Incommensurability Reassessed:
The Cognitive Science Foundations of World-View (In)comparability

Maximilian J. Gebauer
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Advisors: Nathaniel J. Goldberg and Paul A. Gregory
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Introduction

Thomas S. Kuhn’s contributions to the philosophy of science are among the most prominent and contentious of the 20th century; his *Structure of Scientific Revolutions* remains one of the most cited philosophical works in recent history, and it has had an impact on historians, literary theorists, political sciences, and sociologists, also. In this work, Kuhn first laid out his incommensurability thesis: theoretical statements from an older scientific paradigm can be untranslatable into those of a later paradigm. Kuhn spent much of his professional life reformulating this thesis, ultimately giving it an explicitly linguistic form that he termed “taxonomic incommensurability.” A large body of secondary literature has developed to explicate and defend various phases of the development of the incommensurability thesis, with several prominent schools utilizing the resources of psychology and cognitive science to provide a naturalized defense of the thesis.

This paper’s purpose is threefold: to survey the evolution of the incommensurability thesis over the course of Kuhn’s career, to explicate the two major schools of secondary literature that refine and defend Kuhnian incommensurability, those being the dynamic-frames account popularized by Andresen, Baker and Chen (ABC) and Alexander Bird’s naturalized psychological account, and ultimately to argue that Bird’s account, supplemented by Paul Churchland’s work on the structure of the brain and its development, is both preferable to ABC’s on theoretical grounds and represents a genuine explication of Kuhnian incommensurability as opposed to an independent conception of incommensurability that is only loosely related to Kuhn’s version.

Section I: History of Kuhn’s Incommensurability Thesis

“Incommensurability,” meaning no common measure, has its origins in Ancient Greece where it referred to the lack of a common measure between the edge lengths of certain geometric
In 1962, Paul Feyerabend and Thomas Kuhn independently published works in the
philosophy of science wherein they used “incommensurability” to denote a phenomenon that can
arise between scientific paradigms. Over the course of Kuhn’s career, the incommensurability
thesis became more central to his work, with his final, unpublished book devoted entirely to it.
Although he consistently defended the existence of incommensurability, the form of
incommensurability that he defended varied considerably and any paper on the topic is incomplete
without an overview of the evolution of Kuhn’s views. For convenience, we can delineate three
rough epochs: the early period of the 1960’s with Structure of Scientific Revolutions (SSR) being
the principal text, the middle period starting with the postscript to the 1970 second edition of SSR
through the essays collectively published as The Essential Tension, and the final period of the
1980-90’s with his anthology The Road Since Structure and an unpublished manuscript entitled

Kuhn’s early period contains both the fewest explicit references to incommensurability and
the strongest version of the thesis. For SSR-Kuhn, incommensurability characterizes the relation
between successive traditions of normal science and has three main manifestations: 1. Between
successive paradigms there are changes to the problem domain for that field, changes to the set of
accepted methods, values, and the relative importance of specific problems. 2. Theoretical terms
and concepts employed in the two successive paradigms change meaning both extensionally and
intensionally. “Mass” in Newtonian mechanics relates to the world in a different way than it does

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4 “[A] generally accepted theory including exemplary problem solutions, governing research, with implications for
what there is in the world, how it behaves, what questions we may ask about it, what methods may be used in pursuit
of these questions, and what answers we may expect.” Hoyningen-Huene, Paul. (1993). Reconstructing Scientific
in Einsteinian mechanics, and Kuhn claims these changes prevent direct communication and
debate between individuals utilizing competing paradigms. 3. The third element, which Kuhn
holds is the most fundamental, is that scientific practitioners working with paradigms work in
different worlds. Kuhn writes: “Both [of the scientists working with different paradigms] are
looking at the world, and what they look at has not changed. But in some areas, they see different
things, and they see them in different relations one to the other.”
Where one sees bronze as a compound, the other sees it as a mixture. SSR primarily locates incommensurability between
world-views, with meaning-incommensurability being a secondary manifestation that is entailed
by world-view change. The picture of incommensurability in SSR is psychological in the sense
that it is defined primarily in terms of psychological structures and mechanisms wherein Kuhn
cites the work of Jerome Bruner and Leo Postman in cognitive psychology and draws heavily on
empirical science for support.

In the postscript to the second edition of SSR wherein Kuhn’s middle period begins, he
restricted the scope of incommensurability to issues of meaning/conceptual change and
translation. His updated conception is that incommensurability arises between two successive
theories when said theories are not mutually translatable into a neutral observation language
without loss of empirical consequences. His argument here is an extension of his rejection of the
very idea of a neutral observation language from SSR. This shift from the psychological version of
incommensurability that granted primacy to world-view change in the main text of SSR to the
primarily linguistic presentation in its postscript marks the beginning of Kuhn’s personal linguistic
turn wherein he moves from his early cognitive conception of incommensurability to one centered

6 Ibid, p.149.
7 Ibid, pp. 62-4.
8 Ibid, p. 175.
in the philosophy of language which better matched with the dominance of said discipline at the
time in analytic philosophy. Kuhn’s turn is worked out in more detail over the next decade
wherein he published a number of papers that were anthologized as *The Essential Tension*.

During Kuhn’s middle period in his “Second Thoughts on Paradigms,” he locates
incommensurability as a phenomenon observed when attempting to apply the symbolic
generalizations of a given paradigm (symbolic terms like \( m, a, f(x) \) et cetera) to the problem
domain delineated by another. Kuhn argues that difficulty in applying the concepts of a given
paradigm’s theory results from not grasping the similarity and dissimilarity relations that specify
the deployment of said concept in the theory.\(^{10}\) For example, to deploy the Newtonian concepts
implicit in Newton’s second law, one must have the ability to recognize the set of problem
situations in which the law or one of its forms is deployable. Central to this period of Kuhn’s work
is his roughly Wittgensteinian family-resemblance approach that focuses on similarity and
dissimilarity relations to delineate the application of a concept.\(^{11}\) Thus Kuhn’s theory of
incommensurability becomes focused on differences in the application of concepts between
paradigms wherein the web of similarity-dissimilarity relations are altered so that terms that
putatively feature in both theories (that come from different paradigms) no longer relate to the
world or each other in the same way.\(^{12}\) Concepts that used to relate to the world in disparate
domains could become highly interrelated in a new paradigm while ones that used to be applied in
the same or related domains now are disparate. Kuhn’s version of incommensurability in his
middle period is certainly part of his linguistic turn, but by discussing this version of
incommensurability as purely linguistic misses out on the psychological elements still present.

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\(^{11}\) Ibid. pp. 306-7, 318.

\(^{12}\) Andersen, Hanne et al. (1996). “Kuhn’s Mature Philosophy of Science and Cognitive Psychology”. *Philosophical
Psychology*, vol. 9, No. 3, p. 351.
The ability to recognize the resemblances between problems in a given domain and apply the relevant laws of the theory has both a linguistic and psychological element and is the locus of incommensurability for middle Kuhn. Though he writes almost exclusively on incommensurability in terms of conceptual/meaning change, Kuhn does not give up world-view change, rather he revokes the primacy he granted world-view in SSR and now argues that it follows as a result of conceptual shift.\(^\text{13}\) Kuhn argues in this period that due to one’s membership in a given linguistic community, one gains command of a certain set of similarity relations between concepts which shapes how they apply to the world. Kuhn, drawing on cognitive science, articulates/refines his original world-change argument: “members of different communities are presented with different data by the same stimuli. … The given world, whether everyday or scientific, is not a world of stimuli.”\(^\text{14}\) Though the actual stimuli that impinge upon us remain constant across a paradigm shift, the higher-level representations caused by them are partly the result of the similarity/resemblance relations that come along with learning a community’s paradigm, specifically its conceptual structure. Roughly speaking, our higher-level representations are a function of our contingent neural structure/connections, and a change in these connections and structures resulting from a paradigm shift will thereby result in a different mental representation, even with the environmental stimuli remaining fixed. Although the world-view change remains a feature of his thought, the primacy it was granted into SSR has now been given to meaning/conceptual change, a trend that is only intensified in Kuhn’s later period.

The 1983 publication of “Commensurability, Comparability, Communicability” marks the beginning of Kuhn’s mature linguistic turn. Henceforth Kuhn presents incommensurability as an almost exclusively linguistic phenomenon that arises due to shifts in the taxonomic structure\(^\text{15}\)

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14 Ibid.

15 For Kuhn, A taxonomic structure of a given paradigm is the interrelated web of kind terms arranged in a hierarchal
implicit in different scientific theories. Furthermore, incommensurability is now limited to “a small subgroup of (usually interdefined) terms and for sentences containing them.\textsuperscript{16} Kuhn calls this “local incommensurability” and it can be meaningfully contrasted with the seemingly global incommensurability found in SSR wherein entire world-views, methodologies, problem domains, value sets, and vocabularies can be incommensurable.\textsuperscript{17} Kuhn explicitly notes the linguistic nature of his updated view: “The phrase ‘no common measure’ becomes ‘no common language’. The claim that two theories are incommensurable is then the claim that there is no language, neutral or otherwise, into which both theories, conceived as sets of sentences, can be translated without residue or loss.”\textsuperscript{18} Incommensurability is now explicated purely in terms of translation failure between theories embodying different taxonomic/lexical structures. As in SSR, Kuhn maintains that a perfect translation between theories maintains both extension and intension. Further, he holds that mastering a theoretical concept requires one to learn the similarity and dissimilarity relations that effectuate one’s actual application of the concept to potential cases for inclusion in the problem domain wherein said concept is applicable.\textsuperscript{19} And although his thesis is explicitly linguistic, incommensurability maintains some of its cognitive bite as Kuhn argues that a given theory imposes its taxonomic structure on the world and makes ontological commitments about what exists and the relations between said entities.\textsuperscript{20}

The central essay of Kuhn’s late period is his “The Road Since Structure” which lays out the absolute importance of incommensurability to Kuhn’s career, provides a more complete explication of what notion of (un)translatability he operates with, discusses his notion of a lexical

\textsuperscript{17} Ibid, pp. 35-7.
\textsuperscript{18} Ibid.
\textsuperscript{19} Ibid, p. 47.
\textsuperscript{20} Ibid, pp. 50-3.
taxonomy, and ties these strands together to give his most complete mature elucidation of ‘taxonomic incommensurability.’ First, Kuhn now limits his linguistic presentation of incommensurability to a very limited class of words, namely taxonomic kind terms that have two features: they are count nouns that can take the indefinite article and they obey the no-overlap condition which holds that no two kind terms can overlap in their referents unless they are in a genus-species relation. A kind term relation that satisfies the genus-species exception to the no-overlap principle would be something like ‘metal’ and ‘copper’, wherein the entire referent of ‘copper’ is contained within the referent of ‘metal’, but such an overlap is permissible because ‘copper’ is a species of the genus ‘metal’. Kuhn’s next move is to argue that a lexical taxonomy must be in place for a given community before description and theorizing about the world can take place.

A shared taxonomy is a pre-requisite for unproblematic communication. His argument for this claim is also an analysis of what causes and constitutes the phenomenon of (taxonomic) incommensurability. Kuhn contends that when two individuals/communities differ in some local area of their lexical taxonomies, their communication will be necessarily partial as statements made at these points of difference will be inarticulable in the other’s taxonomy. As for why this statement cannot be expressed, we must return to Kuhn’s conditions on lexical taxonomies: the kind-label condition and the no-overlap principle. Kuhn’s argument is that when either of these conditions are violated, we get conflicting and inconsistent expectations for the entity in question. For example, if a statement using a given object-concept in one taxonomy is expressed in the other taxonomy wherein the concept’s referent is cross-classified into two taxonomic categories with conflicting expectations that come along with these respective categories, the statement is not

22 Ibid, p. 92.
23 Ibid, p. 93.
genuinely expressible. For example, imagine that we take a species-concept from one taxonomy and attempt to place it in another one wherein the unique features of this species cause it to be classified within two mutually exclusive taxonomic categories, under this attempted ‘translation’ we now have conflicting expectations for the additional properties of this species due to its classification in two different positions in the taxonomic web. It is as if one made a statement about an object that was both fully blue and fully red all over, it is simply unassertable in our lexical taxonomy. Therefore, incommensurability has now been narrowed to a specific type of untranslatability that arises due to the localized differences in the two theories’ respective lexical taxonomies.

The above schematic overview of Kuhn’s development of the incommensurability thesis shows two major themes: a gradual restriction of the scope of the thesis from global in SSR to located within small sets of interrelated kind terms in RSS and a consistent trend towards a more purely linguistic explication of the phenomenon. The dominant reading in the literature is that Kuhn has a sharp break with his early trends towards a primarily psychological, non-linguistic conception of incommensurability and shifts to doing philosophy of language and that with this transition his incommensurability thesis loses a great deal of its cognitive bite. Although this reading might hold as a very general trend, it fails to acknowledge a line of thought that runs through Kuhn’s career: the ways in which linguistic structures and human cognitive habits and structures impinge on and shape each other. There is strong exegetical support for the contention that one of the main questions that occupied Kuhn throughout his entire career was explicating the relation(s) between languages, paradigms, and lexical taxonomies and human cognition. Acknowledging this theme is essential if we are to appreciate Kuhn’s full conception of

incommensurability, its constitution, and its manifestations. Kuhn’s interest in the connections between language and cognition is clear in SSR, however as he began to make his linguistic turn, he devotes less space directly to the topic. The ways in which language impinges on cognition are explicated in the following sections, forming a crucial link between the Bird-Churchland account to be developed and Kuhn’s own incommensurability thesis. With this brief overview of the development of Kuhn’s conception of incommensurability established, let us to turn to prominent Kuhn scholar Alexander’s Bird’s cognitive science-based defense of incommensurability.

Section II: Bird’s Defense of Incommensurability

Drawing on cognitive science, Bird describes the features of human psychology that can bring about incommensurability between individuals working with different paradigms. Bird’s approach is highly naturalized, and one of his objectives in writing on Kuhn is to show how more recent developments in cognitive science vindicate the earlier ‘psychological’ Kuhn of SSR. Bird follows SSR- Kuhn in asserting that the most fundamental sense of incommensurability is between worlds/world-views and sees communication breakdowns as secondary. In the postscript to the second edition of SSR, Kuhn clarifies that when he speaks of paradigms, he is referring to two distinct uses of the term: the ‘disciplinary matrix’ which is comprised of the accepted methods, values, symbolic generalizations, ontology et cetera of a given scientific community and the ‘exemplar’ which represents paradigmatic examples of exemplary problem solutions for a given domain and which Kuhn considered to be the most novel sense of the term. Bird focuses on this

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second sense and attempts to demonstrate how mastering a given exemplar gives one a set of quasi-intuitive cognitive capacities (Q.I.C.C.s) that effectuate the actual functioning of the exemplar in practice.

Q.I.C.C.s includes processes such as analogical thinking, tacit assumptions, and cognitive commitments embedded in schemata about the world that license quasi-intuitive moves in one’s reasoning.29 These capacities are denoted as “quasi-intuitive” as they function without conscious intervention/deployment, yet they are still learned and not innate in a sense that could be described as second-nature. Crucially, these processes are not derivable from first principles and represent an empirical discovery about how exemplars (contingently) function and what arises when two individuals differ in their set of Q.I.C.C.s. Q.I.C.C.s are an ineliminable part of the actual functioning of a given exemplar as without them, scientific practitioners do not have the cognitive tools to actually determine, by analogy, the membership of the set of relevant cases wherein the paradigm exemplar and its laws are applicable.30 Bird extends his analysis to use Q.I.C.C.s to explicate the failure of comprehension that Kuhn identifies with incommensurability. To do so, he argues that Q.I.C.C.s include cognitive processes that serve as quasi-intuitive steps in our reasoning that influence our judgments of correctness when evaluating a given proof or scientific argument.31

This additional argument is necessary to actually explicate incommensurability in the strong sense given by Kuhn in SSR as without it, one could invoke the context of discovery/context of justification distinction and grant that one’s specific Q.I.C.C.s might be practically useful in discovering new cases where a given exemplar-law is applicable but then argue that this has no

bearing on the justificatory process that comes next. Bird addresses this point directly and contends that even in arguably the field where this context would be strongest (mathematics) the role of Q.I.C.C.s has not been eliminated even in the alleged context of justification. In addition, Bird implicitly maintains a key distinction that underlies Kuhn’s remarks on perception: the observation-perception distinction. Bird’s argument is naturally not that the external world (or the raw stimuli we receive from it) changes, rather it is how we process said data, what connections we see, what laws we apply to a given situation, and how we verbally report the experiment or observation. When presented with the same stimuli, two individuals, each with a different set of Q.I.C.C.s, will make different inferences and perceptual judgments such that their phenomenal worlds can be said to differ. The primacy of the world-view change sense of incommensurability in Bird as in SSR-Kuhn serves as the source for communication breakdown and meaning/conceptual incommensurability more generally.

To corroborate SSR-Kuhn’s claim that communicative breakdown is a secondary manifestation of incommensurability, Bird contends that background tacit assumptions and inferential habits play crucial roles in what speakers in various contexts attempt to communicate. These assumptions and cognitive habits are far richer and decidedly irreducible to a shared taxonomy. The ways in which tacit assumptions enter into language are twofold: at the level of defusing ambiguity and when the meaning of a given utterance goes past the literal meaning of the words used. For a rather uncontroversial example of the first role, if a person asks their partner to stop by the bank after work, we clearly interpret this as referring to the financial institution as opposed to the side of a river. For the second case, Bird argues that we effectively operate under certain ‘folk metaphysical’ assumptions about the nature of the world that are gained through our

34 Ibid, 30.
engagement with the world.\textsuperscript{35} These assumptions can remain unproblematic in everyday communication and likely play an important role in our ability to navigate and manipulate our environments in everyday life, however our intuitive assumptions about the world can make it difficult to comprehend scientific theories that conflict with our existing assumptions. For example, it is conceivable that a tacit assumption we might make due to our engagement with the world is that mass is a fixed quantity of objects, a commitment that fails to hold under General Relativity. When first confronted with this theory, statements about the behavior of objects approaching the speed of light could be difficult to grasp, but not due to some formally stated explicit commitment to a Newtonian theory of mass (though this could of course occur), but due to the fact that our brains’ tacit assumptions and inferential habits are not consistent with this theory. A consequence of the role of tacit assumptions in communication is that they can effectively license certain unstated inferences in formal arguments. Differences in these tacit assumptions are one of the key contributors to manifestations of incommensurability.

Although Bird’s cognitive science-based defense of incommensurability locates him among a host of similar positions, his is unique in that he does not attempt to vindicate Kuhn’s later taxonomic notion of incommensurability. Bird defends arguably a stronger version of incommensurability as it attempts to do justice to the SSR metaphors of world-change and communication failure as originally presented. Although Bird does not defend or attempt to support taxonomic incommensurability, he leaves the question open whether other accounts can provide a defensible cognitive science-based account of taxonomic incommensurability. Another key feature that differentiates Bird’s account from other primarily psychological accounts, like the school of thought that defends incommensurability in terms of cognitive frames, is his is strongly non-linguistic and focuses on psychological processes that are non-linguistic in character (even if

\textsuperscript{35} Ibid.
Overall, Bird’s explication of SSR-Kuhn in terms of quasi-intuitive cognitive capacities goes far in vindicating some of Kuhn’s earliest claims, and as we will see in Section IV, enjoys strong support from work in cognitive science as expounded by Churchland. Let us turn to an elucidation and critical evaluation of the dynamic-frames based explication/defense of incommensurability.

Section III: ABC’s Dynamic-Frames Account of Incommensurability

Hanne Andersen, Peter Barker, and Xiang Chen (‘ABC’ for brevity), both together and independently have worked to vindicate Kuhn’s later, taxonomic version of incommensurability using the recourses of cognitive science. Their efforts represent one of the longest running defenses of incommensurability with a narrow focus on psychological theories of concepts and their role in communication. Their reading sees Kuhn as offering a Wittgensteinian theory of concepts that rejects the traditional mode of conceptual analysis that holds that a concept is determined through its set of necessary and jointly sufficient conditions. They then argue that we can provide a cognitive science-based account using Barsalou’s dynamic frame-based theory of concepts to support this Wittgensteinian view allegedly espoused by Kuhn. Additionally, ABC attempt to extend this theory of concepts to explicate Kuhn’s later notion of taxonomic incommensurability. Before considering the specifics of their account, let us consider the exegetical support for their argument that Kuhn is putting forward a theory of concepts.

ABC claim that a theory of concepts is central to Kuhn’s overall philosophical project, stemming from his middle period through his later taxonomic one. They even claim that as early as the first edition of SSR, Kuhn rejects the classical theory of concepts/conceptual analysis that
holds that a concept is delineated by its set of necessary and sufficient conditions. In SSR, Kuhn does mention Wittgenstein’s later work in *Philosophical Investigations*, specifically Wittgenstein’s famous passages on how some (maybe all) concepts, like ‘game’, are characterized not by a set of necessary and jointly sufficient conditions uniquely determining the concept’s extension, but by a certain “family resemblance” between members of the extension set. ABC argue that Kuhn revisits this theme in the second edition’s postscript where, in a footnote, he argues that certain concepts/theories in science do not have rules specifying the set of necessary and sufficient conditions to identify the set of situations in which they are applicable. It is worth noting that both of these passages are relatively minor remarks that do not constitute central parts of the overall work. The first passage that cites Wittgenstein directly is focused not on the topic of conceptual analysis, but on the topic of rule following in the context of Kuhn’s argument that paradigms need not function as sets of explicit rules. Furthermore, his citing of Wittgenstein is always prefaced by modal operators indicating that such a feature may be the case of the functioning of paradigms, not that it is decidedly the case. In addition, for both mentions of ‘family resemblance’ in SSR, Kuhn is interested in not in conceptual analysis in the strict sense, but in how humans as perceptual beings learn to spot resemblances between cases where a paradigm might be applicable. ABC’s argument that Kuhn is interested in a theory of concepts is therefore not substantiated for SSR, however the evidence for such a reading of Kuhn gains better support from the middle period of his work.

Kuhn’s “Second Thoughts on Paradigms”, while not containing any explicit references to Wittgenstein, does speak of the criteria used in determining when it is valid to apply a given

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38 Ibid, 196.
formalism to a specific situation. Here Kuhn does express that, in practice, there is a set of conditions that directly specifies the class of situations where the paradigm’s formalism is applicable. His argument is that even if one could retroactively reconstruct a set of criteria that picks out the class of situations, this does not give any insight to the criteria actually employed by scientists. Kuhn argues that learning to see similarity relations among classes of objects is crucial in learning a paradigm.40 What specific criteria one employs can be anything if they perceptually sort objects into the correct classes.

Although the exegetical support for ABC’s argument that Kuhn was centrally concerned with a theory of concepts is unfounded, this does not entail that ABC’s separate argument that a dynamic frame account of concepts provides empirical support for a notion of incommensurability falls. On the contrary, this second question is arguably the more philosophically interesting one as long as it is explicitly framed not as an elucidation of a Kuhnian position but as an independent argument in support of a Kuhnian conclusion. With that in mind, let us turn to an overview of ABC’s argument for the utility of a dynamic-frame account of concepts and what said account entails.

ABC begin by arguing that our approach to a theory of concepts should begin by considering the results of the “Roschian Revolution” so named for the empirical work in cognitive science by Eleanor Rosch which purports to demonstrate that human concepts are “gradable” in the sense that not all examples are equally good examples of the concept.41 If human concepts exhibit this property, then the classical theory of concepts is flawed as it sees all examples of a concept as being equally good, or so the argument goes. If humans cognitively represent concepts in a way that is different than the classical theory, a prime desideratum of a new theory will

clearly be its ability to represent this graded structure. ABC attempt this using Barsalou’s dynamic frame account of concepts which they claim can both accommodate the empirical data concerning human concepts and have broad explanatory power for Kuhn’s later notion(s) of incommensurability.\footnote{Andersen, Hanne et al. (2006). *The Cognitive Structure of Scientific Revolutions.* Cambridge: Cambridge University Press.} Before covering how Barsalou’s account is employed, let us consider the rough outline of the theory.

Dynamic frames attempt to represent the structure of concepts at the most fundamental level of human cognition. The approach claims to represent the structure of a given concept by having certain “attributes” each with possible “values.” For example, a (partial) frame for the concept “chair” might include attributes like “number of legs”, “width”, “material” with various values corresponding to each attribute. The fact that the attribute list does not take the form of a set of a necessary and jointly sufficient conditions serves to both match with the empirical data on gradeability and with Kuhn’s work according to ABC. Furthermore, anything can count as an attribute for determining membership--there is no restriction on what features of a given entity may be employed. Concept-frames have certain structural invariants: relations between certain attributes that do not vary. That is, certain concepts have internal structural relations whereby if a certain attribute has a value, then other attributes thereby require a value. For example, if an animal-concept has a value for the attribute ‘fur’, then it must have a value for the attribute ‘fur color’.

Our choices concerning certain attributes are constrained by the relationships that can arise between specific attributes for a given concept-frame. Consider a hypothetical concept-frame for ‘bird’ whenever the value ‘long’ is selected for attribute ‘neck’ we select the value ‘large’ for attribute ‘body size’ which reflects a contingent invariant relationship between said attributes in birds according to our current observational knowledge. ABC argue that we can explicate Kuhn’s
similarity-dissimilarity arguments in terms of the frames of our concepts. This provides the alleged essential link between the frame-based account of human concepts and Kuhn’s notion of paradigms as exemplars which opens the path for ABC to use their account to provide a cognitive science-based account of incommensurability. Roughly, ABC argue that learning similarity-dissimilarity relations means learning to recognize the different relations that hold among different attributes/values in a given frame. These relations are not explicit in the structure of the frame but must be learned through repeated exposure to exemplars and entities that fall within that contrast set. Learning that webbed feet are associated with waterfowl for the overall superordinate concept ‘bird’ is a prime example of this.

For incommensurability, ABC argue that their frame-based account of concepts can both explicate and support Kuhn’s later notion of taxonomic incommensurability by demonstrating that violations of Kuhn’s no-overlap principle due to cross-classification of one conceptual entity into two non-co-extensive categories are cognitively explicable in terms of deletion and addition of conceptual entities and attributes. Changes to a given concept’s frame are not always sufficient to generate incommensurability, for example, the mere discovery of a new value for an attribute in a frame might simply add to our knowledge, not generate taxonomic incommensurability between the new concept-frame and the old one. Problems arise when an anomalous experience forces a change to a frame that violates a Kuhnian condition on the construction of taxonomies. To take a common example from ABC, the discovery of a screamer, a species of bird that exhibits a new combination of attribute-values that cross-classifies it into two existing superordinate categories that are non-co-extensive and part of the same contrast set. By violating Kuhn’s no-overlap

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principle, we are forced to revise our taxonomy in this area to accommodate the anomalous entity and any communication between individuals employing the two taxonomies will be partial.

Although this theory provides interesting insight in human cognition, it makes an ultimately fatal mistake that undermines its theoretical rigor. Put concisely, it makes the error of jumping from the observation that humans deploy concepts with a graded structure to the conclusion that the concepts themselves actually have or should have a graded structure. To see how this move is flawed, let us consider a case dealing with a concept that has well-defined necessary and sufficient conditions: A Euclidean triangle. We can define a triangle in Euclidean space as any closed two-dimensional geometric figure composed of three sides and three angles with the interior angles adding up to 180 degrees. The extension of this concept is well-defined and all examples in the set satisfy the concept’s conditions equally well. However, it is reasonable to assume that when humans think about the concept they might consider an equilateral triangle to be a ‘good’ or paradigmatic example of the concept while also thinking of a scalene triangle with a long hypotenuse as being a ‘less good’ example. Following ABC, we would therefore hold that the concept in question has a graded structure, but this is both unintuitive and inconsistent with the nature of mathematical concepts. Simply, the mere empirical fact that humans may conceptualize and deploy a concept using a graded structure does not and should not lead us to conclude that the concept in question is actually graded. One might reply that this might be the case for some concepts, especially scientific and mathematical ones, but that other concepts do seem to resist conceptual analysis in terms of necessary and sufficient conditions. For example, one might argue that socially constructed concepts like ‘democracy’ or ‘capitalist economy’ resist this form of conceptual analysis and do show a graded structure. This argument may be the case for such concepts; the problem with it is we have 

prima facie  
grounds to hold that if any concepts are analyzable in terms of necessary and sufficient conditions, it is precisely the mathematical and
scientific concepts that appear in scientific theories and paradigms. The analyzability (or lack thereof) of certain socially constructed concepts provides no evidence that the types of concepts that we are interested in are of the same type, and we have strong intuitions that they are in fact analyzable in terms of necessary and sufficient conditions.

ABC’s entire conception of incommensurability is reliant on concepts having a graded structure which now can be seen to be a counter-intuitive presupposition. Furthermore, their argument that Kuhn was concerned with conceptual analysis/a theory of concepts is exegetically suspect at best. A theory of concepts can be thought of as providing some type of answer concerning the internal structure of concepts that are usually lexically expressed (‘knowledge’, ‘sphere’, ‘chair’, et cetera). As mentioned above, ABC read Kuhn’s sporadic references to Wittgenstein as an endorsement of a non-classical theory of concepts, and they support this by citing various points where Kuhn argues that knowing how to determine whether a paradigm is applicable to a given situation does not function through recognizing a set of necessary and jointly sufficient conditions in the situation in question.

This reading of Kuhn fundamentally misreads how Kuhn is deploying Wittgenstein in his overall philosophical project. When Kuhn speaks of there being no set of necessary and sufficient conditions to determine where a paradigm is applicable, he is clearly not speaking about individual concepts, but the application of theories/laws contained within paradigms to the world. It is perfectly consistent to say that there is no set of necessary and sufficient conditions determining which situations Newton’s Second Law is applicable to while also holding that the concepts contained within this law (mass, force, and acceleration) have an internal structure of a form that the classical theory of concepts argues for. In his written work, Kuhn never signals an interest in providing a theory of concepts, and all his remarks that ABC take to be on the topic are on an entirely separate matter: the question of applying theories/laws embedded within paradigms
To summarize this section, the ABC dynamic frames-based account of incommensurability is reliant upon the invalid move from the apparent fact that humans appear to deploy concepts as if they had a graded structure to the conclusion that concepts themselves actually have a grade structure, furthermore, ABC’s argument that Kuhn puts forth a theory of concepts is exegetically unsupported as Kuhn’s deployment of Wittgenstein’s notion of family-resemblance is in the context of determining the set of cases in which a given paradigm’s laws/theories are applicable, not in the context of the internal structure of concepts. The lack of theoretical rigor and exegetical support makes ABC’s account a poor candidate for the task of explicating and defending Kuhnian incommensurability, especially when compared to Bird’s account explored in the previous section. However, Bird’s psychological account would gain serious rigor if it were supplemented by additional work concerning how the physical structure of the brain and the ways that it develops can generate incommensurability. The following section explicates Paul Churchland’s work in this domain to provide the empirical rigor lacking in Bird’s account after which is a defense of the consistency of this unified Bird-Churchland framework.

**Section IV: Churchland on the Plasticity and Structure of the Mind**

Paul Churchland has written extensively at the intersection of neuroscience and philosophy of mind wherein he casts doubt on the soundness and explanatory power of folk psychological concepts and linguaformal theories of cognition. His empirically based skepticism regarding the folk psychological family of concepts and its inherent linguaformalism along with his more general work in neuroscience is central to understanding the relevance of his work to the incommensurability thesis. When Churchland argues against linguaformal theories of cognition, he is only arguing that the most basic types of cognition are non-linguistic in nature, in fact, he
fully acknowledges that there is linguistic representation in higher-level cognition which is central to his theory of ‘cultural learning’ which is explicated below.

His argument against linguaformalism for cognition begins by noting that humans’ brains differ only in degree, not kind, from species that are evolutionarily close to us and that animals exhibit many of the same complex behaviors and interventions in the environment that we do, yet non-human animals seemingly lack complex, systematic formalized language. This observation alone casts serious doubt on the linguaformal view of cognition as, the power of human language notwithstanding, it is *prima facie* implausible that all of the complex behaviors observed in animals require language. Thus, Churchland argues that by accepting that the fundamental unit of cognition is non-linguistic, our theory of cognition better locates us alongside our evolutionary relatives—a desideratum of any theory of cognition. Churchland suggests that we think of the brain as a network computational device wherein relatively stable background knowledge is constituted by the connection weights between neurons while our moment to moment representations are understood in terms of the ever-changing activation patterns across those neural populations. Explicating this distinction between enduring background knowledge and fleeting moment to moment representations in terms of the actual structure and activation patterns of the brain, if successful, would provide a strong empirical basis for incommensurability as it would demonstrate the actual cognitive process by which certain propositions or experiences can resist comprehension due to their conflict with a relatively stable feature of one’s background conceptual scheme about the world.

To this end, Churchland argues that we ought to view the basic unit of cognition as an “activation pattern across a proprietary population of neurons.” He is broadly concerned with

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48 Ibid, pp. 27.
elucidating a theory of representation that is informed by our best available neuroscience. Roughly, he argues that we ought to think of the brain as containing hundreds to thousands of cognitive “spaces” in which some distinct part of human cognition is continually unfolding. These spaces are plastic, and to a high degree their constitution is constantly sculpted as a result of the specific experiences of the organism. Churchland draws a distinction between “enduring” and “ephemeral” representation wherein ephemeral representations are the moment-to-moment neuron activation patterns within a given space. In contrast, the basic unit for enduring representation is the entire relevant activation space. The “shape” of this space is determined by the weightings of the neural connections in them, and they are shaped through experience and embody knowledge about the world; they can be thought of as the physical instantiation of a conceptual scheme. This space encompasses all possible activation patterns for the relevant neural population(s) and the form it takes is heavily contingent on the specific experiences of the organism. Furthermore, these spaces represent not only static perceptual inputs, but perceptions of processes over time, as well as potential and actual actions (motor responses) on the part of the organism. Humans are not merely perceptual devices, they intervene in the world, and the cognitive development of individuals is the sculpting of their neural representational spaces so that it can better predict, navigate, and intervene in its environment.

Now we are able to contrast non-problematic prototype representation with anomalous cases. A prototype is a specific region within a shaped space that is activated when a given input is unambiguously an example of what that prototype represents. They are basins of attraction within the dynamical system for the trajectory of the activation vector such that the “better” the input maps on to the prototype, the more the prototype gets activated. For example, let us take the possible prototype for a masculine face. If the individual has a perceptual experience of a human face that strongly embodies many of the prototypically “masculine” properties of the masculine
face prototype (say, a strong jawline, a boxier head, and a pronounced brow), then the prototype will activate strongly. This is an example of a non-anomalous experience that is assimilated well by the individual. However, let us imagine that the same individual has a perceptual experience of a human face that fails to strongly embody prototypically masculine or feminine traits. Now the individual has more difficulty assimilating the experience to one of the prototypes in this activation space and will need to seek out further information about the observed entity to assimilate it. A small number of these anomalous experiences likely will not result in radical changes to the neural weightings of this space, however, this space is not frozen, and should enough experiences fail to smoothly assimilate, the recurrent neural network may adjust the neural weights to better be able to discriminate between male and female faces. The shape of these spaces evolves dynamically as a result of an ever-changing environment to better allow the individual to navigate and intervene in its environment.

The question of what form these changes in the brain take is not a matter of a singular process. As for how the brain and its conceptual scheme(s) change over time, Churchland draws a tripartite distinction between slow structural learning in the individual, fast dynamical learning in the individual, and cultural/collective learning. The first two types reflect changes in the actual brain: its structure, synaptic connections, neural weightings, and the evolution of the activation vector. At bottom these changes in the representations and transformations are non-linguistic in structure. The third type of learning is the collective assimilation and transmission of past cognitive achievements which ensures that each individual need not start from scratch with their cognitive development. This is largely, but not entirely, linguistic. It also includes cultural artifacts such as art, institutions, and technology. Let us turn to a closer examination of these three types of learning.

Churchland’s slow structural learning refers to changes to the actual synaptic connections in the brain. This form of learning occurs primarily in the earliest stages in an individual’s
development, especially in one’s infancy and early childhood. The specific configuration of one’s synaptic connections forms the foundation of one’s perceptual similarity-dissimilarity relations and provides one’s basic understanding of how to act and intervene in the world. Churchland argues that this basic conceptual scheme is roughly similar, but not identical for all humans; it is not until we reach the second type of learning that we began seeing meaningful divergence between individuals.49

Although our most basic categories are relatively fixed from early development, humans also exhibit a strong form of dynamical non-linguistic learning that represents the redeployment of existing cognitive resources in novel ways in response to anomalous experience. More specifically, learning of this type involves a substantially atypical activation pattern within the existing possible set of activation patterns which is constrained by our basic conceptual scheme. To underscore how much room there is for dynamical learning, Churchland notes that even if we consider our basic conceptual scheme to be fully fixed, there are something of the magnitude $10^{100,000,000,000}$ a priori possible activation states, and even if the a posteriori set of possibilities is substantially smaller, this still leaves an incredible amount of room for this second form of learning.50

This second level of learning is where we can identify the basis of non-linguistic cognitive incommensurability, and the parallels between Churchland’s description of how this learning takes place and Kuhn’s early remarks on the incomprehensibility of incommensurable statements/experiences are striking. Kuhn’s gestalt shift metaphor wherein a sudden realization concerning a phenomenon results in a new world can now be understood as a dynamical change in the brain’s deployment of existing cognitive resources in a new manner. Churchland asks us to consider Newton’s realization that the motion of celestial objects like the moon are governed by

50 Ibid, pp. 17, 186-96.
the very same laws that govern the motion of a thrown projectile on Earth. More specifically, after Newton had the sudden realization that celestial objects and their orbits are governed by the same laws as a projectile thrown on earth, thenceforth his perceptions and higher-order representations of celestial object motion activated his ‘terrestrial motion’ prototype. After enough instances of this new deployment of this prototype in the new context, eventually it can be re-interpreted as a more general, unifying theoretical prototype ‘inertial motion’ that covers the perceptual inputs that used to be represented under two separate prototypes: ‘terrestrial motion’ and ‘celestial motion’. What occurs is not a slow reconfiguration of synaptic connections, nor is it a realization that is purely expressible/explicable in linguistic terms (though of the course the linguistic formulation of this new way of conceptualizing the phenomenon is necessary for it to enter the actual scientific domain). More specifically, while Newton’s perceptual experiences of the Moon used to activate his ‘celestial motion’ prototype, they now activate his ‘terrestrial motion’ prototype, and that has now generalized across the previously disparate sets of perceptual inputs. This cognitive redeployment allows for new perceptual and representational possibilities that can better unify what were previously considered disparate phenomenon.51

This argument relies on a view of what constitutes scientific theories and how we learn to use them—Churchland views scientific theories as not purely or primarily linguistic in structure which is a view likewise found consistently throughout Kuhn’s philosophical corpus. In particular, his notion of paradigms as exemplars demonstrates that learning a given theory and how to deploy it in the world is reliant on not only cognitively committing oneself to a certain ontology, formalism, and set of law-like statements, but also being able to adopt a certain worldview that allows one to make veridical discriminations about where a given theory is applicable which is effectuated through the learning of certain resemblances and similarity-dissimilarity

51 Ibid, pp. 21-2.
relations. Although exemplars themselves exist in the social space, their actual use involves certain irreducibly non-linguistic cognitive processes like the processes of deploying and redeploying existing cognitive resources described above. This parallel in how Kuhn and Churchland conceive of scientific theories as not purely linguistic permits us to use Churchland’s theory of prototype redeployment as an explication of Kuhnian incommensurability and scientific revolution.

The importance of the first two non-linguistic forms of learning does not detract from the significance of this third form of collective learning. In fact, the development of language as a means to communicate cognitive achievements to others represent perhaps the most powerful and unique human ability. This type of learning can serve to regulate and modulate the other two forms of learning and shows how our initially linguistic learning of a new theory connects with our individual conceptual schemes. The importance of this feature of linguistic learning cannot be understated—it provides a possible neuroscientific explanation for the mechanisms by which scientific practitioners can transmit paradigms to other scientists linguistically. Without this form of learning, every organism in a species would have to start from scratch in developing their conceptual scheme. With this form of learning available, each individual’s development is scaffolded by the cognitive successes of past and present individuals.

At this point it is clear that Churchland’s account of the mind and his tripartite distinction between types of learning can provide strong empirical support for the incommensurability thesis. His level of analysis and his contributions are, however, distinct from those given by Bird. A combined framework incorporating the two therefore provides greater support than either alone, but in combing the two there are two important questions: Is such an account internally consistent? And would such an account represent an actual defense/explication of Kuhn or is it best read as an independent approach to elucidating incommensurability?
Section V: Internal Consistency of and Exegetical Support for the Bird-Churchland Account

In attempting to use a synthesized Bird-Churchland account to parallel and explicate Kuhnian incommensurability, we first must examine the compatibility and consistency of such an account. A *prima facie* objection to the compatibility argument drawn here is that Churchland’s skepticism regarding the folk psychological framework makes his account inconsistent and incompatible with Bird’s naturalized incommensurability due to the Bird’s theory’s employment of folk psychological terms. Here we should recognize that Bird’s use of folk psychological terminology is non-committal, and that the crux of his argument refers to mental processes and properties of our brains/minds that can be readily understood using a non-linguiformal representation of cognitive activity, then we can see that this objection to the compatibility argument fails to hold. In fact, Bird explicitly argues that there are serious deficiencies in the folk psychological framework that cannot be remedied through revision within the framework, and that a more empirically grounded approach will better our understanding of cognitive phenomena.52 Therefore, far from being inconsistent with Churchland’s theory, Bird’s work on naturalizing incommensurability is best read as attacking the very same question as Churchland, albeit with a different methodology and lacking the empirical rigor that Churchland’s work brings. By presenting the two in a unified account, we gain explanatory power, detail in our description of the relevant phenomena, and greater breadth of support from the literature. To explore this compatibility in more detail, let us consider the key parallels between the two.

Arguably the point of greatest overlap between the two authors concerns the nature of what

Churchland refers to as the second type of learning: the fast, dynamical redeployment of existing conceptual categories/prototypes into new domains to conceptualize anomalous experiences. Bird addresses himself to this topic in different terms when he writes about how humans employ quasi-intuitive cognitive capacities in both everyday interactions and formal scientific reasoning, discourse, and investigation. Additionally, Bird’s theory of how we acquire Q.I.C.C.s parallels Churchland’s first type of slow learning. Both are acquired through repeated exposure and practice until they have become second nature. Additionally, Bird discusses how in a modularized neural network (like the human brain), a model (prototype) developed in one module for one purpose can end up having utility for another purpose and an overall system can react by redeploying the model for the new purpose. Bird’s remarks on this non-linguistic redeployment of a given model perfectly parallels Churchland’s insistence that we can only understand this type of learning as a non-linguistic process, specifically as changes in the dynamical state of the brain with an emphasis on the redeployment of cognitive spaces that were shaped for another task being used to conceptualize either an anomalous phenomenon or an existing one in a new way.

As Churchland points out, the brain can be thought of as having “typical or accustomed modes of operation” that are understood not in terms of the actual synaptic connections of the brain, but in the unfolding dynamical state of the brain in terms of basins of attraction. Of central importance regarding a vindication of early-Kuhn is Churchland’s argument that a given perceptual experience is dependent not just on the actual sensory input from the external world, but also on the existing dynamical state of the brain, a ‘cognitive context’ whereby a given stimulus is processed and represented. For everyday cases of perceptual experience, wherein our experiences are smoothly processed by our existing conceptual scheme, this is unproblematic and

simply serves as an evolutionary development that allows for more efficient processing. However, these cognitive ‘habits’ are non-fixed and can change in meaningful ways that are reflected in a new world-view wherein existing perceptual inputs are processed in a different manner.\textsuperscript{54}

The parallels between this and Bird’s work on the cognitive science basis for incommensurability are striking. Whereas Churchland speaks of attractor basins for neural activation patterns and trajectories in higher dimension vector algebra, Bird, at a different level of description, effectively argues that this manifests as a set of quasi-intuitive cognitive capacities like inferential habits and mental schema that serve a central role in scientific practice. Bird mirrors Churchland when he argues that these cognitive habits are gained through repeated practice and exposure to the relevant phenomenon under the relevant conceptualization and that said habits have a “quasi-intuitive” nature in the sense that they function automatically yet are not fully intuitive in the sense that they are contingent habits that are fluid over time.

Another intersection between the two concerns the role of non-rule-based analogical thinking which Bird argues is the central cognitive science explanation for Kuhn’s conception of paradigms as exemplars. He argues that the use of exemplars requires one to see certain similarity relations among phenomena that allow one to identify cases wherein the paradigm’s rules/laws are applicable, and that this can be conceptualized as non-rule based analogical thinking that one acquires as a cognitive habit. Churchland argues analogously and explicitly endorses Kuhn’s work on the role of exemplars and their constitutive role in scientific theories; he sees his work as giving a neural grounding to this tradition which is exemplified by Kuhn’s work. In particular, Churchland attempts to demonstrate that the resources of cognitive science can begin to provide a foundation for a non-linguistic picture of the functioning of individual scientific practitioners’ brains.

\textsuperscript{54} Ibid, p. 40.
To summarize the overlap between the two: both scholars emphasize the non-linguistic nature of certain cognitive structures and processes and how said processes play a central role in scientific practice, in particular for analogical reasoning, inferential reasoning, and in applying mental schema. Churchland’s research program focuses more on the actual mechanisms in the brain responsible for these manifestations that Bird addresses at a more psychological level concerning the behavior of scientific practitioners. Furthermore, a unified account is preferable because it expands the scope of the empirical support for incommensurability and explicates the phenomenon at multiple levels. Now that the compatibility of the two accounts has been addressed, let us consider the parallels between this unified account and early- Kuhn’s remarks on incommensurability to evaluate whether this can be used as an actual explication and defense of Kuhn or if it is instead a quasi-independent offshoot of Kuhn’s work.

Early-mid Kuhn’s remarks on incommensurability are relatively sparse and are not articulated in detail. However, we can extract several central themes: the conception is primarily psychological and refers principally to differences between world-views, world-view change can include both difference in ontology and/or a (re)application of different conceptual categories to existing entities or phenomena, linguistic incommensurability is a secondary manifestation of the primary, world-view sense of incommensurability. The primacy Kuhn grants to the exemplar-sense of paradigm in the postscript to SSR is central for understanding Kuhn’s early remarks on incommensurability. A survey of Kuhn’s remarks on incommensurability indicates that the unified Bird-Churchland account defended in this paper can be seen as an explication and defense of Kuhn’s earlier notion of incommensurability rather than as a secondary, quasi-independent offshoot of Kuhn’s work. This position is supported by the strong exegetical parallel between Kuhn’s early writings on incommensurability and the unified account defended here.

The parallels between early-mid Kuhn’s remarks on incommensurability and the unified
Bird- Churchland account are manifold and support the contention that the unified account presented is an explication of Kuhn, rather than a distinct conception. The primacy early Kuhn grants to the psychological sense of incommensurability in SSR is mirrored in the Bird-Churchland account which focuses primarily on psychological mechanisms and cognitive structures that are non-linguistic. In addition, Kuhn speaks explicitly of incommensurability and new paradigms arising due to the redeployment of existing conceptual categories in new domains, something Churchland refers to directly in his discussion on the second type of learning and Bird’s account entails due to the habitual nature of his quasi-intuitive cognitive capacities. Additionally, the primacy of the psychological sense and the secondary nature of the linguistic in the Bird-Churchland account perfectly mirrors the ordering of the two as seen in early Kuhn.

One counterargument to this Bird-Churchland synthesis is that Churchland’s work is actually closer to and serves as a better neuroscientific explication of ABC’s approach to incommensurability. Roughly, this objection holds that Churchland’s remarks on how cognition involves activation patterns and prototypes perfectly parallels ABC’s remarks on gradeability and how certain examples of a concept are graded as ‘better’ examples of said concept. Such an argument, however, is doubly in error. First, ABC’s argument still speaks of cognition in terms of linguistic categories, something that Churchland’s work is explicitly antithetical to, at least for the most fundamental levels of cognition. This alone is sufficient to reject a proposed synthesis of Churchland and ABC, yet we can add a second familiar objection. Mirroring one of the arguments against ABC’s account of incommensurability in general found in a previous section, we can see that such a proposed synthesis only repeats ABC’s error of assuming that what is at stake is a theory of concepts. Churchland’s work on representation and cognition are not concerned with a new theory of concepts, such a reading obscures the true purpose of his theory and masks its central contributions. Churchland’s concern is with explicating representation and basic cognition
and interpreting him as offering the foundation for a new theory of concepts mistakenly conflates a formal theory of concepts with an explication how humans’ cognitive categories are formed and deployed. Simply, the *prima facie* similarities between Churchland and ABC dissolve upon a deeper inspection. However, as mentioned above and below, this leaves open the theoretical question of whether there is a second, distinct sense of incommensurability in line with Kuhn’s later taxonomic version.

**Section VI: Conclusion**

Kuhn’s earliest notion of incommensurability in SSR granted centrality to a strongly psychological notion of world-view change from which incommensurability of linguistic meaning followed as a secondary manifestation. However, due to his lack of a sophisticated theory of cognition and the general trend in that period towards philosophy of language, Kuhn struggled to defend his original conception and ultimately abandoned it for the rest of his career in favor of a narrower, more localized linguistic conception of incommensurability. Nevertheless, recent developments in cognitive science provide a new empirical foundation and explication of Kuhn’s original notion of incommensurability. Of the two major cognitive science-based approaches to explicating incommensurability in the literature, ABC’s dynamic-frames account fails to have exegetical support from Kuhn’s work and is best read as an independent conception of incommensurability. In contrast, Bird’s extensive work on providing new foundations for Kuhn’s original formulation of incommensurability in terms of quasi-intuitive cognitive capacities, when combined with Churchland’s work on the structure of the brain and the nature of cognition, enjoys strong exegetical support from Kuhn and renewed theoretical rigor. With this Bird-Churchland account, we can effectively rehabilitate and strengthen Kuhn’s world-view change notion of incommensurability and thereby return a significant degree of cognitive strength and theoretical
scope to the concept dominated Kuhn’s intellectual career.

The Bird-Churchland framework entails an important lesson: incommensurability comes in degrees, not as an all or nothing affair. From Bird we understand some cognitive habits to be more deeply ingrained and central than others, and from Churchland we see a strong parallel in his argument concerning how certain cognitive spaces (and their accompanying prototypes) are more closely related than others leading to varying degrees of difficulty in reapplying existing conceptual categories in new domains. This entailment naturally leads to the objection that allowing for incommensurability as a matter of degree provides little to no actual demarcation criteria to delineate cases of incommensurability from those of commensurability. This objection can be made more explicit: if incommensurability comes in degrees, how can we tell if two given statements, theories, paradigms, et cetera are incommensurable at all? Here we ought to follow Bird in arguing that this confusion results from a misrepresentation of the actual phenomenon of incommensurability as originally stated by Kuhn in SSR. The key point is that incommensurability arises not between theories or statements at its most basic level, but between world-views/cognitive habits. Incommensurability here is first and foremost a non-linguistic, psychological phenomenon that at most manifests linguistically as a secondary effect. This entails that attempting to demarcate incommensurability between linguistic entities will fail to adequately capture the nature of the phenomenon. That being said, we can still look to commensurability problems in the linguistic domain to point us to potential cases of incommensurability. Bird’s numerous examples of the role of tacit assumptions in formal deductive reasoning provide excellent examples of how this can be done.

Finally, it is reasonable to suggest that some tacit assumptions and entrenched prototypes can admit of at least partial linguistic representation. By making these psychological commitments explicit we might better identify (and potentially resolve) cases of incommensurability. The most
interesting question here is the possibility of a second, distinctly linguistic sense of incommensurability—a sort of linguistic projection of the underlying psychological world-view incommensurability that Kuhn originally focused on. Such a linguistic account might better reflect Kuhn’s later taxonomic version of the thesis, and the two together could be seen as a unified account of both aspects of incommensurability. This is a question for future research.
Works Cited


On my honor I have neither given nor received any unacknowledged aid on this thesis.

-Maximilian J. Gebauer