2 Massimi and Alethic Relativism

If Kuhn is a perspectival realist, as Giere takes him to be, then it is difficult to see how perspectival realism can be regarded as a scientific realist position in any substantive way. Michela Massimi reaches a similar conclusion in "Walking the Line: Kuhn Between Realism and Relativism" (2015). Massimi discusses Giere's perspectival realist reading of Kuhn and suggests, based on one version of perspectivism that she considers, that Kuhn may be committed to a sort of relativism that disqualifies Kuhn as a realist. Massimi discusses two versions of perspectivism as candidates for Kuhn's view—I will discuss the second version since it seems to be in line with what was concluded in section 4.1. Massimi calls this view $PiKu_2$ and summarizes it as follows: "Scientific perspectives are defined by the theoretical perspectives of a scientific lexicon, through which we can *experience* the physical world" (2015, 141). After identifying this as a candidate perspectival reading of Kuhn, Massimi discusses whether or not this reading, if correct,

precludes identifying Kuhn as a realist. As Massimi notes, "If Kuhn's view deserves the name of realism, not only must there be perspective-independent facts or states of affairs. What we can also *truly* assert about those facts should not depend on our scientific perspective" (2015, 143). But according to Kuhn's conception of a lexicon—or Giere's notion of a theoretical perspective—the role of truth is dependent on lexicons/perspectives in exactly this way. While in section 5.1 I argued that Kuhn could not accept the epistemic thesis of realism due to his views on incommensurability and on scientific progress, here Massimi argues that Kuhn is precluded from accepting the epistemic thesis of realism (and the metaphysical thesis) if he is understood as a perspectivist in the sense defined by $PiKu_2$. According to Massimi, "Realism…is incompatible with both facts and truths being relative to incommensurable scientific perspectives. Relativism about facts and relativism about truth are at odds with the metaphysical and epistemic tenets of realism, respectively" (2015, 144). Thus, she thinks that this perspectival realist reading of Kuhn should not be regarded as a realist reading of Kuhn.

For the most part I think Massimi is correct, save for the minor point that Kuhn isn't a full-blown metaphysical anti-realist since he's committed to the existence of the external world. Kuhn is not a relativist about facts if facts are understood as being the state of affairs of the mind-independent world or simply the way the world is outside of what we say about it (Kant's *noumena*). There is no relativism on Kuhn's account regarding the existence of the mind-independent world or the way that it actually is; rather, there is a relativism related to the way scientists are able to make claims about the

world which is determined in part by the lexicon with which they are working. Not that this gets Kuhn very close to scientific realism, and in fact he seems to endorse what Massimi refers to as alethic relativism: "Under PiKu$_2$ reading, changes in phenomenal worlds are due to changes in the constitutive theoretical principles of a lexicon. Different theoretical principles make possible different *experiences of the world* and of what we can truly assert about it" (Massimi 2015, 144). That this sort of relativism is alethic follows from the idea that the truth of scientific claims/theories are only to be understood as relative to a theoretical perspective[19]. Since it is possible to adopt any number of theoretical perspectives, it is possible for there to be any number of conditions constituting whether or not a given theory or claim is true. Interestingly, Massimi also notes that Giere seems to accept alethic relativism, which lends support to the idea that (Giere's construal of) perspectival realism is not scientific realism.

5.3 Giere, Perspectival Realism, and Objective Realism

Aside from Massimi's point about alethic relativism, there is some additional evidence that Giere would agree with the conclusion that perspectival realism should not really be regarded as a form of scientific realism. Recall from section 2.3 that in *Scientific Perspectivism* Giere aimed to develop a perspectival understanding of scientific realism, understood as a position not to be identified with objective realism. However, the above

[19] In "Four Kinds of Perspectival Truth" (2016), Massimi discusses giving an account of perspectivism and perspectival truths that are potentially compatible with scientific realism.

scientific realist theses characterize the standard ways in which scientific realism is understood. Claiming that perspectivism is a form of scientific realism is, at best, misleading. My contention is that it would be more accurate to entirely leave out the 'realism' part—perhaps perspectival pragmatism would be a better name. Even though Giere spends much of his time focusing on scientific practice and emphasizes that a good account of scientific methods, in terms of justifying scientific claims, "supports a perspectival rather than an objectivist understanding of scientific realism" (Giere 2006, 88), based on the discussion in 5.1 and 5.2 it is clear that Giere's perspectival realism is only a form of scientific realism in a very weak sense. This is not to say that Giere's position is untenable; rather, the point is that perspectival realism and scientific realism are largely at odds with one another.

Before concluding, it is worth noting that there is a large degree of overlap between Giere and Kuhn regarding their views on realism. Giere, like Kuhn, doesn't deny the existence of the mind-independent world but he is skeptical of whether or not the mind-independent world has a mind-independent structure. Specifically, Giere regards "presuming a single structure to the world" as something that is a "metaphysical doctrine… [If] it is regarded as more than a well-entrenched maxim of scientific practice" (Giere 2006, 35). Thus it seems that Giere and Kuhn are on par in accepting a sort of weak metaphysical realism.

It also seems that Giere, like Kuhn, can partially accept a qualified version of the semantic thesis. We can restate Psillos' semantic thesis in terms applicable to Giere's view: scientific models are to be taken at face-value, the fit between scientific models and

the world is truth-conditioned, and if a model fits the world well—where a "good fit" is understood as being dependent upon the purposes for which it is being used—then the entities it posits populate the world. On Giere's view, abstract scientific models aren't taken at face-value because only specific models can be tested empirically. Abstract models situated within theoretical perspectives are not straightforwardly truth-conditioned. However, specific models *are* truth-conditioned in the sense that it is either true or false that a particular specific model fits the world sufficiently well and it is either true or false that a particular specific model makes sufficiently accurate predictions. Thus specific models are pragmatically truth-conditioned on Giere's account. Are specified models that fit the world sufficiently well and posit unobservables to be treated any differently than models that do not posit unobservables? In both cases it seems that what matters is whether the model functions well as a representation of the real world system it is being used to investigate and not on whether the entities it posits can be directly observed. If that's correct, then Giere can accept a qualified version of the semantic thesis which asserts that the fit between specific scientific models and the world is pragmatically truth-conditioned regardless of whether or not the model makes any claims concerning unobservables.

Giere and Kuhn thus seem to be in agreement in accepting a weak metaphysical realist thesis and a qualified semantic realist thesis. However this is hardly evidence that perspectival realism should be considered a scientific realist position, especially since

Giere, like Kuhn, would clearly reject each of the claims of the epistemic thesis.[20] Thus, regardless of whether or not Kuhn is to be regarded as a perspectival realist, it seems that perspectival realism, of the Giere/Kuhn variety, should not be identified as a scientific realist position.

[20] I take it that this follows from Giere's rejection of objective realism.

6. CONCLUSION

Consider again Giere's definition of perspectival realism: "some claims generated by scientific practice are claims about the world…that is the realism part. Second, these claims are not unconditional, but relative to a set of humanly constructed concepts…That is the perspectival part" (2013, 53). It should be clear that Kuhn should be regarded as a perspectival realist based on this rough definition and on the discussion in sections 4 and 5. However, we are now in a position to add some detail to Giere's definition. According to the perspectival realist, then, scientific claims are claims about the mind-independent world and the mind-independent world may or may not have a definite structure. Moreover, the absolute truth of these scientific claims is not something that can be assessed, but the fit exhibited by a model or the ability of a scientific theory to make accurate predictions, can be assessed. Truth functions as relative to a lexicon/theoretical perspective and while many lexicons/theoretical perspectives are incommensurable with one another, communication across them is not a problem. Lastly, the claims made within theoretical perspectives/lexicons that invoke unobservable entities aren't necessarily reducible to claims about observables. According to the perspectival realist, the role of truth in science is not limited based on the observable/unobservable distinction; rather it is limited based on the conceptual scheme within which one is working.

Thus, Giere's interpretation of Kuhn as a perspectival realist should be regarded as correct. Lexicons are identifiable with theoretical perspectives and scientific claims are always made relative to a lexicon. These claims are about the world in a limited sense, because while there is a mind-independent world on Kuhn's account, our understanding

of it (our ability to assess claims concerning it) is inescapably tied to the conceptual scheme within which we are working. Thus, insofar as perspectival realism characterizes Kuhn's views (or Giere's) it is not a form of scientific realism. Rather, it is a form of alethic relativism. Moreover, this version of perspectival realism is incompatible with the epistemic thesis of scientific realism, and is compatible with only a very weak version of both the metaphysical and the semantic realist theses.

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