Condensed Thesis of forthcoming book 'Semantic tradition of pictures to syntax to inferences'

Eric Schmid

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Following Reza Negarestani, the aim of this book is to argue for a Kantian-Hegelian idealism, but where historical epochs are divided into the three temporal periods of Michael Friedman's "dynamics of reason": metascience, revolution and philosophy. The first temporal period, metascience, is explicitly Kantian in terms of the (mathematical) presuppositions behind formulating physical theories (Kant had said geometry was a priori). This time period (the epoch of metascience) is structured by a transcendental logic which necessitates a "synthetic a priori" of existent mathematical knowledge in order to "philosophically refashion" it into scientific theory. While universally valid during this period, this a priori is relativized as new scientific revolutions occur. The second period is scientific revolution. Then, the final period is deliberation on the aftermath, which Friedman calls the period of "philosophy." I claim the overarching temporal teleology/progress through the entirety of the three periods is explicitly Brandomian-Hegelian, while the first period is Kantian. **The central thesis of this book is that this metatheory for scientific progress can be expressed through the language of Homotopy Type Theory/Univalent Foundations (HoTT/UF).**

Moreover, due to the wide scope of (in particular *linear*) homotopy type theory (using quantam natural language processing), **this metatheory can be applied not just to scientific progress, but ordinary language or any public language** defined by sociality/social agents as the precondition for the realizability of (general) intelligence via an inferential network from which judgement can be made. How this metatheory of science generalizes to public language is through the recent advances of quantum natural language processing, but the traditional metalogical encodings (of Tarski) is relatively comparable through universes such as the **type of types** or **type of types of types** found in the inherent inferentialism of UF/HoTT via ∞-groupoids. The "computational trinity" of proofs=programs=algebra in HoTT also means reason is defined functionally as "what it does" by what it computes (proofs are programs). Following Negarestani's recent book, through the self's self-realizability, achieving self-consciousness and consciousness beyond selfhood, "geistig manifestation" is achieved in the form of general intelligence, but only through an inferential network of social agents intrinsically encoded through computation.

Abstract of forthcoming book

Eric Schmid

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1 Reclaiming the Kantian synthetic a priori:

1.1 **Frege** $\longrightarrow Russell \longrightarrow Wittgenstein \longrightarrow Carnap \longrightarrow Gödel \longrightarrow Tarski \longrightarrow Church \longrightarrow Turing/Kleene \longrightarrow Tait \longrightarrow Girard \longrightarrow Martin{-}Löf \longrightarrow Coquand \longrightarrow Voevodsky'sunivalenceaxiom \longrightarrow Awodey \longrightarrow Altenkirch \longrightarrow HoTT/UF$

I am interested in focusing on Carnap's critiques of Wittgenstein, specifically the deracination of 'meaning' and substitution of 'meaning' with syntax. Analytic philosophy was created at the height of neo-Kantianism in the aftermath of German Idealism. Obscure terms and concepts were much overused at the time (such as Hegel's philosophy). But I am interested in a return to an 'analytic pragmatism' as advocated by Brandom and his readings of Hegel. There was a flood of what Reza Negarestani calls 'metaphysical bloatware' (inflationary metaphysics) at the turn of the 20th century. Russell's pupil Wittgenstein famously said that where we cannot know something, we must remain in silence (Tractatus). Is analyticity only meaningful when it is devoid of all content and meaning (i.e. only positivistic logico-philosophico propositions where all deductions/math are implied from itself deductively like a succession of dominos)? All math is tautology? "5.133 All deductions are made a priori" (Tractatus) And is analyticity only meaningful when philosophy is truly 'tolerant' (in Carnap's sense) for a multitude of interpretative frameworks (metalanguages) for instituting the object language of scientific theory (the language where one has propositions or the arithmetic, e.g. Peano arithmetic) through the supporting "ocean of metalanguages" to use Steve Awodey's term (e.g. Goedel's encoding of the Peano Arithmetic through prime numbers) backing this object language. My plan is to argue for the inferentialist account of meaning (Brandom), that meaning is understood in terms of use and that semantics is inherently an ethical question tied to commitments to discursive norms.

I am interested in surveying the history of early analytic philosophy and then connecting semantic inferentialism to intuitionistic type theory (connecting philosophy to mathematics). I am interested in drawing a connection between the philosophical (semantic anti-realism) and the logical (with the codification of intuitionism in Martin Lof type theory + recent work in HoTT by Awodey and many others). Frege established the analytic demarcation of a priori reasoning which would inform Russell's logicism and Wittgenstein's construction of fact or tautology. Carnap would make the logical framework robust in the notion of analyticity–a radical opposition to the synthetic a priori. But what about the morning star and the evening star? How does one identify the same sense of different denotations? Frege's work on incomplete arithmetic expressions provides a hint of the functional paradigm after the work of Church's lambda calculus, defined by functionals. Tarski posed a great challenge to Carnap with the undefinability of truth theorem wherein every metalanguage necessitates a metalanguage to encode prior object language; the model theoretic paradigm begins. Yet I am interested in an alternative reading of the split between Tarski and Carnap. Through the work of intuitionistic logic, propositions are taken as if the witness matters. This would later culminate in type theories such as Martin-Lof and substructural logics such as Girard's linear logic. The semantic anti-realist position (where the opposition between transcendent truth and constructive truth can be situated between Platonist and intuitionist philosophy of math) harkens back to Carnap's original principle of verification via the witness of intuitionistic logic, yet situated in an inferential network. Through the constructive possibilities of Homotopy Type Theory, a new paradigm for the foundation of mathematics, the identity of types with topology extends the synthetic lineage of the a priori through a mathematical codification of intuitionism (which remain mere mental constructions).

I am interested in the split between Carnap and Tarski over metalogic regarding semantics. Carnap crystallized the bare minimum of structure for an alien civilization to understand our language based on propositions and variables defining such propositions. Carnap argued that we should be tolerant of a multitude of metalanguages for instituting the object language in a logical syntax of language. What are the possibilities of defining a universally-quantified language or is such an endeavor doomed to fail because of Goedel's theorem regarding incompleteness? What about the recent advancements in the foundation of mathematics, i.e. Homotopy Type Theory? There has been a continual casting away of the synthetic a priori by Russell, the positivists and later Quine and Putnam. The central question of the book will be whether to admit ontologically, metaphysical realism or anti-realism and then epistemologically, semantic realism or anti-realism? Per Martin-Löf in his tracts on the philosophy of math accepts the synthetic a priori, which Kant postulated as existent with geometry and arithmetic. I will be arguing for the synthetic a priori in terms of synthetic geometry such as Homotopy Type Theory, which is at the nexus between theoretical computer science and algebraic topology. The computational types can be transported directly into geometric terms through Steve Awodey's interpretation of the Univalence Axiom. One of the main readings of Frege's logicism, which is the school of philosophy of math which believes in the fundamentality of atomic propositions, will be Michael Dummett's work regarding the bivalence of truth statements and the justificatory power of demonstrating a proof to a witness via the assertion. This is what Robert Harper calls "logic as if people matter." The key disagreement between Martin-Löf and Dummett is whether

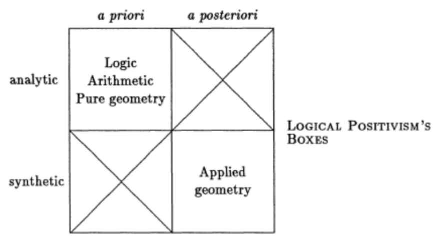

Figure 1: Taken from "The Taming the True"

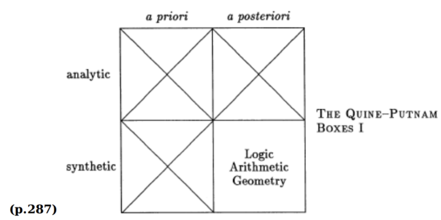

Figure 2: Taken from "The Taming of the True"

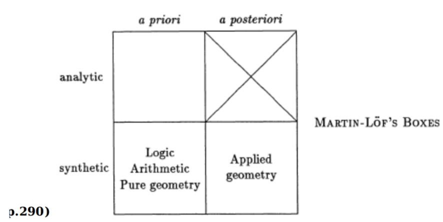

Figure 3: Taken from "The Taming of the True"

proof of a statement is an ontological or epistemological claim with Martin-Löf arguing for the latter and Dummett for the former. Dummett was the key proponent of the semantic anti-realist school and argued that all language can be reduced to its logical basis in the philosophy of math: either one is a Platonist or one is a intuitionist. Dummett was a proponent of verificationism, which Carnap and the logical positivists believed was central to establishing the veracity of empirical phenomenon. David Corfield argues that that inferentialist school of Brandom would be the most faithful way to read the philosophy of Homotopy Type Theory:

I believe that there are grounds to hope that large portions of Brandom's program can be illuminated by type theory. Since Brandom's inferentialism derives in part from the constructive, proof-theoretic outlook of Gentzen, Prawitz and Dummett, this might not be thought to be such a bold claim. However, his emphasis is generally on material inference, only some aspects of which he takes to be treatable as formal inference. For instance, the argument he gives in Making it Explicit (Brandom 1994, Chap. 6) for why we have substitutable singular terms and directed inferences between predicates, is presented with a minimal formal treatment, and yet this phenomenon makes very good sense in the context of HoTT when understood as arising from the different properties of terms and types. Indeed, the kind of category whose internal structure our type theory describes, an (,1)-topos, presents both aspects—the '1' corresponding to unidirected inference between types (morphisms between objects) and the '' referring to the reversible substitutability of terms (2-morphisms and higher between morphisms). On the other hand, his frequent use of formalisms, even very briefly to category theory (for example, Brandom 2010, p. 14), tells us that he recognizes the organizing power of logical languages. Elsewhere (Brandom 2015, p. 36), he notes that while both Wittgenstein and Sellars emphasized that much of our language is deployed otherwise than for empirical description, whereas Wittgenstein addressed this excess as an assortment, Sellars viewed much of it more systematically as 'broadly metalinguistic locutions'. These additional functions of language pertain to the very framework that allows for our descriptive practices, and are what Brandom looks to make explicit in much of his work. My broader suggestion in this book is that we look to locate these locutions in features of our type theory, especially those modalities we will add in Chap. 4. (Corfield 2020)

Through inferentialism, truths are not related necessarily to its meaning, but rather meaningfulness in the sense of the meaning in context or meaning-as-use. The book will be situated in the history and philosophy of language and mathematics. I hope to further the research on Homotopy Type Theory being done by Corfield, Andrei Roden and Awodey and extend this mathematical subfield into the larger philosophical lineage of philosophy of language. If time permits, I would like to compare the pragmatist reading of philosophy of language with the rationalist nominalist reading of Jean Cavailles. My book would examine the universality of mathematical necessity through the mathematical philosophy of Cavailles. Through the mathematical Absolute we arrive at both the contingent accidents and mathematical necessity that allows for the development of new theorems, but moreover mathematical experience as a determined concept. Can we found universality (as in Cavailles) on the generality of infinity-groupoids in Homotopy Type Theory, i.e. globally, or is it necessary that metalinguistic locutions be situated in terms of the inferentialism of Homotopy Type Theory, i.e. locally?

Some conceptual propositions of my forthcoming book 'Semantic Tradition of Pictures to Syntax to Inferences'

Eric Schmid

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1 Following Reza Negarestani

Intelligence needs to be made intelligible, the mind needs to be approached functionally in terms of "what it does" (behaviors and functions), which needs to exist within a "history of histories" (spirit).

2 Brandom's Claim

Brandom makes the claim that not only Geisteswissenschaften exists within history but moreover Naturwissenschaften. Science inherently has a historical dimension, which is not to say that it is socially constructed but rather the semantic truth of scientific theory involves context-dependent norms that make determinate scientific truth.

3 Michael Friedman in *Dynamics of Reason*

Michael Friedman argues that there is a contextual milieu that provides the relative a-priori for each and every scientific revolution. David Corfield says, "If we are to follow Friedman's schema, then the period we are currently in is his 'metascientific' one, where thinkers refashion mathematics and reformulate physical principles in a philosophically-minded way. Think of Helmholtz, Mach, Clifford, Klein, Poincaré,..., Einstein." This a-priori is both universally valid and relativized.

4 Brandom's Argument

Brandom argues that most statements in a language need to be materially good and are not substitutable, i.e., not formally inferred. Following David Corfield's book on the philosophy of HoTT, it is agreeable that Homotopy Type Theory can correct this through "terms and types" of (∞,1)-topos where 2-morphisms, 3-morphisms, 4-morphisms, etc., are reversibly substitutable, and therefore formally inferred. Corfield has pointed me (in a private email) in the direction of Quantum Natural Language Processing, in particular linear homotopy type theory, and he says it provides a means of defining a topological metric between similar words, and formal substitution is defined by such a metric.

5 Semantic Ascent vs. Semantic Descent

As opposed to J.N. Findlay, who argues for semantic ascent in Hegel from the object-language to the meta-language (a move championed by Tarski) in order to define a judgment, Brandom argues for semantic descent to the bottom level or the materially good inferences.

6 Theorem

Apart from the original morphisms and objects directed in the lowest level, there exists a transit up and down and vice versa between object language and metalanguage through (∞,1)-topoi. In Agda (the proof-checker/proof-assistant language for Univalent Foundations) **a type of types** or **type of types of types** corresponds to varying universe levels. For example, see Agda documentation: "Agda' type system includes an infinite hierarchy of universes $Set_i : Set_{i+1}$. This hierarchy enables quantification over arbitrary types without running into the inconsistency that follows from $Set : Set$."

7 The Universally-Valid A Priori

The universally valid a-priori prior to a scientific revolution, which informs said revolution, is context-dependent and exists within a history of histories.

8 The Curry-Howard Correspondence

The Curry-Howard Correspondence states that $\prod$ types are equivalent to $\forall$ intuitionistic quantifiers, $\sum$ types are equivalent to $\exists$ in logic, and maps are equivalent to intuitionistic implication.

- "Types correspond to logical formulas (aka propositions)."
- "Programs correspond to logical proofs."
- "Evaluation corresponds to simplification of proofs."

Mind becomes only what it does functionally and therefore what is computable. Spirit becomes context-dependent codifications of public language in an inferential network of ∞-topoi.

9 Univalence Axiom and Awodey's interpretation

9.0.1 $(\mathbf{A} = \mathbf{B}) \cong (\mathbf{A} \cong \mathbf{B})$

9.0.2 Awodey (as quoted in private email): "The Univalence Axiom was indeed the work of Voevodsky, but the interpretation of identity types as topological path spaces, which forms the basis of HoTT, was in fact due to me."

10 Fibrations and Co-fibrations

Fibrations are equivalent to $\prod$ types and co-fibrations are equivalent to intervals

11 Pure Geometry, Arithmetic, Logic

Following Per Martin-Löf, it is agreeable that pure geometry, arithmetic and logic are modes of synthetic a priori knowledge epistemologically.