

Against Metaphysical Necessity

Alethic Modalities in Updated Logical Empiricism

Abstract. The paper argues against a commitment to metaphysical necessity, semantic modalities are enough. The best approaches to elucidate the semantic modalities are (still) versions of linguistic *ersatzism* and fictionalism, even if only developed in parts. Within these necessary properties and the difference between natural and semantic laws can be accounted for. The proper background theory for this is an updated version of Logical Empiricism, which is congenial to recent trends in Structural Realism. The anti-metaphysical attitude of Logical Empiricism deserves revitalization. Another target besides metaphysical necessity are substantial forms of iterated modalities, as used, for instance, in the philosophy of religion.

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§1 *Structures*

Science concerns itself with developing theories to explain and predict *patterns* encountered in experienced reality. Regular patterns supporting counterfactual dependencies are captured in laws expressing dependencies between parameters.

Underlying these patterns are *structures*. They are as real as the patterns are, thus: Structural Realism. Structures are identified functionally, i.e. because of their functional role in patterns. Scientific progress consists in finding more (more detailed) patterns and structures, and finding out more with respect to the already known structures.

The Theory of Relativity and Quantum Mechanics originated at a time when Logical Empiricism and some version of its verificationism and/or operationalism were the accepted view of treating scientific theories. Some theorists themselves expressed their approach in this fashion. Taking some of their claims – especially those couched in terms of expressions borrowed from ordinary language – at face value in a realist spirit they sound strange or outrageous. In the light of a logical empiricist re-construction (like Reichenbach's *Die Philosophie der Raum-Zeit-Lehre*) these claims are the result of respective *conventions* of coordinate definitions or operationalizations of re-defined concepts (say, of 'time' or 'distinct object'). From a Logical Empiricist perspective, we have here axiomatic theories with postulates and definitions which in total account for the observations and are successful in predictions. In their success they have captured some structures and laws of reality. Their general statements about *these* (say, about uncertainty or the existence of entanglement) can be taken literally, the detailed statements involved in calculating predictions and giving explanations might be taken with a pinch of salt as there might be empirically equivalent theories with different calculating devices. These devices (like detailed mathematical theories and models) share their empirical content. We might prefer some theory on meta-theoretical principles (like simplicity or connectedness to other theories), but there seems little benefit in committing oneself to such a *fine-grained* ontology in a realist spirit.

By observational regularities we can fix reference to the structures underlying these regularities. Theory succession substitutes formerly assumed laws about these structures with reformulated laws with respect to the same structures, preserving referential continuity, and thus expressing advancements in theoretical understanding. This may involve changing the detailed ontology (and mathematics) involved in the theoretical apparatus and its explanations

and predictions. Referential continuity in structures may come with discontinuity of detailed object ontology (i.e., of the sort of posited items *realizing* the structures).

Structural Realism allows for Ontological Relativity in objects and other ontological categories, not allowing, however, for Structural Relativity in the sense of a general instrumentalism or constructivism with respect to scientific theories. Structural Realism still endorses the argument of Scientific Realism that the best explanation of the success of science rests in its approximate truth with respect to the structures of reality. Structural Realism contracts the realist stance to structures. This fits better to the *functionalist* understanding of theory development and the *plurality* of fine-grained theoretical modelling.

In *Der Logische Aufbau der Welt* (§§11-12) Carnap explicitly states that science is concerned only with structural descriptions and not with claims about the carriers of these structures.

§2 *Objects*

Objects are *derivatively* modelled as the relata of these structures. One can still talk about the same structure – and patterns – although the modelling of the objects has changed. Structures inasmuch as identified functionally have a hidden nature only insofar as more can be learned about them. Objects as introduced as the items related in a structure are not introduced as substances with a hidden nature.¹

As reality and the models of it come in scales objects of one level may be the structures of a more fundamental level. As reality and theories come in scales ontologies of these theories and levels of reality come relative to theories and levels. As much as these theories are successful and our best theories there is no need for a unified grand ontology of science beyond (i) the occasional reduction between theories, and (ii) the coherence/consilience between our best theories. All cover reality and its structures and (experiential) patterns. Their ontologies are devices to discern certain relevant aspect of these structures in light of the scale or scientific discipline in question.

A *theory* comes with an ontology. Ontologies are relative to theories and kinds of sciences (like sociology or biology). The *language* a theory is expressed in also comes with an ontology: a formal ontology resting in the *types* of syntactic phrases and variables. The most general ontology of this sort in First Order Logic with no further specified variables. First Order Logic

¹ Cf. Ladyman and Ross, *Every Thing Must Go*.

can express any ontology as *predicates* can be introduced for *types* of entities (ranging from general types like ‘proposition’ to specific ones like ‘unicorn’).² A theory accepts a type of these entities if it existentially quantifies over variables in parameter places of corresponding predicates. So far Quine’s famous slogan (most conspicuously developed in *Set Theory and Its Logic*) is quite appropriate. Whether to quantify in such a way is a theoretical and empirical question of respective theories. A linguistic framework (like Second Order Logic or a language of typed/sorted quantifiers or a Free Logic with different types of quantifiers with different ontological impact) can also already come with further ontological commitments beyond the mere presence of variables to be bound. Accepting such a linguistic framework then is a theoretical question itself, one of a background fundamental theoretical outlook above the more specific theories expressed within that language – against the pragmatist conventionalism Carnap proposes on many occasions (most famously in “Empiricism, Semantics, and Ontology”). That linguistic frameworks are in most parts conventional is part of Logical Empiricism, but that conventions are beyond theoretical arguments for their adoption need not be.

The most congenial abstract metaphysics fitting Structural Realism is *Neutral Monism*: the basic items/events of the world are neither physical or mental or whatnot in themselves, but can be described as realizing structures described in terms of physics or psychology.³ Neutral Monism need not commit itself to a metaphysics of item/event *constitution* for the basic type of neutral items/events. Neutral Monism identifies properties as dispositions and generally states that they are founded (somehow) in the nature of the ultimate items/events, the constitution of which in detail is beyond our ken – thus every claim thereof beyond some *general* idea of ‘tropes’ or ‘universals *ante rem*’ is metaphysics. This comes close to a nominalist understanding of predicate application, an understanding congenial to the constructive approach to building linguistic frameworks. This property theory is structurally realist inasmuch as it refers to the founding nature of the ultimate items/events, and talks not just about predicate application but (real) properties themselves. This property theory is anti-realistic inasmuch as it does not engage in property metaphysics. Neutral Monism is non-

² By a theorem of Alan Turing standard First Order Logic is as universal as Turing Machines [cf. §18], in the sense of being able to express any explicit/computable semantics or ontology, thus we can make use of the *Church Turing Thesis* or *Hilbert’s Thesis* (in mathematics) to express any ontology in First Order Logic.

³ This was championed by some Logical Empiricists sometimes (say, Russell in his *An Outline of Philosophy*) and rejected by others (say, the physicalism of the Vienna Circle, cf. Carnap, “Die physikalische Sprache als Universalsprache der Wissenschaft”).

reductive with respect to psychology and avoids dualism at the same time. Types of behaviour should not be taken as introducing types of substances, which will for Structural Realists and Neutral Monist forever be beyond our ken.⁴ As Neutral Monism does *not* state that physical items/events are basic – neither are mental items/events – it need not concern itself with physical-psychological laws to explain the mere presence of the psychological. There may well be discoverable physical-psychological laws as established *correlations* of behaviour, but they are not in themselves reductive or explanatory. For Neutral Monism to speak of ‘physical’ objects or events is short for ‘carriers of structures described according to the laws of physics’. The same holds for psychological events. The same events might realize physical and psychological structures, whether they are *the same* we have difficulty to say because (i) we cannot further access their constitution (i.e. beyond their behaviour), (ii) we may lack a reduction of (some) psychological properties.⁵

§3 *Ontological Relativity*

With respect to one and the same structure different models of this structure (including a carving up into related items) may be developed. Thus, there can be *Ontological Relativity* with respect to these models. Some models may be discarded because of meta-structural reasons like simplicity and consilience with other models of other structures. Some ontologies fare – *prima facie* – equally well with respect to these criteria. If that happens, we have a case of scientifically acceptable ontological relativity. For a realist with respect to structures this relativity is not as dramatic or anti-realistic as for a realist with a foundation in objects.

The general possibility of ontological relativity does not deliver interesting cases by itself. In mathematics, say number theory, Zermelo’s conception of the ordinals and von Neumann’s differ set theoretically, but are isomorphic, thus spelling out the same structure. For such a logicist or at least set theoretical foundation of mathematics the question “What are numbers really?” seems otiose. There might be more interesting empirically equivalent ontologically

⁴ In this way Neutral Monism accompanied by Structural Realism regains or preserves the idea of (metaphysical) pseudo-problems in philosophy, although not the letter of Carnap’s *Scheinprobleme in der Philosophie*.

⁵ Thus, Neutral Monism disagrees in part with Davidson’s Anomalous Monism (cf. Davidson “Mental Events”) in rejecting the claim that the ultimate constituents or reality are all and firstly physical. It also disagrees with Nagel’s present day Neutral Monism (in his *Mind and Cosmos*) as it (i) comes close to panpsychism, which is constitutional metaphysics, (ii) stresses the urgency of physical-psychological laws, and (iii) confuses the epistemological irreducibility of the 1st person perspective with a semantic shortcoming of a 3rd person world description.

distinguishable theories in the empirical sciences. Also in empirical sciences, however, piped up syntactical variants that just add something to an accepted theory (as often invoked by Quine as arguments for ontological relativity) can be rejected for reasons of simplicity or by requiring that the traditional trajectory of theory successors should not be left without good reason, which in these cases seems obviously missing.

The actual scope of ontological relativity in the sciences can be made out only by detailed analyses of supposed examples and the history of science.⁶

§4 *Logical Empiricism* ≠

One may characterize a viable position in the analytic tradition as ‘Logical Empiricism’ ≠.⁷

Logical Empiricism has developed over time. It *can* and *has* embraced holism of justification, against early foundationalist verificationism. It *can* and *has* embraced – at least in some philosophers in that tradition – scientific realism in the form of Structural Realism, therefore the “+” in “Logical Empiricism” ≠.⁸ Empiricism as a theory of scientific knowledge can be separated from theories of meaning inspired by empiricism (like verificationism or

⁶ Cf. Laudan’s explorations in “Demystifying Underdetermination” and “A Confutation of Convergent Realism”.

⁷ All labels are problematic because of their historical associations, but taking up an approach and label might be more helpful than inventing ever more idiosyncratic labels. ‘Logical Empiricism’ ≠ is the specialization to theoretical philosophy of a broader general attitude of ‘scientism’ with respect to knowing factual truths – where ‘the sciences’ are not just the natural sciences, but include methodologically explicit approaches in the social sciences and humanities. This orientation on the sciences, further on, can and should acknowledge the irreducible role of practical philosophy, taken broadly, and the arts. The ideological heritage of (early) Logical Empiricism and some current ‘scientism’ should be abandoned – as ‘unscientific’ after all. There is some truth in Curtis White, *The Science Delusion*. Just talking of the ‘Analytic Tradition’ or ‘Analytic Philosophy’ would be more misleading (i) because of the differences between Logical Empiricism and Ordinary Language Philosophy (in the Oxford or Wittgensteinian tradition), (ii) because the ‘Analytic Tradition’ has developed into branches championing metaphysics – contrary to the foundational ideas of Logical Empiricism – and branches which offer theories which should be offered and tested by the sciences. Logical Empiricism defines an understanding of philosophy as meta-science. This conception of philosophy should allow for other conceptions of philosophy besides it. They may care for themselves, Logical Empiricists set forth their conception and its proper updates and revisions. Neo-Kantians took exception to most of the detailed claims of Kant’s philosophy, but considered themselves Kantians in the spirit of their conception of Kant’s methodological self-understanding. In the same vein philosophers today can understand themselves as Logical Empiricists ≠ without subscribing to most of the detailed claims of early Logical Empiricism (say, in the Vienna Circle).

⁸ Even the differences between Structural Realism in Logical Empiricism ≠ and van Fraassen’s ‘Constructive Empiricism’ in *The Scientific Image* and *The Empirical Stance* seem to be minor.

operationalism). As theories of meaning verificationism and operationalism have failed both for epistemological reasons (in the failure of ultimate verification in some undeniable ‘given’) as for semantic reasons (in the failure of complete definitional reductions and verification rules not being compositional). They should not be tied to empiricism, therefore the “–“ in “Logical Empiricism≠”. Empiricism is compatible with externalistic or atomistic semantics, expressed, say, in some form of a Davidsonian disquotational theory of truth for some language. Rules of justifying or verifying a (scientific) statement are linked to its semantics, but need not be its meaning. Verificationism *in the broad sense* can be understood as the methodological commitment to have one’s theories tied to testable predictions and observation requirements.⁹ Operationalism possesses some residual adequacy in that theoretical terms of a theory occur in sentences with observational terms (‘observational’ relative to that theory) which fulfil the function of ‘bridge principles’, which tie the theoretical core of a theory to testability. This allows to take some claims of, say, fundamental physics with less ontological commitment than scientific realism.

Logical Empiricism – starting already with Carnap in *Logische Syntax der Sprache* and *Testability and Meaning* – embraced both a holism of justification and a theory of meaning which reject epistemic foundationalism and meaning constitutive verification rules. Carnap refines in *Testability and Meaning* verifiability towards confirmability, and explicitly embraces holistic theory confirmation and comparison in *Logische Syntax der Sprache*.¹⁰ Even Quine in his late work (like *The Pursuit of Truth* and *From Stimulus to Science*) can be classified as Logical Empiricist in this sense.

Logical Empiricism distinguishes between the (linguistic) framework of theories and their empirical content. The framework set up (axioms and definitions) is pre-given to empirical exploration and thus *a priori*. This *a priori* is in most parts language relative and, as language can be changed, revisable, seen from a meta-perspective. To be distinguished are truths coming with the language frame set up and true sentences contingent with respect to the frame. The latter are the empirical synthetic sentences. The former are *frame truths* and by their semantic

⁹ Carnap in §27 of *Testability and Meaning* states the ‘principle of empiricism’ thus: “As empiricists, we require the language of science to be restricted in a certain way; we require that descriptive predicates and hence synthetic sentences are not to be admitted unless they have some connection with possible observation, a connection which has to be characterized in a suitable way.”

¹⁰ Cf. *Logische Syntax der Sprache*, §82. This was way before the appearance of Quine’s “Two Dogmas of Empiricism”! Neurath in 1931 famously expounded coherentism against Schlick’s foundationalism.

constitutive role also *determine the logical space* of semantic modalities. Given a broad definition of “analytic” as ‘following from the axioms and definitions’ and the fact that the axioms and definitions follow from themselves the frame truth can be taken as ‘analytic’, which does not exclude that they contain information about the world.¹¹ Given a narrow definition of “analytic” as ‘following from the axioms and definitions and not being an axiom or definition’ the frame constitutive axioms and those definitions which are not just nominal definitions introducing a term to express what could be said otherwise are synthetic, even synthetic *a priori*. Partial Meaning Postulates should be considered synthetic *a priori* in this sense as they embed in the language framework conditional dependencies that are taken to be true, i.e. corresponding to facts (like foxes being animals). That axioms should rather be classified as ‘synthetic’ should not be surprising as many axioms (already in set theory) involve existence claims. Again, this does not exclude the revisability (i.e. change) of the language framework and axioms.¹²

One may use (with respect to a specific language) the distinctions ‘synthetic/analytic’ and ‘necessary/contingent’ and abandon the distinction ‘*a priori/aposteriori*’ altogether. Abandoning the distinction ‘*a priori/aposteriori*’ has the advantage of banning an epistemological distinction in favour of proper semantic distinctions. Empirical sentences are synthetic and contingent. Theorems are analytic and necessary. Axioms and those definitions which are not just nominal definitions are synthetic and necessary. To classify a sentence as ‘analytic and contingent’, on the other hand, might only be used as a shorthand for the meta-language statement that a corresponding definition or axiom could have been otherwise in a modified language framework [cf. §17]. If one wants to get rid of the epistemologically loaded distinction ‘*a priori/aposteriori*’ and deems the distinction between nominal definitions, partial

¹¹ “A fox is an animal” is about foxes, and not ‘empty’ in any useful sense: it is empty of new information, which means it is not synthetic and contingent, which means it is analytic or definitional, which we knew beforehand! Analytic consequences can extend our subjective understanding. In as much as they refer to the world definitions have to be chosen to stand in no conflict with known scientific truths, otherwise the frame has to be revised. One quality standard for a framework can be how it restricts the alethic possible by adopting corresponding definitions.

¹² The Axiom of Infinity in ZFC, say, is synthetic in the common and Kantian sense, as it postulates the existence of an object (in fact of infinitely many). The aversion of early Logical Empiricism against synthetic *a priori* principles rests on taken such principles to be unrevisable and as expressing the idea that reason can fix and determine basic structures of reality (paradigmatically taken thus and rejected in Reichenbach’s *The Rise of Scientific Philosophy*). Giving up these problematic features of synthetic *a priori* principles and corresponding (Transcendental) Idealisms undercuts the opposition to an otherwise useful notion, which might be supplanted by other notions like ‘synthetic and necessary’ but signals, at least, the meta-linguistic spot where some such a distinction need to be placed.

definitions and axioms cumbersome, and finds re-categorization of sentences like “All foxes are mammals” as synthetic repugnant, then the fallback position is Carnap’s broad use of ‘analytic’ for all sentences following from the axioms and definitions, including the axioms and (partial) definitions themselves. As this again involves categorizing some existence claims as ‘analytic’ instead of ‘synthetic’, and still uses the traditional term “analytic” the best and clearest option is to use Carnap’s distinction ‘L-determined/not L-determined (a.k.a. contingent)’. “L-determined” was introduced by Carnap in the *Logische Syntax der Sprache* as ‘determined (solely) by logic’, but it might better be broadened to ‘determined (solely) by language’ to include any definitions and axioms (existential or not) of the language framework. We then have the distinction between framework truth of the language framework adopted, such sentences being L-true, and sentences being rejected as false by the language framework adopted, such sentences being L-false, these two groups comprising the L-determined sentences, sentences *determined by language* set up alone. Empirical sentences, being contingently true or false, are the other group, again with two subgroups.¹³ ‘revisable’ is another notion to be employed in meta-language statements – leaving open the possibility that a core of logical and meta-linguistic principles, at least, might be ‘unrevisable’ for any comprehensive language framework.¹⁴ The role of language building is to come up with a most feasible and comprehensive framework which does not get into conflict with theories empirically developed.

This much is already present in early Logical Empiricism, say, Carnap’s *Logische Syntax der Sprache*. Carnap in *Logische Syntax der Sprache* – and later in his semantic work, starting with *Introduction to Semantics* – also admitted *the universal perspective* of constructing languages. From this perspective there may be features present in all comprehensive frameworks, such that these, despite the revisability of individual frameworks, are universally L-true and L-constitutive (or *a priori* in the traditional sense) and will not be revised, apart from our coming to a better understanding of these features. Such features provide the foundation for the

¹³ Although this classification is clearest and carries the least luggage from philosophical tradition, a regimented and explicit usage of the other distinctions might be employed and will most times be employed here, as, unfortunately, “L-determined” has not been widely adopted. Labels should not be multiplied.

¹⁴ A ‘comprehensive’ framework is one in which all thoughts can be expressed (like in a natural language or ‘regimented’ natural language). Special languages/frameworks for some science or other human endeavour (like art) need not be comprehensive. The concept of framework does not exclude the framework coming with no inference rules but the single axiom “Pop goes the weasel”.

broadest sense of alethic possibility. [Carnap himself did not develop an explicit meta-theory which recognizes this.]

With the distinction between framework and theories early Logical Empiricism (say, in Carnap and Reichenbach) takes up Kantian themes. Kant's Transcendental Philosophy distinguishes between the framework (the topic of 'Transcendental Logic') and empirical knowledge. Framework principles and concepts are *a priori*, although we know about them only as we gather experience. Thus, Transcendental Logic is compatible with Logical Empiricism, as Logical Empiricism – even if not always clearly stated – does not subscribe to a simple empiricism which claims that *all* knowledge is gained by experience (inner and outer senses) *only*. The contrast between epistemological analysis in transcendental philosophy and empiricism is overrated.¹⁵

Assuming innate components of knowledge – once again a conflict much overrated – is also compatible with empiricism in the sense that empirical theories establish knowledge about what has to be assumed as *a priori* or innate (e.g., in linguistics or in computational cognitive science).¹⁶ What is innate is ontogenetic *a priori*, but phylogenetic acquired (i.e. *aposteriori*), and thus revisable. It can also (e.g. concerning our beliefs formed by interaction with middle sized objects) be suspended by scientific theories. Nonetheless it often secures in the mind/brain and human bodies in general knowledge about the world which need not be acquired by experience.¹⁷

The age of scientific philosophy started with the distinction between the empirical sciences, dealing with factual discoveries, and the reflection on the foundations of science (i.e. meta-science). The best way to understand and undertake this reflection is as a study of the *linguistic frameworks* of the sciences (their forms of arguments, ontologies, basic vocabularies, and axiomatics). Even after this step philosophy can use the discoveries of science in its arguments and expositions. It has to, as the choice of a (better) framework for a field of study will depend

¹⁵ Already Strawson in *The Bounds of Sense* classifies large parts of Kant's 'Transcendental Analytic' as "a truly empiricist philosophy". Reichenbach's praise and criticism of Kant neglects this because of his crusade against Rationalism and the Synthetic Apriori [see note 12]. Philosophical debate, of course, proceeds by evaluating the views of others one contrasts one's own view with. There lurks the danger of overstating the differences to defend one's view or to advertise it to the philosophical public, the more so as one tries to establish or preserve a name for oneself or one's school of thought. This applies even to 'sober minded' analytic philosophers.

¹⁶ Cf. Chomsky, *New Horizons in the Study of Language and Mind*, esp. chapter 3.

¹⁷ Cf. Plotkin, *Darwin Machines and the Nature of Knowledge*; cf. Kornblith, *Scientific Epistemology*.

on what we already know about this field. An explication of foundational concepts has to consider their usage and proper and improper application conditions of related expressions and employment of methods. Philosophy involves scientific knowledge in reflective equilibrium of conceptual exposition. What philosophy should not put forth are empirical/factual claims. To discover the facts the sciences explore reality (with all the required training and equipment). Simple factual claims, apart from those about using a linguistic framework, will not follow from the linguistic framework and its development. If philosophers proclaim such contingent truth in the field of a science in question, they are almost certainly overstepping their resources of justification, and may have used a bad argument to derive such claims from meta-scientific considerations. Of course, they can report any claim established by the sciences, but to derive factual claims from the proverbial armchair, which then turn out to be just wrong or at least questionable, has given philosophy a bad name in some quarters.

A particular source of error can be the formulation of a comprehensive philosophical system, which covers several or even all areas of inquiry. The architectonic of the system may invite the philosopher to transfer principles and structures from one realm to the other, postulating on this way elements and facts which owe their existence only to the image imposed by the structures of the system.¹⁸ The amount of effort to make such a system fit reality or the state of the sciences should be a warning sign of philosophical overreach.

Slightly later, but almost in parallel to Logical Empiricism the theory of computability developed. It immediately expanded the methods of meta-logic. Computational modelling also allows for a form of more fine-grained analysis. Programs and data structures can be employed for models that simulate or emulate, say, cognitive faculties. Given the equivalence of First Order Logic and Turing Machine Computability [cf. §18] these analyses can be translated into each other.

Computational modelling, however, provides a further quality standard of analysis. With respect to a calculus (say, of epistemic modality) correctness and completeness proofs vindicate the axiomatic approach. With respect to a computational model one can further on test it on examples and in the light of the relation between predicted output and valid or analytically acceptable output. This has been captured in the slogan:

(C) Implementation provides a higher methodological standard than formalization.

¹⁸ Which might be a more fitting criticism of many features of Kant's theoretical philosophy.

Elucidating a concept (in the spirit of Logical Empiricism) thus can proceed – often preferably should do so – by computational modelling.

With the advancement of – nowadays called ‘traditional’ – Artificial Intelligence (AI) in the 1970s another slogan has been coined: “AI is philosophy.”¹⁹ Human thought consists in processing and transforming representations (they may be linguistic or pictorial, conscious or sub-conscious). Computation consists in processing and transforming representations. That makes human thought a target area for computational analysis. More precisely: computation consists in processing and *algorithmically* transforming representations. Human thought cannot be completely algorithmic.²⁰ Inasmuch, however, as human cognition is (intuitively) computable [cf. §18], cognitive faculties are open to computational modelling. This includes, for instance, deductive but also probabilistic inference – topics of explication by Reichenbach, Carnap and other Logical Empiricists. Logical Empiricism was close to the gestation of AI (with the work of von Neumann and Turing) and the Dartmouth and Macy Conferences.²¹ The integration of AI into Cognitive Science integrated as well analysis of epistemologically relevant concepts at least in the tradition – if not the letter – of Logical Empiricist conceptual elucidation.²² The connection is obvious in the field of Logic Programming.²³

§5 *Against Metaphysics, Again*

Philosophical conceptual analysis can degenerate into so-called ‘intuition mongering’: a style of argumentation in which some states of affairs are propounded as ‘metaphysically’ or conceptual possible, whereas other truths or links between states are propounded as conceptual or *a priori*, on idiosyncratic assessments of intuitions. Done this way, it is not an argumentation

¹⁹ Cf. for instance: Cummins & Pollock (Eds.) *Philosophy and AI*; Bynum & Moor (Eds.) *The Digital Phoenix. How Computers are Changing Philosophy*. What nowadays mainly is called “AI” is mostly ‘Machine Learning’, which has little to do with analysis or intelligence – or learning in any non-associative sense either.

²⁰ For a variety of philosophical reasons – not to be dealt with here – ranging from creative language use to judgement and choices.

²¹ Cf. Dyson, *Turing’s Cathedral*; Dupuy, *The Mechanization of the Mind*.

²² One may see examples in early paradigmatic work like Winograd’s Procedural Semantics (cf. Winograd, “Towards a procedural understanding of semantics”) or Newell’s General Problem Solver (cf. Newell, *Unified Theories of Cognition*), and more recent work like Thagard’s *Computational Philosophy of Science* and Pollock’s *Cognitive Carpentry*.

²³ Cf. the analytic claims of one of the founding fathers of Logic Programming: Kowalski, *Computational Logic and Human Thinking*; on foundations cf. Fitting, *Computability Theory, Semantics and Logic Programming*. A recent philosophical application with respect to belief revision is Tennant, *Changes of Mind*.

with clear standards of quality or empirical (sociolinguistic) backup. What we have here – at best – are proposals for word use and definitions of word meanings or concepts. There are *no* truths about metaphysical modalities to be discovered, all depends on definitions one may endorse or reject. Such proposals of definitions are essential for science, but should be announced and methodologically reflected as being such proposals about linguistic frameworks. Their force derives from both the linguistic support of talking thus as well as from their fruitfulness in describing phenomena, putting them into an explanatory structure of a theory that employs the concepts as so defined.

Because of this connection to theories in the sciences conceptual analysis should be considered as part of the framework building in sciences. Isolated from this embedding it might be difficult to articulate clear quality standards apart from the logical coherence of the proposed definitions and usage. In some fields where we lack developed scientific theories one should at least aim at reflective equilibrium of prior intuitions (personal ones or taken up from tradition), statements of (uncontroversial) facts, and phenomenological descriptions (especially in the philosophy of mind). In these cases philosophy aims at a coherent framework of best capturing the area (semantic field) in question. In natural languages and folklore there are established forms of usage and definitions, but – at best – only with respect to some few fundamental (i.e. *a priori* or innate) concepts might we find genuine conceptual discoveries apart from the empirical sciences.

Like sentences knowledge can be analytic or synthetic knowledge. Knowledge of L-true sentences can be gained *a priori*, nonetheless it might be subjectively surprising. Although our framework already contained the content of the L-true sentences, we can subjectively learn about it. Thus, analytic knowledge is no deficient mode of knowledge. Debates about frameworks are also debates about what should be considered L-true – or analytic and synthetic *a priori* [cf. §4]. Synthetic *aposteriori* knowledge and belief stems from experience. Minimally empiricism claims that all *aposteriori* belief and knowledge stems from perceptual experience, and that all a priori knowledge grounds in frame constitutive postulates.

The distinction between *a priori* – and thus in the framework used unrevisable – and *aposteriori* sentences is a *synchronic* distinction. Terms can be re-defined if a definition turned out to be useless or in conflict with empirical results. Definitions should *track* some fundamental constituent properties of the property (term) defined or put in analytic links to other properties (property terms). This spans a net of analytic sentences, a net of semantic necessity stronger

than the lawlike connections discovered within empirical theories. Semantic necessity in this way *follows* natural necessity, and *suspends* some connections between properties from revision, *for the time being* of the success of this linguistic framework.²⁴

For Logical Empiricism there is *no* further ‘metaphysical necessity’ beyond or besides this.

Whether some definitions are so fundamental that they can never be successfully re-defined constitutes a question of traditionally called ‘Transcendental Philosophy’, difficult to settle. Meta-linguistic and logical concepts may belong in this realm.²⁵ In any case, defined concepts of a specific science can be discarded or re-defined in the light of better theories. Diachronically what was *aposteriori* can be made *a priori*, or vice versa – improperly speaking as by this the language itself has been changed. In this (limited) sense proper definitions are *discovered*, all this being compatible with the presence of conventions and a distinction between language and theory.

A methodology of building language frameworks presupposes – as a kind of ‘first philosophy’ – a core theory of the main concepts of a theory of language inasmuch as these as these are relevant for the methodology (involving, e.g., ‘meaning’ ‘derivation’, ‘denote’, ‘wellformedness’ etc.). This theory is the *remainder* of the philosophy of language. Most of the traditional topics of philosophy of language are now dealt with in linguistics. The general core theory of language deals both with formal/artificial and natural languages. Its claims with respect to natural language should be consilient with linguistics, which it does not compete with. It differs also from the philosophy of linguistics, which is one of the branches of specialized philosophy of science on a par with the philosophy of biology and so on. The general theory sets up the methods of philosophy. As philosophy itself it has self-referential features.

The general philosophy of science deals with core concepts present in each specialized branch of philosophy of science (like ‘theory’ or ‘confirmation’). It is meta-scientific and not history or sociology of science. Its most basic concepts and their clarification comprise a *remainder* of (traditional) epistemology (concepts like ‘justification’, ‘evidence’, ‘coherence’ etc.).

²⁴ This answers to the proper concern and partial truth of Quine’s criticism in Quine, “Truth by Convention” and “Carnap and Logical Truth”.

²⁵ For a recent analytic approach towards a (partially) formalized and explicit transcendental philosophy of meta-linguistic knowledge cf. the two volumes of Vanderveken, *Meaning and Speech Acts*. Acknowledging the role of force markers and formal pragmatics beyond formal semantics is also compatible with Logical Empiricism. Formal Pragmatics arrived to late on the scene to be considered by early Logical Empiricism.

Clarification of these concepts is continuous to general philosophy of science on the one hand and the core theory of language on the other hand. Most of traditional epistemology is today dealt with in the cognitive sciences.

The combination of a core general theory of language (remnant of the philosophy of language), a core theory of justification (remnant of philosophical epistemology), and the general philosophy of science constitute (what remains of) a ‘first philosophy’. What they say should be consistent with the empirical sciences, which they do not compete with. Therefore – as metaphysics in the traditional sense is handed to the sciences completely – theoretical philosophy has very limited content with respect to the constitution of the world. This is an echo of the old claim of Logical Empiricism that philosophy does not put forth (factual, non meta-scientific) thesis in the way the empirical sciences do.

§6 *A Reductive Analysis of Modality?*

Many accounts of the alethic modalities²⁶ like ‘possibility’ and ‘necessity’ try to be reductive. Modalities are supposedly explained by providing truth conditions for modal statements in a semantics that does not contain modalities itself, but refers to some *sui generis* entities like ‘propositions’ or ‘possible worlds’. One may ask whether there could or should be any reductive account of the modalities at all. Modality may be an irreducible semantic concept, and all we can do is to elucidate it by some model (e.g. some type of ‘possible worlds’ talk). Modality of some type may point to a fundamental feature of reality.

The reason for this scepticism concerning reduction rests in the hidden modal assumptions made with respect to the entities that are employed to explain modality. The very term “possible world” points to such presuppositions. These presuppositions may hide in some construction principle (like ‘independence’ of the building blocks of a combinatorial account of modality) or be given with assumptions of consistency. For example, ‘consistency’ explained as the non-derivability of a contradiction rests on ‘derivability’. ‘derivable’ is a (hidden) modal notion (as witnessed by the “-able” in the English term). One is not saying that the contradiction has been derived, but – sic! – that it could be derived, i.e. that it is *possible* to derive it.

There may be reductions of modality, however – *inter alia* versions of consistency accounts. Nonetheless even a non-reductive elucidation (e.g. in terms of consistency) may be

²⁶ In the following ‘modalities’ for short.

illuminating. It may (i) establish meaningful modal talk; modal talk could be meta-semantic talk (with respect to consequence) being *mirrored in the object-language* (like in Provability Logics). It may (ii) be part of a full-blown metaphysical picture (like Modal Realism) – of course rejected by Logical Empiricists.

§7 Linguistic Fictionalism (I): Consistency and Possibility

Linguistic ‘ersatzism’ as an account of the modalities provides a version of a *fictionalist account of possibilities*: the possibilities do not exist (neither in the space-time universe nor anywhere else in reality), there are no possible existants, there are only *stories*. Or stories about them *might be written*. If the stories just ‘might’ be written the account cannot be reductive. It can be *reflective*, however: ersatzism *is* a story about possibilities itself. It tells how and why such stories might be written.

Carnap in *Meaning and Necessity* aims at an explication of modal terms in terms of his semantic construction of state *descriptions* and Meaning Postulates.²⁷ He does not supply a formal system of modal logic, although his suggestions point to something close to **S5**. Modality is modelled by means of a theory of formal languages. The main idea is that all complete recombinations of basic terms (singular terms and general terms) which *do not* contradict the Meaning Postulates (including logical axioms) constitute a state description, the logical closures of which are the possible worlds.

This means that

α is possible iff there is a possible world w , $w \models \alpha$

because this means it is not L-false, i.e.

$\not\models \neg \alpha$ iff $\models \Diamond \alpha$.

This is not **S5** inasmuch as **S5** is deductively complete with respect to some (standard) possible worlds semantics for it, and for this $\Diamond \alpha$ should be *derivable* if valid (i.e. true with respect to all possible worlds, which can access all other possible worlds). But to know in the conception here whether $\Diamond \alpha$ is valid, one has to know $\not\models \neg \alpha$, i.e. a *negative* fact about derivability. This not

²⁷ Remember [from §4]: Meaning Postulates are just axioms including non-logical concepts without any presumption of providing complete conceptual analysis. They need not be biconditionals. Explicit nominal definitions can also be set up as axioms where on the left side of a biconditional the *definiendum* occurs.

just makes it dependent on a (hidden) modal concept like derivability, but is a fact which in the interesting cases (say, of quantified logics with non-finite domains) is *not decidable* in general. It will be decidable in principle given *finitistic* restrictions on the number of basic singular terms (individuals) and general terms (properties).

Even if this conception was not deductively complete, however, would not make it useless. Statements of the type $\diamond\alpha$ are epistemically difficult to assess, but such epistemological difficulties do mean neither that we do not understand what the statement says nor that we do not know how to argue for such a statement's truth or falsity. Modal statements need not be epistemically simple. They are not on any of the main accounts of modal semantics.

$\nVdash\alpha$ is if true *not* itself a derivable truth in a sufficiently expressive First Order System, as for the property of being provable ("B")

$$(*) \quad \nVdash\alpha \Rightarrow \vdash\neg B\alpha$$

is *not* valid in the logic of provability (by *Gödel's Incompleteness Theorems*). So, although $\nVdash\neg\alpha$ is a semantic/logical property of the system, $\neg B\neg\alpha$ cannot be a *derivable* truth in *such systems* in all cases of α . So, strictly speaking, Carnap's supposed system is *not* deductively incomplete, as $\diamond\alpha$ is not a *consequence* that can be *expressed* in general as a logical truth *in* the system (by first deriving $\neg B\neg\alpha$). $\diamond\alpha$ is true by the logical/semantic rules of the system, thus a logical/semantic truth, but a truth *about* the system, not a logical/semantic truth *in* the system.

$\diamond\alpha$ could be *derivable* in a paraconsistent system in which Gödel sentences are (just) further antinomies – in a system in which the meta-reasoning about derivability is done in the system itself.²⁸ Thus – given semantic closure combined with an application of the *Church Turing Thesis* of capturing our (meta-)reasoning within a sufficiently extended (paraconsistent) formal system – one may argue:

- i. Suppose: $\nVdash\neg\alpha$ is true given a system of inference.
- ii. Then: $\vdash\neg B\neg\alpha$ as the argument for (i) is existing *within* the system of inference, reflecting in paraconsistent semantic closure on itself.
- iii. Thus: $\vdash B\neg B\neg\alpha$ again as the argument for (ii) is existing *within* the system

²⁸ Cf. Bremer, *An Introduction to Paraconsistent Logics*.

- iv. Thus, by definition: $\models B\Diamond\alpha$
- v. Thus: $\models\Diamond\alpha$ by the plain correctness of “B” [$\vdash B\alpha \supset \alpha$], as *Löb’s Theorem* [i.e. $\vdash B(B\alpha \supset \alpha) \supset B\alpha$] does not apply in a paraconsistent context.

Semantic closure and self-reflection allow to capture a truth about the (semantic) framework in a modal statement within the framework. Without reference to a paraconsistent derivation of the kind (i) – (v) non-constructive truth conditions for the modal operators can achieve the same (i.e. $\models\Diamond\alpha$ iff $\exists w w\models\alpha$) [cf. §8].

§8 *Modality as Meta-Semantic*

Alternatively to such an approach one could proceed in a fashion of elucidating modality *without* logical/semantic closure by starting from the observations just made:

- i. there being a (often hidden) dependency on derivability
- ii. possibility being the *meta*-property of ‘possibly true’ with respect to sentences of a formal system.

and see them as a way to *forsake* a philosophically loaded primitive notion of possibility altogether. One could claim that $\Diamond\alpha$ is just an object-language rendering of a meta-language statement, namely one of *satisfiability*:

$$\models\Diamond\alpha \text{ iff } M\models\alpha \text{ for some model } M \text{ (i.e. } \alpha \text{ being satisfiable)}$$

And the claims about satisfiability and the existence of models can – given the presumption of at least correctness if not completeness as well – be further traced back to statements about a story’s *consistency*:

$$\models\Diamond\alpha \text{ iff } (\exists s)(\alpha \in s) \text{ and } s \not\vdash \perp$$

i.e. α is part of a (complete) consistent story (a negation-complete consistent set of sentences).

A consistent story s has a model, thus:

$$\alpha \in s, s \not\vdash \perp \Rightarrow \exists M(\forall \gamma \in s) M\models\gamma, \text{ i.e. } \exists M M\models\alpha, \text{ i.e. } \models\Diamond\alpha.$$

§9 Linguistic Fictionalism (II): Existing Derivations

Possibility is thus reduced to consistency, where consistency has a modal element in talking about the *derivability* of sentences.

A realist with respect to abstract entities who considers a formal system as an abstract object, which exists even without our successive epistemic access to it, can *eliminate* the *residual* model element in ‘derivable’ and simply state $\nabla \perp$ as a *fact* given the system as it is.

This (“ \vdash ” meaning “there *exists* a derivation”) would be a complete reduction of modality.

Thus, on the one hand “possible” as a term can be reduced ultimately to a syntactic concept, which thus elucidates it in a regimented form. An ‘explication’ in Carnap’s sense is achieved. On the other hand, we see that the basic syntactic notions contain an aspect of modality *if* we restrict ourselves to talk in terms of our limited (epistemic and deductive) abilities.

§10 Metaphysical Modalities

An account of this sort would, it seems, take all modalities to be *de dicto*; there are no modal properties ascribed to entities independently of linguistically established modalities. The fact that a formal system might be able to express *de re* modalities is in itself no reason to consider the respective sentences (possibly) true. One might give their truth conditions in a way that leads back to *de dicto* modalities, e.g. $\exists x \diamond F(x)$ may be seen as making a *de dicto* claim for all assignments to the variable (i.e. some sentence being true of that object).

But *de re* claims seem to make sense. *In* the object-language $\diamond \alpha$ says not of a sentence but of a state of affairs that it is possible. Modal talk in the object-language applies to the world. We say what is possible or not *in* the world. Derivatively we ascribe modal properties to entities in the world. They have them themselves (in that sense *de re*) [cf. §14].

These *de re* modalities, nevertheless, go back to the ways we in our theories and in the Meaning Postulates of our language describe or conceive of the world. We have chosen these ways of talking and formulated our theories, on the other hand, *because* we want our language and theories *to fit to* reality. By our *de dicto* modalities we try to trace any inevitable (i.e. exception forbidding) objective connection in reality. The strength we attach to some connection determines whether we see it as semantic or just empirical.

Considering just semantic axioms we can talk of a broader class of possibilities than if we are taking the *empirical* assumptions of our best theories into account as well. We see links (between properties) of different strength and we want to capture the differences in strength. Consistency with respect to some empirical theory elucidates empirical possibility (i.e. compatibility with the laws of nature [cf. §15]). Consistency with respect to semantic axioms elucidates logical/semantic possibility.

The contrast between metaphysical and linguistic possibility should not be understood in a way that any linguistically *based* elucidation of modality rejects the distinction between the strength of some connections between properties. Our best theories and corresponding Meaning Postulates try to trace the structure of reality. If they are true, these connections are *there*. ‘Metaphysical Necessity’ understood as the obtaining of strict dependencies between properties in reality is then *not* to be contrasted to ‘Semantic Necessity’: in our best theories they should coincide. *There is no further ‘metaphysical necessity’ beyond or besides semantic necessity*, especially not one necessity stronger than semantic necessity.

§11 *Necessary Existants*

If modalities are elucidated by Meaning Postulates and the semantic and syntactic properties of a formal system, there are no exclusions with respect to sentence types that are considered possibly or necessarily true. So, existential claims can be possibly true (if the concept of the entity involved contains no contradiction) – or even be necessarily true. If there are Meaning Postulates/Axioms making *existence claims* these existence claims are – *prima facie* in the *shallow* or *braod* sense of a Carnapian explication of ‘analytic’ (as ‘following from the Postulates’) – derivable as theorems, thus being necessarily true. In the narrow or traditional sense they are synthetic (as they do not decompose by the form of an implication the meaning of a term, as most Meaning Postulates). So, in that sense postulating them renders them *synthetic a priori* [cf. §4].

These necessary existence claims – prototypically in mathematics – may be part of our best theories, thus we understand that necessary existants are part of reality. Controversial posits are entities like the ‘perfect being’, necessarily existent.

Our linguistic frameworks are not directly proven themselves (as they set out what counts as a proof). In that sense synthetic *a priori* sentences in them cannot provide a – non-shallow (i.e.

not just axiom repeating) – *proof* of a necessary existant as postulated. They can be used in proving other necessary existants conditional on the ones postulated. Our frameworks are viable in the holistic pragmatic fashion that ultimately serves as our best available justification of proceeding with these frameworks and believing their theorems and assumptions.

§12 *Linguistic Fictionalism (III): Constructing Possible Worlds*

A linguistic ersatzism avoids the postulation of (new) kinds of *sui generis* entities: necessarily existing abstract propositions which do not contain their subject matter as constituents (which these do not to avoid possible existants and overlap between such propositions which take on the role of possible worlds, as abstract stories).²⁹ If one has other reasons besides an account of modality for this type of entity, they come in handy: As they need not be constructed (like real sentences) a reduction of modality seems possible. The possible is the realm of these complete, conjunctive propositions (standing in for possible worlds). Supposedly inconsistent propositions just do not exist. In contrast linguistic ersatzism has to explain why supposedly inconsistent sets of sentences are not constructed (or are not constructible). The postulation of abstract propositions – as an ontological investment – solves a problem of analysis by fecund ontological postulation. *Nonetheless* we see a postulation here which inherits all the epistemological and metaphysical problems of postulating abstract entities. Linguistic ersatzism avoids such metaphysics. Once one has a linguistic theory of semantic content and an ontology of sentences one may use talk of ‘propositions’ as mere convenience in non-foundational analyses related to semantics, just as one could do with ‘possible world’ [cf. §13].

A linguistic ersatzism also has advantages over a non-linguistic account in the tradition of Ludwig Wittgenstein’s *Tractatus logico-philosophicus*, which deals in a combinatorial account of the modalities using a non-abstract ontology, the major ingredient of which are states of affairs.³⁰ The problem such an account faces is to talk about possibilities (‘possible states of affairs’) without either taking them as sentences or as abstract entities (like propositions). There seems to be no place left to place such entities. A ‘possible states of affairs’ cannot *be* a recombination of the constituents of actual states of affairs (i) because these are parts of the actual states of affairs *already* (and at least the individuals cannot be replicated), (ii) because *if*

²⁹ An example is Alvin Plantinga’s *The Nature of Necessity*.

³⁰ An example is D.M. Armstrong’s *A Combinatorial Theory of Possibility*. The ontology of non-transcendent universals and states of affairs Armstrong sets out in *A World of States of Affairs*.

they were combined thus, they *are* combined, i.e. one would have actual states of affairs.³¹ So where are the combinations? One seems to land on a general principle:

(*) $\diamond\alpha$ iff the constituents of α could be combined in that fashion.

This is, of course, no longer a reductive explanation of modality, but just a substitution of *possible combination* for *possible truth*. A reductive account might proceed on the general principle

(**) All combinations of atomic individuals and atomic properties are possible.

This shows the alignment of such a theory to Logical Atomism. This explanation now rests on the assumption of independently existing atomic constituents. This might be an option, but it certainly faces the epistemological challenges (i) to identify such atomic constituents, and (ii) to analyse all complex individuals and properties in their terms. No one has delivered on these desiderata – presumably relegated to a completed science! The problem was – at least – involved in the downfall of Logical Atomism.

Linguistic ersatzism, therefore, remains the best option. So long as it relies on the idea of sets of sentences being ‘constructible’ and (semantic) consistent in adhering to previously given axioms or Meaning Postulates it cannot provide a reductive explanation of the modalities. It can, however, provide an elucidation of our modal talk and the role of modal talk in our linguistic frameworks. At the same time, it avoids more controversial ontological posits.

To make it explicit: The *story* of linguistic ersatzism goes something like this: ‘possible worlds’ can be stepwise constructed (i) and (ii) evaluating a modal claim will typically involve construction only up to a point dependent on the logical structure and the constituent terms of the claim under consideration.

The whole construction concerns a specific language L and a corresponding consequence relation (logic). In the simplest case possible worlds are negation-complete, consistent and deductively closed. In all interesting cases L contains a negation symbol and (at least) one detachable conditional. As possible worlds are interesting only in modal semantics L should have modal operators, in the simplest case with universal accessibility between the possible worlds.

³¹ The problem resembles Bertrand Russell’s problem in his attempt of a *Theory of Knowledge* with having individual negative states of affairs which make negated sentences true.

One can model this construction in terms of Turing Machines (TMs). What TMs compute is computed constructively and finitely (apart from the assumption of indefinite storage capacities).

The possible worlds are constructed by a complex TM TM_{pw} , which consists of several sub-machines. The complex TM_{pw} executes alternately chunks (or single steps) of the constituent machines. (Because of the alternating execution some copying, adding and replacing steps have to be repeated.)

The input of TM_{pw} consists of:

1. A list of general terms of the language
2. A list of singular terms of the language
3. A list of the axioms (including nominal definitions and meaning postulates) of the language

The output of TM_{pw} consists of:

1. An indexed list of state descriptions
2. An indexed list of possible worlds

In the second list a supposed possible world that within the construction process below turns out to be inconsistent (and so no possible world after all) is marked closed.

The sub-machines are the following TMs:

1. A TM_{sd} that sets up the state descriptions:
 - a. MT_{sd} looks for a general term and a singular term not dealt with and applies the general term to the singular term (giving an atomic sentence); these terms are searched for starting from the list of terms: a general term and a singular term are new if in the list of state descriptions no corresponding atomic fact can be found.
 - b. if the list of state descriptions is empty, two entries are created: one with the atomic fact, one without it; otherwise: the list of state descriptions is extended by a self-copy where the first half of the state descriptions are extended by the atomic fact;

- c. MT_{sd} proceeds to either another general term or another singular term (alternately) and goes back to step (a), it stops when all terms have been dealt with (i.e. the search for new terms terminates with failure).
2. A TM_t which enumerates the theorems of the language and adds them to all possible worlds. For all theorems α TM_t adds $\Box\alpha$ to all possible worlds.³²
3. A TM_c which copies from state descriptions to possible worlds:
 - a. TM_c goes to the first not treated index of a state description;
 - b. If there no possible world with that index a copy of the state description is added with that index to the list of possible worlds;
 - c. If there is a possible world with that index and is marked closed TM_c moves to the next index; otherwise: TM_c copies sentences in the state description not present in the possible world to the possible world. [This can be required because of the mutual stepwise construction of state descriptions and possible worlds.]
 - d. TM_c goes to the next not treated index or stops otherwise.
4. A TM_{cl} which computes the deductive closure of possible worlds:
 - a. TM_{cl} goes to the first not treated index of a possible world;
 - b. If the world at that index is marked closed TM_{cl} goes to the next index.
 - c. If the world contains sentences with a general term δ and sentences with a singular term γ but not the atomic sentence $\delta(\gamma)$ TM_{cl} adds $\neg\delta(\gamma)$ to that world;
 - d. If the world contains conditionals, then for each of them: If the world contains the antecedent of the conditional and the negation of the consequent, then TM_{cl} marks the world as closed, otherwise TM_{cl} adds the consequent to the world. [Introduction of conjunctions and disjunctions happen then by closure with respect to corresponding conditionals derived as theorems.]
 - e. For each sentence α in the possible world: if $\Diamond\alpha$ is not contained in the world, $\Diamond\alpha$ is added to the world and to all possible worlds which do not contain $\Diamond\alpha$;

³² TM_t exits by well-known computability theory theorems.

- f. For each sentence α in the possible world TM_{cl} checks whether the sentence is contained in all other possible worlds; if so, $\Box\alpha$ is added to the world, otherwise $\neg\Box\alpha$ is added to the world;
- g. For each sentence of the form $\Box\alpha$ in the world TM_{cl} checks whether α is contained in all other worlds; if not so, $\Box\alpha$ is replaced by $\neg\Box\alpha$. [By the stepwise construction of possible worlds non necessary sentences can transiently seem being necessary.]
- h. TM_{cl} goes to the next not treated index or stops otherwise.

If one assumes that all objects are named by singular terms TM_{cl} also has to add $\forall x \delta(x)$ into a possible world if for a general term δ all instances with respect to the singular terms are in the possible world.

If one was to develop the machine tables of the TMs involved in detail one would need to program immense amounts of copying and shifting of contents, because of the extension of state descriptions and possible worlds. The running time in steps of computation for any mildly complex language L will be astronomical.

The point of the outline of an algorithm of possible world construction is not, however, to proceed to program it in detail and use the output in an philosophical inquiry. The description of TM_{pw} is *a proof in principle* that such a construction is available.

§13 *Modal Instrumentalism*

A fictionalist account involves many intricacies and might be cumbersome to handle at least in its semantics expressed with *stories* (about entities) for modal talk and existing *entities* of various types for non-modal talk. Quantifying-in and counterfactual reasoning about existing objects raise then technical intricacies in formalising them within one (object) language. Higher order quantification aggravates the complexities.

The point of setting out the conception of fictionalism, however, is not to propose working with a formal system that mirrors fictionalism and its claims properly. The point is to have a theory that shows how modal analysis *could* be done without extravagant ontological commitments. This resembles a nominalist or fictionalist account of numbers – one sets out the account and then goes on to use the standard formal systems in the knowledge that their efficiency and seeming simplicity of expression is valuable, i.e. taking an *instrumentalist* stance on their

ontology, especially set theory and model theory. The same can be done in modal logic: One may use higher order intensional/modal logic with a model theoretic framework (in the broad sense of including inaccessible cardinals or classes ...) including an ontology containing possible worlds and possible entities (of whatever type). The fictionalist just does not believe in these scaffolding structures (i.e. the ontological talk taken literally).

Given the ersatzist theory this is not instrumentalism in the vein of early Logical Empiricism. There *is* a preferred ontologically less committal account, which one endorses. For mere convenience of daily non-foundational science, a scheme is employed which one does not endorse. The background or foundational scheme are not on a par with this.

An argument for scientific structural realists to be modal instrumentalist may stress the difference between a commitment to unobservables of some kind and a commitment to non-existing entities (whatever ‘non-existing entity’ means).

§14 *Necessary Properties*

Suppose a species term “F” is *defined* by characteristics F_1, F_2, F_3 . An object a of the type F , insofar as it is F , necessarily has the feature F_1 . That is, *relative* to being F , being F_1 is semantically necessary, *de dicto*. a is not *absolutely* necessarily F_1 unless a necessarily exists. *De dicto* necessities are *conditional* with respect to a definition of a species concept. Objects cannot lose their species concept without ceasing to be that object, even if – for example in the case of physical objects – the physical components continue to exist. An object a , which necessarily exists *in its type* F , necessarily has the properties F_1, F_2, F_3 . If an *object* exists necessarily, then it – as an object – necessarily exists in its kind. A necessarily existing object therefore has necessary properties because these are relatively necessary to the kind and the kind property itself belongs to the object. These properties belong to the constitution of the object, they are *de re* (in the object as it exists).

First Question:

- (1) Can one say of an object that *its* nature could be different?

Answer: No. Because then it wouldn't be *this* object.

Insofar as an object necessarily exists, its kind properties are necessarily *de re*. So necessarily existing objects have their species-relative properties *absolutely* necessarily, it seems.

Second Question:

- (2) Can one deny that the characteristics F_1, F_2, F_3 that define a species F are necessary for that species?

If one defines “ F ”, the characteristics of F -objects are fixed (i.e. the characteristics that they have if they are correctly described as “ F ”). Appropriate definitions capture the characteristic properties of a species. *Appropriate* definitions thus capture the properties that necessarily belong to objects of a species – as objects of that species.

Third Question:

- (3) How do we know that a particular definition is appropriate?

Only within the framework of our overall theory of reality do we assume that certain definitions (parts of our theories and language) are appropriate. There are no isolated arguments for the adequacy of a linguistic framework. However, *if* a linguistic framework is adequate, then the objects of type F necessarily have the features F_1, F_2, F_3 *de dicto* according to the species definition. This (with the adequacy of the *linguistic framework*) does not yet justify the existence of objects of type F . If it is part of our best theory that there are objects of kind F , then it is part of our best theory that there are objects that necessarily (*de dicto*) have the properties F_1, F_2, F_3 . If our best theory is true, these objects have the properties F_1, F_2, F_3 *de re*. If it is part of our best theory that some objects of the kind F necessarily exist, then it is part of our best theory that these objects necessarily have the properties F_1, F_2, F_3 *de re*. If this best theory is true, these objects necessarily have *the properties* F_1, F_2, F_3 .

Fourth Question:

- (4) Can the constitution of a species be further questioned? Can one ask: “Why F_1, F_2, F_3 for the species F ?”

The identity of the language frame (i.e., semantic necessity) could point to the language-*constitutive* character of *definitions*. The necessity explained above relates to these definitions. The definitions are adequate if reality is in a certain way (namely that of the definitions). Then reality will be such that objects of the kind F *are* necessarily F_1, F_2, F_3 (*de re as* objects of the kind F).

Fifth Question:

- (5) Can one meaningfully ask about the *necessity* of a species constitution *de re*?

This means asking why reality has exactly the necessities *de re* with regard to species constitution that it does. This means asking why the species *F* is constituted by the features F_1 , F_2 , F_3 so that the corresponding conditional necessities are present.

A “why” question regarding a necessity aims to trace a necessity back to something else. However, this has to be a necessity (for logical reasons), so the problem only shifts. The structure of necessities may explain each other, so that we understand more when looking at the structure than when considering the individual necessities. So, we are referred back to our understanding of an overall theory of reality. This regression concerns our understanding, not the dissolution of the existence of the ultimate necessities of the species constitution *de re*. We seem to have reached a limit to understandable regression. It seems we to have to say:

- (6) Necessities are *ultimate* facts – that is exactly what constitutes necessity.
Question (5) about the necessity of *de re* necessities of the species constitution makes no sense.

Nevertheless, there seems to be an intuition about ultimate facts that asks:

- (7) Couldn't there have been a differently constituted reality (that is, one with *different necessities*)?

What does “could have been” mean in (7)? What modality does this refer to? If it is a question of possibility and necessity in the *previous* sense, then again there is only the iteration of modalities: Necessities, insofar as they are (precisely) necessities, are necessarily necessary (in a language framework), so they cannot be otherwise. *De dicto* necessities could be different *de re* if we could successfully *speak another language*, which seems to be possible, at least in part. The question of the extent to which the semantics (i.e. not the historically contingent grammar and phonology) of our language is contingent is also not trivial. Adequate *de dicto* necessities cannot be different in the sense of what was said above: the underlying necessities are (just) necessary.

Is there another – higher level – necessity in the context of (7)? If some such necessity exists, the *de re* necessities of reality – and also any necessary existants – are *not necessarily necessary without* further ado. The question of their necessity arises again. Their necessity, even in the sense of higher-level necessity, does not have to be ruled out, but it has to be argued for, then.

As a rule, modal metaphysicians do not care about such arguments or such an argument pattern. Because in metaphysics – that is, not only in semantics – they posit a concept of necessity of type **S5**, in which all iterations coincide ($\Box\alpha \supset \Box\Box\alpha$, $\Diamond\alpha \supset \Box\Diamond\alpha$).³³

This means that question (7) is simply rejected. If one does not see question (7) as obviously nonsensical, one sees the commitment to metaphysical **S5** modalities as a non-trivial commitment. One may very well dispute that our *semantic* intuitions about *semantic* necessity, in which case most semanticists argue in favor of an **S5** modality, can be extended to metaphysical necessity – at least one can doubt that they can easily be extended to metaphysics.

Our best theory and the presupposed linguistic framework may need to be expanded to include such a higher-level concept of necessity – or we now understand that we and the intuition behind (7) have always operated with such a concept. The linguistic framework includes a second concept of necessity (the higher level, non-tautologically iterated one). The best theory must now also justify why the necessities *de re* of reality are also necessities *de re* in the sense of the second concept of necessity.

Now you can guess what question this development is leading to:

(8) Can the rise to new questions of necessity be repeated?

Answer: Only if question (7) cannot be repeated at the next level as question (7') is there any prospect of a conclusive answer to the question of the inevitability of necessities. But why should this be so? The intuition articulated in (7) will also be able to motivate such an ascent into ever-further necessities. A negation of (8) or a defusing of it in the sense that this progression is argumentatively harmless would have to be based on a pattern of argumentation, the understanding of which entitles us to either cancel the progression entirely or to understand it as an epiphenomenon in the modalities. We have to face a non-trivial question of modality iteration [see §17].

Concerning necessary properties of any objects we may sum up: The statement

(9) a is necessarily F_1 .

can be analyzed in various ways. In an adverb construction, “necessarily” has a narrow scope (in the predicate):

³³ For instance, Plantinga in *The Nature of Necessity*. See also his *Does God Have a Nature?*

$$(10) \quad a \Box_{\text{ADV}} F_1.$$

with an adverbial operator “ \Box_{ADV} ”. In contrast, one can relativize the predication to the existence of a :

$$(11) \quad \Box (a \text{ exists} \supset a \text{ is } F_1)$$

This typically expresses the relative (metaphysical) necessity related to a sortal. (11) is if F_1 is part of the definition of a sortal F true in all possible worlds, since in the worlds in which a does not exist, the antecedent is false and the material conditional is therefore true. And a exists – as an object of its sort F – only if the sortal applies to a , i.e. also “ F_1 ”. Relative necessity allows us to say that an object has necessary properties. (10) will be false if either singular terms are eliminated in favor of descriptions with existence claims or if, in a free semantics, statements with non-referring singular terms are not necessarily true, but rather not-true.

In (10) one can also “necessarily” give scope to the entire statement, *de dicto*:

$$(12) \quad \Box (a \text{ is } F_1)$$

If singular terms can be non-referential or are eliminated, (12) must not be true as soon as “ a ” does not refer, rather (12) will be false. In such an analysis the truth of (12) presupposes the necessary existence of a . If a necessarily exists, then (9), if it is true, which it will be in the case of a sortal component, is necessarily true in the *absolute* sense.

§15 *Natural Laws and Metaphysical Necessity*

Insofar as reality is not determined, the past could have been different and the future can be one way or another. These possibilities can be understood as 'natural law possibilities' (possibility in the light of the laws of nature) and a corresponding term and operator " \Diamond_N " (or " \Box_N ") can be defined. Our everyday planning and assumptions about what could have been and what might be refer to such possibilities. Given the semantic definitions of a language L_1 (total or partial definitions of expressions through analytical connections or Meaning Postulates), scenarios can be described in L_1 that even lie outside the scope of natural law possibility. These are often found in literature. Such possibilities are semantic possibilities (possibilities in the light of a language's meaning system), which corresponds to the usual use of " \Box " and " \Diamond " [as discussed above §§6 – 13].

It is doubtful whether, beyond or between these two concepts of possibility (and necessity), there is a need for a further concept of 'metaphysical possibility', understood as genuinely different from the other two.

Sentences like

(13) Water is necessarily H₂O.

are considered paradigms of metaphysical necessity. However, these sentences can be understood without assuming a new kind of modality. If we introduce the term “water” in a reference fixing definition (“baptism”) as a “substance of this chemical constitution” and then discover – perhaps later, i.e. empirically – that this constitution can be specified as “H₂O”, then due to our *semantic conventions* (regarding reference determination and 'chemical constitution' and corresponding practices of (re)identification), "water" only refers to H₂O. (13), therefore, refers to a combination of our linguistic practices and the properties of reality back. In this *deflationist sense* one can speak of 'metaphysical possibility/metaphysical necessity', but this does not include any metaphysical laws of its own alongside the natural laws and semantic conventions.³⁴

If the language L₁ allows (partially) to speak appropriately about reality and contains sentence

(14) $(\forall x,y,z)(x = y \wedge y = z \supset x = z)$

then reality also behaves in such a way that identity is transitive (and correspondingly co-referential expressions can be substituted for each other in many contexts). This is a feature of reality.

Many examples of 'metaphysical necessity' revolve around the concept of identity. However, the identity of objects has to be understood as relative to sortal predicates: an object belongs to a sort as long as it exists and this may be linked to methods of re-identification [cf. §14]. 'Identity' therefore refers back to our linguistic ontology of 'objects'. Pieces of reality are what they are. If they don't change, they will stay as they are. Introducing this as a genuinely *further* modality 'metaphysical possibility/metaphysical necessity' brings more modal-theoretical confusions than clarifications.

³⁴ The usual 'Twin Earth' narrative goes like this: Earth and Twin Earth exist *at the same time*, and then it seems plausible, given our baptism of water, that water is necessarily H₂O, while there is no water on Twin Earth. However, if Twin Earth is a counterfactual alternative to our Earth, then it could have turned out for *us* that water was XYZ, so not necessarily H₂O, and thus, even without a Twin Earth somewhere, water is not necessarily necessary H₂O.

The 'metaphysical necessity' associated with identity is the conditional necessity associated with sortal predicates [see §14], i.e. ultimately a *semantic* necessity. If we had specified 'substance of this color and taste' when baptizing water, then presumably (given the usual 'Twin Earth' stories) water would not necessarily be H₂O, which shows that the definition is the basis from which we derive 'metaphysical necessity', and not the other way around. The properties F₁ ... F_n that make up a sortal generally constitute an object's identity within the framework of what is necessary/possible according to natural law. Sortals for beings beyond the universe presumably do not arise from natural law modalities (of this universe), but presumably from either purely semantic modalities – or from supernatural modalities, that is, modalities in the light of the laws of the supernatural – if such exist. However, laws of the supernatural, if they exist, especially if any area of the supernatural were law-like at all, are no more metaphysical laws than natural laws are metaphysical laws – or just as much, given the indirect role explained above in a deflationist theory of metaphysical modalities. Corresponding religious-philosophical theses and arguments require less a theory of metaphysical modalities than an explanation of corresponding supernatural sortal predicates.

§16 *Deconstructing Rigid Designation*

One major argument for metaphysical necessity has been the theory of rigid designation of proper names and natural kind terms.³⁵ There are some linguistic intuitions that proper names and natural kind terms are used as rigid designators. One may doubt that they are. Once we restrict the descriptive content to the content employed in the reference fixing situations (say, in the case of a proper name to 'the human being born at time t at place p'), almost all intuitions of rigidity can be covered by a proper name with minimal semantic content. A reference fixing postulate will integrate proper names then into the ersatzist model of possible worlds. Natural kind terms can be treated similarly, where additionally there is linguistic evidence for at least partial decomposition by meaning postulates [cf. §14].

Nevertheless, let us, for the sake of the argument, assume that such assignments of minimal content are not feasible and there is the phenomenon of rigid designation. Does this commit us to a metaphysical necessity beyond semantic necessity?

³⁵ Classically in Kripke's *Naming and Necessity* and Putnam's "The meaning of 'meaning'".

No, it does not. This can be seen in the way rigidity is introduced into the language, given a proponent of rigidity bothers to outline this. Rigidity is enforced by Kripke by postulating that we look only at possible worlds *after* we have the reference of proper names and natural kind terms fixed, i.e. others worlds are not possible at all.³⁶ That is a way of restricting the set of possible worlds or the set of models. Linguistic ersatzism restricts the set of possible worlds or the set of models by enforcing the axioms including meaning postulates. The same effect meaning postulates achieve could be achieved by forsaking meaning postulates but disregarding all models or possible worlds that would render something satisfiable or possible that we do not consider so for the language under construction. The two methods are (with respect to true modal statements generated) equivalent. Forsaking meaning postulates but restricting the set of models or possible worlds results in sentences mirroring the forsaken meaning postulates to be true in all – remaining – possible words or models, i.e. to be necessary true. Proponents of rigid designation proceed exactly this way (excluding models or possible worlds that semantically interpret a proper name or natural kind term differently to its given interpretation in the actual world). Given the restrictions on enforcing rigidity some sentences are found to be necessarily true. This is perfectly acceptable as a way of modelling and there may be good reasons for enforcing some rigidity. We have, however, here a variant of enforcing semantic rules. Rules of rigid designation if we want to have them are semantic rules. So, the consequences of them are semantic necessities. No metaphysical necessities are found. If talk of corresponding ‘metaphysical necessities’ was meant only as a short form of talking about special semantic necessities, Logical Empiricists would not complain as one may explicate the very term “metaphysical necessity” in this way. This, however, is not the way the debate is conducted or talk about corresponding ‘metaphysical necessity’ is defended or introduced. That debate needs some deconstruction in the manner just outlined.

§17 *Iterated Modalities*

If we make a distinction (like Descartes in his *Philosophical Letters*) between the human conceptual system and the logical laws that limit it, and the conceptual system of the divine mind, which we cannot see, with logical laws granted by God, which we also know, but also a super-logical scope that goes beyond them, which makes completely different laws of logic conceivable for God, then all considerations about strict necessity are only relative to our –

³⁶ Cf. Kripke, “Identity and Necessity” and *Naming and Necessity*.

limited – conceptual system. This may be sufficient for argumentation among human persons, since our arguments are aimed at them. However, no metaphysical conclusions can be drawn from this to a non-humanly relativized realm.

Arguments that make assumptions about the human conceptual framework or the spectrum of possible individual linguistic conceptual frameworks can be an opportunity to reflect on the limits of human understanding and thinking. The idea that our conceptual framework may have limits does not show that it has them. And if he has them, little can be said about them, especially not that they concern a specific (metaphysical) problem. A specified and restricted claim of this sort must seemingly itself concede reliable meta-epistemic capacities. In the case of modalities, however, the very idea of human limitations and the contingency of human nature casts doubt on iterated modalities referring to language frameworks themselves. What seems necessary to us – or is necessary in our conceptual system – does not have to be necessary. What then remains consistent is a *modal metaphysical agnosticism*.

If modalities can be iterated, this can be understood as meaning that “necessarily true” applies to sentences relative to a semantic language framework. However, it is not necessary that we use *this* linguistic framework, so the 'necessarily true' sentences of this framework need *not* be necessarily 'necessarily true'.³⁷

Talk about the possibility of a *different* linguistic framework must take place within a linguistic framework. There are three variations of this approach:

1. We distinguish between the language frame we are talking about and the language frame by talking about its modalities. If it is a hetero-lingual meta-frame, a hierarchy of such frames builds up in which the most recently used frame is not reflected.
2. We distinguish between *relative* necessity (of a linguistic framework) and *absolute* necessity beyond all linguistic frameworks – perhaps even the limits of what is humanly conceivable. The alethic modalities of a language (“□”) may then be **S5** modalities. And one may also assume that the absolute modalities (“□”), insofar as their absoluteness excludes further alternatives, are S5 modalities. This means that we assume:

$$(15) \quad \Box\alpha \supset \Box\Box\alpha$$

³⁷ This does not exclude the possibility that there are sentences that are necessarily true in every comprehensive and humanly possible linguistic framework [cf. §4]. What these could be is a – difficult – transcendental philosophical question. It is particularly problematic whether these include theological statements, say about the nature of God.

$$(16) \quad \Box\alpha \supset \Box\Box\alpha$$

What you have to avoid, however, is mixing up these modalities, that is:

$$(17) \quad \Box\alpha \supset \Box\Box\alpha$$

3. Are these, on the other hand, statements of a self-referential linguistic framework that can be used as its own framework for meta-considerations, and which we may think of as the human universal meta-framework (i.e. which does not overcome *the* limits of what is humanly conceivable towards 'absolute' modalities), then no modal-logical reduction principles *like* **S4** or **S5** apply.

The meaning of “red” and “coloured” may determine that

$$(18) \quad \text{Everything that is red is colored.}$$

is a necessary truth. Certainly, the meaning of “language” does not determine that

$$(19) \quad \text{We speak this language.}$$

is a necessary truth. Corresponding semantic principles justify from (18):

$$(20) \quad \text{Necessarily}_1 \text{ everything that is red is colored.}$$

However, since (19) is not necessarily true, they do not justify:

$$(21) \quad \text{Necessarily}_? \text{ necessary}_1, \text{ everything that is red is colored.}$$

This means that a Necessitation rule may not be applied to statements with modal operators, or only when they are instances of propositional tautologies. Corresponding modal logics could be **S1** or **S2**.³⁸

In summary, the above considerations boil down to the following points:

- (i) There is *no independent metaphysical necessity*: corresponding ways of speaking go back to the *semantic conditional necessity*, which in particular entails the semantics of sortal predicates.
- (ii) Since definitions (including those of sortal predicates) are supposed to be adequate to reality, the conditional dependencies in the definition of adequate sortal

³⁸ Cf. on all these modal logics: Hughes & Cresswell, *An Introduction to Modal Logic*; Cresswell, “The completeness of S1 and some related systems”; Chellas & Segerberg, “Modal Logics in the Vicinity of S1”.

predicates correspond to structural facts (of reality), which can be understood as modalities *de re*.

- (iii) Since reality could presumably be different and we could speak a different language – and would have to if reality were constituted differently – the definitions of the best linguistic framework are also presumably *not necessarily the way they are*. While something is necessarily *relative to* a definition, establishing that such a definition exists, even if it co-constitutes a language, is establishing a contingent fact!
- (iv) While *semantic necessity allows for iterated modalities within a linguistic framework* – in particular given the usual truth condition for " \Box " ('true in all possible worlds') and universal accessibility of all possible worlds – there is the question of *semantic necessity* in the sense of (iii) *from the outside perspective of a linguistic framework*, from which perspective iterations do not make sense (it is semantically necessary in German that everything that is red is colored, but it is not semantically necessary in German that it is semantically necessary in German that . . . – this iteration *makes no sense* because it mixes linguistic levels: *establishing* a definition itself is not definitionally necessary).
- (v) The logic of internal semantic necessity may (according to the explanations in (iv)) correspond to logic **S5**, the logic of external semantic necessity either does not allow confusion between absolute and relative necessity or may correspond more to a logic like **S1**.
- (vi) The talk of necessity as an attribute of God either makes inadmissible metaphysical use of the inner semantic necessity **S5** or the corresponding (cosmological) arguments are hanging in the air because of the admissibility of the questions concerning external semantic necessity.

§18 *Meta-Framework Reasoning and Universal Logic*

Building language frameworks and comparing their merits requires a meta-framework able to express the meta-linguistic, meta-logic and meta-semantic concepts needed. Modalities are introduced and discussed in this meta-framework. Ideally the meta-framework should be applicable to all kinds of language frames. Elucidating natural languages, then, leads to the issue of a universal meta-framework able to express even *its own* features and meta-theory.

This can be discussed as the question of a Transcendental or Universal Logic. As the principles of language and meta-theory should be feasible for human reasoning they most likely should be computable. Universal Logic approaches, therefore, have to face the question how their elucidation of universal logic relates to universal computability. Universal Logic – it seems – tries to capture all logical reasoning. Universal computation captures all computable algorithms. So, should they coincide?

The first – and short – answer is that the question might rest on an ambiguity in ‘universal’: universal computation is universal in the sense of comprehensively *capturing all* intuitively algorithmic (‘computable’) procedures; Universal Logic is universal in the sense of being *applicable in all contexts*, where not every context has to involve the full force of classical logic, on pains of paradox and triviality (making all sentences derivable). So, even if FOL is tied to universal computation that does not imply that Universal Logic is tied to FOL. So, Universal Logic (in the sense of a paradigm meta-framework) and universal computation need not coincide.

The second – and longer – answer looks closer at the ideas behind the *Church Turing Thesis*, a crucial theorem by Turing, and how all this does not show that some strong Universal Logic programme is in conflict with the *Church Turing Thesis*.

The *Church Turing Thesis* (CTT) can be expressed in different ways, for example:

Church Turing Thesis

Everything that is computable is computable by a Turing Machine.

The *Church Turing Thesis* is generally seen as outlining an upper limit on computability. Nothing seems to be computable that is not TM-computable. Seen from a naive point of view the existence of super-computability would falsify (CTT). But (CTT) involves a precise and definite notion of an effective procedure (an *algorithm*) and a corresponding concept of computability: (CTT) identifies the *intuitive* notion of computability with a *formally explicated* notion (being computable by a TM). The cornerstone of this is the idea of an *algorithm* on *discrete* symbols, executing steps each of which is mindless, where each (sub-)computation ends after finitely many steps (if defined at all), and is implementable by different devices.³⁹ Given (CTT), the arithmetization of formal languages and

³⁹ There are machine models that are beyond the power of the (universal) Turing machine, e.g. *Coupled Turing Machines* or Copeland’s *Accumulator Machines*, but they do not have finite input, so *are beyond* what is intuitively computable. These machines are notional machines only. Cf. Burgin,

Montague's Thesis

Natural languages are equivalent to some interpreted formal languages.⁴⁰

we get a version of the *computational theory of mind* – or at least – a *computational theory of cognition* with respect to processing language, which is relevant to meta-framework reasoning. In his classical paper⁴¹ on computing machines Turing constructively proves two sides of an equivalence

- (i) If a TM M accepts some input α , there is a FOL axiomatized theory T of the machine table of M such that $\vdash_T \alpha$ (for all and only the accepted input α).
- (ii) If there is a FOL axiomatized theory T such that $\vdash_T \alpha$, there is some TM M which accepts α (for all and only the derivable theorems α).

The first part means in the light of CTT

- (i) Everything that is intuitively computable can be captured by a derivation in FOL theory.

The second part means in the light of CTT

- (ii) Every derivation of a FOL theory is intuitively computable.

So, TMs and FOL (theories) are computationally equivalent. This is the backbone of the idea and claim that everything logical (in the narrow sense of being algorithmically computable) can be captured by FOL. In that sense FOL is the universal logic. Another thesis, *Hilbert's Thesis*, therefore claims that any cogent reasoning anywhere in mathematics can be given a FOL rendering. So, FOL *can* be used universally – but should it?

In cases of semantic closure and self-reference by identifying object and meta-language FOL yields both paradoxes and (by *ex falso quodlibet*) triviality of the meta-theory.⁴² In the reasoning concerning the Liar:

$$(\lambda) \quad \lambda \text{ is not true.}$$

Super-Recursive Algorithms; Copeland (Ed.), *Hypercomputation*; Siegelmann, *Neural networks and analog computation*.

⁴⁰ Cf. Montague, *Formal Philosophy*. This extends to semantics what has been called *Chomsky's Thesis*: Natural languages are equivalent to some formal language. Both are presupposed if not explicitly endorsed even by early Logical Empiricists.

⁴¹ Turing, "On computable numbers, with an application to the Entscheidungsproblem".

⁴² Cf. Priest, *In Contradiction* for a wider reflection of these issues (including the problem of meta-language hierarchies, set theoretical universality and the accommodation of Gödel's *Incompleteness Theorems* in a universal meta-language). Cf. Bremer, *An Introduction to Paraconsistent Logics* on systems, including system able to be a Universal Logic. Brady developed Universal Logic(s)

we make use of intuitive principles of semantic self-ascription, the intuitive *Convention T* (Tarski's scheme for "true") and FOL reasoning to derive at " $\lambda \equiv \neg \lambda$ " and " $\lambda \wedge \neg \lambda$ ".

Intuitively valid reasoning leads to the contradiction. By CTT it can be completely rendered in FOL. FOL – and computationally equivalent systems like Lambda Calculus – are consistent in their bare form, not if one adds axioms which are inconsistent (like those leading to λ). The Liar reasoning can be formalized in FOL, but is, of course, explosive in FOL (leading to a trivial, all sentences encompassing theory). What is intuitively computable is computable by some formal system S. S need not be *full* FOL to justify the idea behind the reflection on closure given the Gödel sentences (and taking them to be *provable contradictions* in that *universally closed* system S). So, system S will be computable, and the paradoxical arguments do not contradict CTT.

It is possible to have a FOL (classical) meta-theory for any universal logic – but the aspiration of a truly universal logic, of course, must be to be able to express *its own meta-theory*. By *Tarski's Theorem* a FOL theory cannot (without trivialization) contain its own semantics, whereas some paraconsistent logics can formalize semantic closure. So, our universal meta-frame, being its own meta-frame and semantically closed, should be couched in some paraconsistent logic. This looks, *prima facie*, like a massive deviation from the logical work of the early Logical Empiricists. Again, there is no deviation from the spirit of Logical Empiricism, as the very point of this move to paraconsistency is to enlarge the logician's tool box and to extend formal treatment to areas of philosophy – namely universal meta-reasoning – that were opaque beforehand. Paraconsistency and even Dialetheism (the view that there are true contradictions) can be embraced by Logical Empiricism. Whereas paraconsistency and Dialetheism can be the outflow of a corresponding controversial and extravagant metaphysics (like in Priest's work⁴³), even Dialetheism can be cleared of such commitments and understood in the fashion of a *Minimal Dialetheism*, which claims that the methodological tenets of a truly universal philosophy, semantics and logic are to be taken seriously, even if one has to admit some (namely metarepresentational) true contradictions (like the Liar, Berry's Paradox etc.).⁴⁴ A Logical Empiricism committed to a universal framework thus must and can 'bite the bullet' of some metarepresentational antinomies without engaging in a wider metaphysics of

over many years (cf. Brady, *Universal Logic*). A related approach is followed in Neil Tennant's research program on a 'Core Logic' sufficient for meta-logical reasoning, basic arithmetic and managing belief changes (cf. Tennant, *Core Logic* and *Changes of Mind*).

⁴³ Cf. *inter alia* Priest's books *Beyond the Limits of Thought* and *Towards Non-Being*.

⁴⁴ Cf. Bremer, "Believing and Asserting Contradictions".

inconsistent objects. Modelling such reasoning about inconsistent objects proceeds by building inconsistent possible worlds by switching the logic employed in constructing (ersatz) possible worlds to a paraconsistent logic.

Universal Logic structures the field of language framework building. Following an approach of this type Logical Empiricism captures its own meta-reasoning and bans appeals to needed intuitions, pragmatic decisions without argument – or whatnot.

Manuel Bremer, 2024.

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