

# Carnap and Quine

by

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## Abstract

Carnap, one of the foremost representatives of the Vienna Circle movement of Logical Positivism, and Quine, who mutated and hybridized their ideas with those of American Pragmatism, set the agenda for much of twentieth century philosophy in the analytical and empiricist tradition. We examine their points of contact and divergence, and how their intellectual legacy continues to shape and be altered by the work of their successors.

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## 1 Personal reflections

Carnap more than anyone else, more than Wittgenstein, was the individual embodiment of logical positivism, logical empiricism, the Vienna Circle. ... I find much to disagree with in Carnap. A lot of my work has been motivated by this disagreement. This was one reason why I dedicated *Word and Object* to him; the other reason was that I had learned so much from him. I think that in the past 35 years of philosophy no figure has loomed larger than Carnap, and only Wittgenstein as large.

— from a letter from Quine to Ernest Moody, 21 January 1963

At the end of my paper ‘The Life and Work of the Early Carnap’<sup>1</sup>, I recounted how Lewis had written to Carnap in 1934 to say “Some day I hope that some member of your group may publish a paper in which some comparison may be made between your views and the pragmatism of Peirce and James and Dewey”. Carnap had just received, early in 1933, a visit in Prague from Quine. This paper picks up the threads of that story. It seeks to take philosophical stock on some contested topics in metaphysics, epistemology and the philosophy of logic, language, mind and science, and to survey the impact of Carnap and Quine on some current trends.

There is a saying that my colleague Philip Pettit attributes to Martin Hollis. It is that Quine is like Kant, but with all the steel replaced by elastic. I prefer rather to think of Quine as having taken the Kantian corset from the comely contours of Mother Nature (recall the discussion of Mama and masses in *The Roots of Reference*) and having replaced all the whalebone with elastic.

## 2 Background to the confluence of thought of Carnap and Quine, I: The pristine vision of Logical Positivism

It is easy, with hindsight, to belittle the legacy of Logical Positivism. But in its day its proponents were intellectually and morally brave men and women. Their vision was rational, scientific and historically informed enough to lend their endeavours, in the midst of great scientific breakthroughs, a sense of

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<sup>1</sup>in N.Rescher (ed.), *Scientific Inquiry in Philosophical Perspective*, University Press of America, 1986, pp.261-80

excitement and adventure. Some were committed socialists. Some were in the midst of the Bohemian foment of personal values. All were free-thinkers.

The Vienna Circle does not confine itself to collective work as a closed group. It is also trying to make contact with the living movements of the present, so far as they are well disposed toward the scientific world-conception and turn away from metaphysics and theology. ... The vitality that shows itself in the efforts for a rational transformation of the social and economic order, permeates the movement for a scientific world-conception too.<sup>2</sup> No special 'philosophic assertions' are established, assertions are merely clarified; and at that assertions of empirical science<sup>3</sup> ... The representatives of the scientific world-conception resolutely stand on the ground of simple human experience. They confidently approach the task of removing the metaphysical and theological debris of millenia.<sup>4</sup>

And as Herbert Feigl trenchantly put it years later<sup>5</sup>:

There is nothing dogmatic or ritualistic in our movement. It is *not* a religion. Quite to the contrary, it is a reaction against and an emancipation from the bondage of metaphysical dogma and speculation.

Their influence reached out to many disciplines: law, economics, sociology — even architecture. (Carnap was once invited to lecture at the *Bauhaus*.

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<sup>2</sup>This stirring prose is from the *Ernst Mach Verein's* publication of 1929 entitled *Wissenschaftliche Weltauffassung: Der Wiener Kreis*, at p.14 (p.305 of the English translation; see below). No authors' names appear on the title page of this pamphlet, but its preface bears the names of Hans Hahn, Otto Neurath and Rudolf Carnap on behalf of the *Verein*. In the only extant English translation I know of (but carrying the German title), Marie Neurath has supplied an editorial reference to the effect that "... Neurath did the writing, Hahn and Carnap edited the text with him ... Carnap and Hahn's widow gave us their permission to include the pamphlet among Otto Neurath's writings." The edited translation is at pp.299-318 in Marie Neurath and Robert S. Cohen (eds.), *Otto Neurath — Empiricism and Sociology*, Vienna Circle Collection Vol.1, Reidel, Dordrecht, 1973. Subsequent page references are to this translation and will be prefaced by *WW*. *Wissenschaftliche Weltauffassung* was written as a manifesto for the Vienna Circle, in celebration of Moritz Schlick's decision to decline a 'very tempting call to Bonn'. His continuing patronage of that extraordinary group of intellectuals confirmed them in their sense of group identity and common purpose.

<sup>3</sup> *WW* p.316

<sup>4</sup> *WW* p.317

<sup>5</sup>'Some Major Issues and Developments in the Philosophy of Science of Logical Empiricism', in H.Feigl and M.Scriven (eds.), *The Foundations of Science and the Concepts of Psychology and Psychoanalysis*, Minnesota Studies in the Philosophy of Science, Vol.I, University of Minnesota Press, 1956, pp.3-37; at p.4

The most prominent line in his notes for that occasion was *Weg mit der Metaphysik!*.) Their Diaspora was yet to come.

## 2.1 The main tenets of logical positivism

*Pace* their own protestation to the contrary<sup>6</sup>:

(t)he scientific world-conception is characterised not so much by theses of its own, but rather by its basic attitude, its points of view and direction of research ... ,

there were what most philosophers would regard as theses on offer from the Vienna Circle. These can be roughly and telegraphically summarized as follows:

1. There is no “first philosophy”: “... *there is no such thing as philosophy as a basic or universal science alongside or above the various fields of the one empirical science*; there is no way to genuine (*inhaltlicher* — NT) knowledge other than the way of experience; there is no realm of ideas that stands over or beyond experience.”<sup>7</sup>
2. Unity of scientific method — “The goal ahead is *unified science*.<sup>8</sup> ... The aim of scientific effort is to reach the goal, unified science, by applying logical analysis to the empirical material.”<sup>9</sup>
3. Denial that there are synthetic *a priori* truths — “It is precisely in the rejection of the possibility of synthetic knowledge *a priori* that the basic thesis of modern empiricism lies. The scientific world-conception knows only empirical statements about things of all kinds, and analytic statements of logic and mathematics.”<sup>10</sup>
4. Famous (notorious?) ‘first dogma’: analytic/synthetic (or logical/factual) distinction. Meaning postulates. Extricability of fact and meaning — “Through the application of the *axiomatic method* ... the empirical components always separate from the merely conventional ones, the content of statements from definitions.”<sup>11</sup>.

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<sup>6</sup> *WW* pp.305-6

<sup>7</sup> *WW* p.316; emphasis in original

<sup>8</sup> *WW* p.306; emphasis in original

<sup>9</sup> *WW* p.309

<sup>10</sup> *WW* p.308. This view was put forward unequivocally by Schlick in his *Allgemeine Erkenntnislehre*, Springer, 1918.

<sup>11</sup> *WW* p.312; emphasis in original

5. Famous (notorious?) ‘second dogma’: reductionism (especially of the intentional and the intensional) — to sense data; or to physics — “Since the meaning of any statement of science must be statable by reduction to a statement about the given, likewise the meaning of any concept, whatever branch of science it may belong to, must be statable by step-wise reduction to other concepts, down to the concepts of the lowest level which refer directly to the given.”<sup>12</sup>.
6. The basis question: where does entification begin? Epistemic immediacy v. constructional adequacy.
7. Famous (notorious?) ‘third dogma’: scheme/content distinction.
8. Basis question for psychology (and semantics): observable behaviour — “The attempt of behaviorist psychology to grasp the psychic through the behaviour of bodies, which is at a level accessible to perception, is, in its principled attitude, close to the scientific world-conception.”<sup>13</sup>
9. A single over-arching scheme of empirically analysable concepts. The method of logical analysis to be employed in the construction of this scheme.<sup>14</sup>
10. Verification principle. Criterion of cognitive significance. Principle of demarcation between science and metaphysics.
11. Decidability (in principle) of all cognitively meaningful questions.<sup>15</sup> — “The scientific world-conception knows *no unsolvable riddle*.”<sup>16</sup>
12. Observational/theoretical distinction. Protocol sentences.

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<sup>12</sup> *WW* p.309

<sup>13</sup> *WW* p.315

<sup>14</sup>This of course was Carnap’s great task in the *Aufbau*.

<sup>15</sup>An interesting discussion of the ramifications of this principle, and how it motivated what he calls the principles of *methodological atomism* and *methodological nominalism*, can be found in J.F.Hanna, ‘The Logic of 20th-Century Empiricism’, in N.Rescher (ed.), *The Heritage of Logical Positivism*, University Press of America, 1985, pp.29-53.

<sup>16</sup> *WW* p.306; emphasis in original. Carnap was later to abandon this viewpoint in the wake of the undecidability results in logic. In §34a ‘Incomplete and Complete Criteria of Validity’ in his *Syntax*, he criticizes Schlick for saying that directly a sentence is understood, it is also known whether or not the sentence is analytic. Carnap concedes that ‘... a sentence is only understood when the rules of application are clear. But the crux of the matter is that it is possible to be clear about the rules of application without at the same time being able to envisage all their consequences and connections.’

13. Possibility of formalized inductive logic. Rationality of theory revision and scientific change. Commensurability of competing theories.
14. Naturalism/physicalism/materialism: all things and events are physical things and events; with classes and numbers perhaps admitted as well.
15. Anti-modalism; anti-mentalism; extensionalism.
16. (once entertained:) Constructivism — every individual in the range of variables is to be denoted by a closed term of the language; and varying degrees of finitism — the theory has a finite model; the theory has only finite models; the theory has only models of cardinality less than some finite number.
17. Molecularity in semantics.
18. Material v. formal mode.
19. Justification of choice of logic: it is analytic. Conventionalism about logic and physical geometry (the metric). Logicism about mathematics.
20. Fact/value distinction. Emotivism in ethics.
21. Principle of Tolerance: “*It is not our business to set up prohibitions, but to arrive at conventions.* ... Everyone is at liberty to build up his own logic, i.e. his own form of language, as he wishes. All that is required of him is that, if he wishes to discuss it, he must state his methods clearly, and give syntactical rules instead of philosophical arguments.”<sup>17</sup> (Later this developed into Carnap’s account of external v. internal questions in ontology, appealing to the notion of a linguistic framework.)<sup>18</sup>

## 2.2 Influences on Carnap

The philosophy of Carnap, strongly representative of the general outlook just characterized above, was in large measure a response to challenges to the Kantian framework that arose from scientific revolutions at the turn of

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<sup>17</sup> *Syntax*, §17

<sup>18</sup> as observed also by Hanna, *loc. cit.*, p.39. fn.15.

the century, and Frege's foundational work on logic and the structure of language.

Carnap was Frege's student in Jena. The influence of Frege, mediated by Carnap and Quine among others, is with us still today. There is the continuing emphasis on the necessity of language for thought; on the univocal sense of the existence predicate (a higher order one), and consequent willingness to accommodate abstract ontology; contextualism in semantics; and the emphasis (at least in the earlier days) on the axiomatic method, and foundationalism.

The influence of Kant is also obvious in the philosophical programme that Carnap set himself. His doctoral dissertation, *Der Raum* (1921), sought to recover a more modest spatial *a priori* in the *topological* core common to the competing geometries after Einstein's revolution. The *metric* was man-made, conventional. Carnap's *Habilitationsschrift*, under the direction of Schlick in Vienna, consisted in part of Part I of *Der Logische Aufbau der Welt* (published in full in 1928). In this great piece of constructional ontology, he sought to apply the extensional method of *Principia Mathematica* to Russell's problem of how to construct the external world from sense data. The program, however, was still neo-Kantian. He was attempting to bring rigorous detail to Kant's synthesis of the manifold of appearances.

In this work we have the first hint of Carnap's philosophical hallmark, the principle of tolerance. He does not *insist* on an autopsychological constructional basis, but merely seeks to show that it is a possibility<sup>19</sup>. Other protocols, perhaps, would do — including observation sentences (or observation categoricals<sup>20</sup>) about middle-sized objects. His methodological solipsism is confined to a single primitive relation: recollection of similarity between cross-sections of the stream of experience (*Gestalt*'s). He does not claim to be giving analytically necessary and sufficient conditions for perceptual beliefs, but claims only that he is providing what he calls a *quasi analysis* of their constitutive genesis and referential import. The work foreshadows other developments, found in *Logische Syntax der Sprache* (1934), which culminated the linguistic turn. There the Principle of Tolerance is explicitly formulated, with the ironic injunction *In logic, there are no morals*. The distinction is made between the material and the formal modes. We are warned against lapsing into meaningless metaphysical wrangles should we

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<sup>19</sup> Professor Quine, in his comments, said he thought that this catholicity was by way of afterthought, and at the behest of Neurath. The real author of the *Aufbau* was, in Quine's view, a phenomenalist.

<sup>20</sup>cf. Quine, *The Pursuit of Truth*, Harvard, 1990, p.10

address in the material mode questions that would be properly introduced in the formal mode, as questions about the logical syntax of our language.

The guiding thought behind the *Syntax* is that one needs to provide a comprehensive theory of the different forms of language that may be used for scientific purposes. This theory is to involve only formal syntactic properties and relations. It is to be a theory of signs as grammatical patterns, involved in inferential relations determined by their form, not their content. It is sometimes difficult to understand, even at this brief historical remove, how new at the time the idea was that reasoning in the mathematical sciences is a matter of form, not content. The philosophical pre-occupation with linguistic form as an object of study in its own right may have played some inspirational part in Gödel's development, at about that time, of his ideas concerning arithmetization of syntax.

### 2.3 A hallmark of Carnap's philosophical character: his response to Tarski's theory of truth

In due course this purely syntactic approach was to be widened to include the formal semantics of the formalized languages, once the importance of Tarski's theory of truth<sup>21</sup>, also developed around this time, took hold in the minds of logicians and philosophers in central Europe. Indeed Carnap was in the vanguard for the new semantical approach, advocating its potential fruitfulness for philosophy. A remarkable document entitled 'Ueber den semantischen Wahrheitsbegriff'<sup>22</sup>, dated 18.7.37, and probably circulated privately among his colleagues, shows him arguing that their differences of opinion over the philosophical importance of Tarski's theory should be hammered out among themselves, and that they should not go public with their disagreements until they had taken the opportunity to resolve the matter by rational and informed debate within the inner circle. Carnap, of course, was a strong advocate of the value to philosophers of Tarski's theory of truth. His modest account, in his *Intellectual Autobiography*, of his rôle as an advocate for the new field of semantics probably does not do justice to the service he rendered the philosophical community. It is worth letting a long passage from the aforementioned document speak for itself:<sup>23</sup>

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The situation at present is this: One group among us (consisting of

<sup>21</sup>'The concept of truth in formalized languages', in *Logic, Semantics, Metamathematics*, tr. and ed. J.H. Woodger, Oxford University Press, 1956

<sup>22</sup>RC 080-32-01

<sup>23</sup>author's translation

the Poles, especially Kotarbinski, Tarski, Lutman, and the Chicagoites, Carnap, Hempel, Helmer) intend to busy themselves with Semantics, and are of the opinion that this will prove to be useful for the overall work of our movement; this group defines semantic concepts, among which is a particular concept which in their view agrees as closely with the meaning of the word 'true' in ordinary language as is at all possible in connection with concepts of ordinary language. They therefore regard the application of the word 'true' for this concept as natural and useful. Another group among us (especially Neurath, possibly also Ness and others) have misgivings about the semantic concepts and especially about the aforementioned concept, and moreover especially about the application of the word 'true' for this concept. They are afraid that behind the semantical concept there lurk dangers of metaphysics. (*Sie befürchten, dass hinter den semantischen Begriffen Gefahren der Metaphysik lauern.* — NT) They recommend avoiding the semantic concepts as far as possible, and replacing them with scientific-logical concepts, that is, with syntactic ones. Perhaps they think also that this replacement is always possible; this however is not the case.

We cannot expect as a result of the expression of our views that the first group will give up their intention to work in Semantics, and their hope that something fruitful will come of it; nor, in addition, that the second group will drop their misgivings and fears. I would like to think, however, that both groups might adopt the following attitude in their publications, in order to avoid bringing present differences of opinion prematurely into the open and in an overstated form. With really deep differences of opinion that would naturally be unavoidable. But I am of the opinion that with the questions at issue here we have to do with only temporary unclarities and mutual misunderstandings, which will have disappeared within the next few years. ...

1. Suggestion for the group of those who wish to pursue Semantics and who in doing so are empirically and antimetaphysically minded. They should — out of concern not only for themselves, but above all for their readers also — devise terminology and formulations so that the demarcation of metaphysical problems always remains clear. ...
2. Suggestion for the group of those who have misgivings about the semantic concepts. They should at first adopt a policy of wait-and-see and not polemicize in public against Semantics as a whole, until its further development allows one to see, firstly, whether this work in the field of Semantics is fruitful for science and especially for our collective task of scientific analysis, and

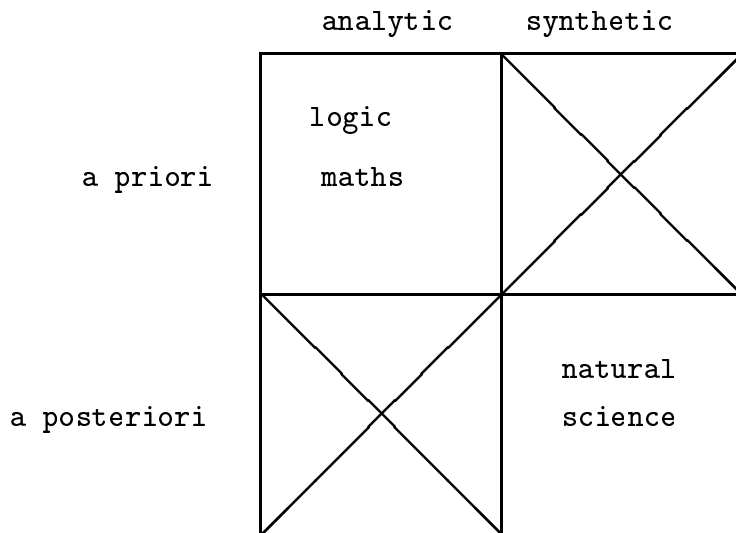
secondly, whether the feared danger of a slide into metaphysics really does arise.

## 2.4 The impact of Gödel's incompleteness theorem

As Carnap notes in his own intellectual autobiography, one of the major 'insights' of Logical Positivism was that logic *and mathematics* were analytic; while empirical science was synthetic. Kant's guiding category of the synthetic *a priori* was evacuated by Logical Positivism. Arithmetic was thought to have been assimilated or reduced to logic by the Fregean or Russellian definitions of number in 'logical' terms, and the consequent derivation of basic arithmetical laws within class theory or type theory. Geometry was splintered: formal geometry was analytic, going the same way as number theory; while physical geometry, in the wake of the theory of special relativity, was now regarded as wholly empirical. Other important Kantian synthetic *a priori* truths were discredited, and demoted to a posteriori status. The Kantian principle of substance (construed as conservation of mass<sup>24</sup>) was shaken by relativity theory, and the fundamental principle of cause (that every event has a cause) was shaken by quantum theory. The diagonalization of the analytic-synthetic/a priori-a posteriori diagram was complete:

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<sup>24</sup>but see C.F.von Weizsäcker's re-interpretation of the principle of substance as concerning instead mass-energy: 'Kants's "First Analogy of Experience" and Conservation Laws of Physics', *Synthese* 23, 1971, pp.75-95



It took time for the consequences of Gödel’s discovery of the incompleteness of formal arithmetic to sink in. There was no immediate rush to resurrect arithmetic truths as synthetic.

Now it has been claimed that there is evidence in the *Syntax* that Carnap had not fully absorbed the implications of Gödel’s result for the claimed analyticity of arithmetic<sup>25</sup>. Limitations of space prevent me from taking issue here with this claim; and its thorough investigation would also be at best tangential to my main concern, which is to study the relationship between the thought of Carnap and Quine<sup>26</sup>.

Carnap, anyway, would have been in exonerating company even if Friedman’s diagnosis and criticism is correct. For in ‘Truth by Convention’ (1935) one finds Quine acquiescing with the main claim that *Principia Mathematica* had successfully reduced arithmetic to logic.

Tardy though he might have been to seize on Gödel’s result to call into question the analyticity of arithmetic, Quine perhaps had a more important reason not to worry himself unduly about the classification or reclassification of arithmetic truth within the famous four-celled box. For he

<sup>25</sup>cf. M.Friedman, ‘Logical Truth and Analyticity in Carnap’s “Logical Syntax of Language”’, in W.Aspray and P.Kitcher (eds.), *History and Philosophy of Modern Mathematics*, Minnesota Studies in the Philosophy of Science, Vol.IX, University of Minnesota Press, 1988, pp.82-94.

<sup>26</sup>I try to give a detailed rebuttal of Friedman’s assessment in ‘Carnap, Gödel and the Analyticity of Arithmetic’ (unpublished).

was about to obliterate the internal partitions of that box anyway<sup>27</sup>.

### 3 Background to the confluence of thought of Carnap and Quine, II: The spirit of American Pragmatism

William James was as keen to disavow any particular theses on behalf of pragmatism as the Viennese pamphleteers had been for logical positivism:

A pragmatist turns his back resolutely and once for all upon a lot of inveterate habits dear to professional philosophers. He turns away from abstraction and insufficiency, from verbal solutions, from bad *a priori* reasons, from fixed principles, closed systems, and pretended absolutes and origins. He turns towards concreteness and adequacy, towards facts, towards action, and towards power. That means the empiricist temper regnant, and the rationalist temper sincerely given up. It means the open air and possibilities of nature, as against dogma, artificiality and the pretence of finality in truth.

At the same time it does not stand for any special results. It is a method only. But the general triumph of that method would mean an enormous change in ... the 'temperament' of philosophy. Teachers of the ultra-rationalistic type would be frozen out, much as the courtier type is frozen out in republics, as the ultramontane type of priest is frozen out in protestant lands. Science and metaphysics would come much nearer together, would in fact work absolutely hand in hand.<sup>28</sup>

James was out to extract the whalebones:

Pragmatism unstiffens all our theories, limbers them up and sets each one at work. Being nothing essentially new, it harmonizes with many ancient philosophic tendencies. It agrees with nominalism for instance, in always appealing to particulars; with utilitarianism in emphasizing practical aspects; with positivism in its disdain for verbal solutions, useless questions, and metaphysical abstractions. ... It has no dogmas,

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<sup>27</sup>As Putnam has pointed out, Quine's attack on the analytic-synthetic distinction is just as much an attack on the *a priori-a posteriori* distinction. See his essay ' "Two Dogmas" Revisited' in *Realism and Reason, Philosophical Papers Vol. 3*, Cambridge University Press, 1983, pp.87-97.

<sup>28</sup>William James, 'Lecture II: What Pragmatism Means', at p.31 in the combined edition *Pragmatism and The Meaning of Truth*, Harvard University Press, 1978. Subsequent page references will be to this edition.

and no doctrines save its method. ... No particular results, then,..., but only an attitude of orientation, is what the pragmatic method means. *The attitude of looking away from first things, principles, 'categories', supposed necessities; and of looking towards last things, fruits, consequences, facts.*<sup>29</sup>

James concludes on an almost millenarian note, as one could only if one were innocent of Voltaire's *Candide*:

(Pragmatism's) manners are as various and flexible, her resources as rich and endless, and her conclusions as friendly as those of mother nature.<sup>30</sup>

The corset was about to crumple. Pragmatism might have been able to claim freedom from dogma; logical positivism, we have just seen, definitely not. A young American visitor was making his way to Vienna, to an historic encounter, personifying in his life and work what James said of 'new truth':

New truth is always a go-between, a smoother-over of transitions. It marries old opinion to new fact so as ever to show a minimum of jolt, a maximum of continuity.<sup>31</sup>

## 4 The first meeting in Prague

The *Syntax* was about to be published when Quine visited Carnap in Prague in 1933. The Hillman Special Collection has some remarkable notes made by Carnap about their exchange on that occasion. Bear in mind that 1951 was the date of publication of 'Two Dogmas of Empiricism'. Almost two decades earlier Carnap made this record<sup>32</sup>:

Quine, 31.3.33

He said after reading my MS 'Syntax': 1. Is there a principled distinction between the logical laws and the empirical statements? He thinks not. Perhaps though it is only expedient, I seek a distinction, but it appears he is right: gradual difference: they are the statements that we want to hold fast.

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<sup>29</sup>'What Pragmatism Means', p.32; emphasis in the original

<sup>30</sup>*loc.cit.*, p.44

<sup>31</sup>*loc.cit.*, p.35

<sup>32</sup>RC 102-60-12; author's translation

With the writing of 'Truth by Convention' in 1935, the worry was touched on as follows:

... there is the apparent contrast between logico-mathematical truths and others that the former are a priori, the latter a posteriori; the former have "the character of an inward necessity" in Kant's phrase, the latter do not. Viewed behavioristically and without reference to a metaphysical system, this contrast retains reality as a contrast between more and less firmly accepted statements; and it obtains antecedently to any *post facto* fashioning of conventions. There are statements which we choose to surrender last, if at all, in the course of revamping our sciences in the face of new discoveries; and among these there are some which we will not surrender at all, so basic are they to our whole conceptual scheme. Among the latter are to be counted the so-called truths of logic and mathematics, regardless of what further we may have to say about their status in the course of a subsequent sophisticated philosophy.

The issue was still under discussion in Santa Fe, 7-9.9.1949:<sup>33</sup>

Main difference: Quine sees much in terms of differences in degree (with not even a crude boundary line through aggregations), where I want to draw a boundary line ...

'Conceptual scheme': This includes for him the structure of language, as well as the recognised laws and the recognized singular statements; empirical science, mathematics, logic, everything is together and inseparable. There is only the difference in degree of readiness to give something up as might be required by new experiences. At the centre stand: logic of truth tables (this will be the most difficult to give up, and so, if one wished to put it that way, 'analytic' in the highest degree); near to that lower predicate logic; arithmetic; higher mathematics; laws of theoretical physics; etc.; finally at the periphery singular observable facts.

Semantics appears to him to be comprehensible and useful only if for each semantic concept it is clear which pragmatic concept it is supposed abstractly to reconstruct.! For 'statement' ('Satz') and 'denoting' that is clear; for 'analytic', 'intension', 'designatum (in the intensional sense)', 'synonym', not at all.

Nor is this the only mainstay of Quinean thought that made such an early appearance. Here is a passage from an unpublished address<sup>34</sup> to the American Philosophical Association in Princeton in 1937:

<sup>33</sup>RC 102-62-02; author's translation

<sup>34</sup>'Is logic a matter of words?', 12 pp., 102-61-05 in Carnap Archive

As to the plausibility of the doctrine (the linguistic view of logic), some support may be gained from the abstract consideration of an anthropological problem: the problem of determining whether a certain tribe of unknown tongue shares our logic. Before testing whether these savages accept a given logical principle, we must translate the principle into their language; and before doing this we must construct a dictionary of translation. We can identify many words for our dictionary, words of concrete meanings, simply by direct correlation with features which were prominent in the environment when the words were uttered. But the words relevant to logical principles, such particles as “is”, “if”, “not”, “and”, “every”, cannot be translated by this direct method; we must examine rather the general manner of use within contexts other words of which we have learned by the direct method. And among such contextual criteria of translation we will surely include conformity to the basic logical principles which characterize our use of “is”, “if”, etc. We will thus find the savage conforming to our logic, but only because of our so choosing our translations as to preserve logic.

## 5 The blurring of the vision

Thus there is historical evidence aplenty of how early Quine’s dramatic departures from the received wisdom of Logical Positivism were conceived. The shift from dichotomies to gradations, the basing of intensional notions in observable behaviour, the approach to meaning via radical translation, reached their mature expression only years later. It took time to replace all the whalebone with elastic. In its most developed and extreme form, Quine’s doctrine came to incorporate the following fundamental claims in the theory of knowledge and meaning:

1. There is no analytic/synthetic distinction. *Any* statement *can* be revised; *no* statement *has* to be.
2. The unit of empirical significance is the whole theory.
3. The meaning of a word or sentence derives from its place in the whole theory or language to which it belongs.
4. Language learning (mastery of meaning) in the case of the infant (*The Roots of Reference*) and in the case of the radical translator (*Word and Object*) is based entirely on observation of behaviour. On this basis one can distinguish various types of meaning, such as stimulus meaning and occasion meaning. But one cannot, in the case of theoretical sentences

generally, mark out which ones would be true simply on the basis of their meaning.

5. There are empirically equivalent but logically incompatible theories.
6. The respective contributions of perceived fact and grasp of meaning cannot be factored out from any belief we hold.
7. Talk of ideas in semantics is useless. Translation is indeterminate.
8. Reference is inscrutable: there is no way of knowing exactly what is being referred to by another speaker's words, even when one knows the general conditions under which their assertions are true (or false).
9. One can tell what things a theory is committed to by looking at what has to be included in the range of its individual variables in order for its statements to be true.
10. Classical logic is correct. In particular, the use of excluded middle is justified, because every declarative sentence is definitely true or false.
11. Science is extensional. The world consists only of physical objects and classes of physical objects, classes of these, classes of classes of these, ... and so on.
12. Mathematics can be developed within pure class theory; the ontological commitments of the former can be assimilated to those of the latter.
13. Perceptual beliefs are caused by stimulations of nerve endings and the linguistically conditioned application of innate standards of similarity.
14. We start with ordinary middle-sized objects ('Entification begins at arm's length'); and science builds out from there, postulating both smaller contained particles and larger containing systems, subject to various forces and laws of interaction.
15. There is no 'first philosophy'; science is a continuation of common sense, and philosophy is continuous with science. The basic task of philosophy is to systematize, clarify, explicate, synthesize. The philosopher can appeal to the findings of science to make a philosophical view more plausible.

## 6 Carnap's post-positivist work

### 6.1 Testability and meaning

Once Carnap arrived in the USA, his interests focussed for a time on questions of scientific methodology and empirical meaningfulness. These occupied him from his long essay *Testability and Meaning* (written just before the move), to his paper 'The Methodological Character of Theoretical Concepts'<sup>35</sup>. The former was the first comprehensive attempt, apart from the ill-fated one of Ayer in the second edition of *Language, Truth and Logic*, to indicate in some detail how high-level hypotheses in scientific theories can derive empirical import from their connections with observation sentences. In this work we find Carnap struggling with the content of dispositional claims, as the extensional method is pushed to its limits in the face of lawlikeness and counterfactuality. He is struggling still, in the latter, to formulate a criterion of cognitive significance that will survive the collapses inflicted on those of Ayer and his successors. (Whether there is a published *reductio* of Carnap's 1956 proposal I do not know.) Ayer's famous formulation was of course an attempted refinement of the basic idea that Carnap had expressed earlier in *Philosophy and Logical Syntax* (1935) as follows:

What, then, is the method of verification of a proposition? Here we have to distinguish between two kinds of verification: direct and indirect. If the question is about a proposition which asserts something about a present perception *e.g.* "Now I see a red square on a blue ground", then the proposition can be tested directly by my present perception. If at present I do see a red square on a blue ground, the proposition is directly verified by this seeing; if I do not see that, it is disproved. To be sure, there are still some serious problems in connection with direct verification. We will however not touch on them here, but give our attention to the question of *indirect* verification, which is more important for our purposes. A proposition P which is not directly verifiable can only be verified by direct verification of propositions deduced from P together with other already verified propositions.

As late as his Intellectual Autobiography in the Schilpp volume in 1963, he writes (pp.80-81):

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<sup>35</sup>in H.Feigl and M.Scriven (eds.), *The Foundations of Science and the Concepts of Psychology and Psychoanalysis*, Minnesota Studies in the Philosophy of Science, Vol.I, University of Minnesota Press, 1956, pp.38-76

... I am inclined to believe that it is somehow possible, even in the wider framework of the theoretical language, to make a clear distinction between those terms and sentences which are cognitively significant and those which are not.

## 6.2 Modality

Relaxing the requirement of extensionality was one of the major changes to the overall doctrine of Logical Positivism. On modality, Carnap and Quine were at odds. Quine was stubborn in his view that one may not quantify into modalized contexts. In a letter dated 4 February 1938<sup>36</sup> he wrote to Carnap:

... I talked at length with Hempel, learning your new views. He has told you I am alarmed by them; v. infra ... I proceed to inveigh against your recent intensional propensities ... I fear your principle of tolerance may finally lead you to tolerate even Hitler.

Carnap underlined the last remark and placed an exclamation mark in the margin. In his reply dated 11 February<sup>37</sup> Carnap writes:

Your sermon against my sin of intensionality has made a great impression on me. But I may say as an apology, I do not indulge in this vice generally and thoroughly. I used an intensional meta-language only for certain special purposes and I found it useful and even necessary for these purposes, namely for the investigation of the relation of translation between an extensional and intensional language. It seems to me that certain interesting results are found in this way. Although we usually do not like to apply intensional languages, nevertheless I think we cannot help analyzing them. What would you think of an entomologist who refuses to investigate fleas and lice because he dislikes them?

The correspondence continued at some length, until a letter of Quine's dated 4 December 1946<sup>38</sup>:

The issue between us over extension and intension, though still unresolved, seems to me to have reached a plateau. I think we did accomplish a good deal toward ironing out misunderstandings in the preliminary correspondence, and that it is all right to let the public in.

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<sup>36</sup>102-61-04

<sup>37</sup>102-61-03

<sup>38</sup>RC 30

The public seem to have vindicated Carnap's initial tolerance of this line of enquiry, producing new semantical treatments of such quantification. These exploit possible worlds containing (and here's the rub) supposedly re-identifiable individuals within their domains. Re-identifiable, that is, as one imaginatively journeys from world to accessible world through possibility space.

### 6.3 Probability and induction

The move from truth values to probabilities was another major departure from Logical Positivism, transmuting it into Logical Empiricism. Another major ingredient in this change was the move from a sense-datum basis for the construction of scientific knowledge to a physicalistic basis, bringing with it intersubjective verifiability at the epistemic cost of certainty in foundations (as stressed by Neurath). The principle of verifiability was relaxed so as to become the principle of confirmability. No longer did one see cognitive content as based on apodeictic evidential relations that would settle the truth value of an empirical claim one way or the other. Rather, relations of inconclusive inductive support could enter into the transmission of content from periphery to core. Carnap tried to account for probabilities as logical values, and treat induction within an extended logical calculus. Logical probabilities, or confirmation values  $c(h/e)$ , attached to statements or hypotheses  $h$  relative to a body of evidence  $e$ . The inductive logic that resulted had to be regarded as analytic. But Carnap retained also the working scientist's usual frequentist conception of probability for ascriptions of probabilities to events described in the object language. This way he sought to respect the scientist's contingent (synthetic) conjectures about statistical distributions, but also to provide an analytical inductive logic to explicate the notion of confirmation, or evidential support. This venture marked perhaps the sharpest disagreement in approach to scientific methodology from Popper's falsificationism and hypothetico-deductivism.

### 6.4 Ontology

There was a period of eight years during which Carnap and Quine corresponded without meeting. They appeared to be working in a strikingly parallel way on ontological matters, but corresponding mainly about modality. On 21 July 1949 Carnap wrote from Santa Fe<sup>39</sup>:

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<sup>39</sup>RC 18

I have just written the first version of a paper “Empiricism, Semantics and Ontology” (which deals with the problem of the admissibility of abstract entities, especially in semantics.) (sic) I discuss here also your nominalistic views together with those of Nagel and Ryle. I heard that you had recently published a paper “On What There Is”, which presumably deals with the same problem. If your paper contains anything new in comparison with your earlier papers, I should like very much to take it into consideration for my discussion. Could you perhaps send me a reprint?

Carnap’s principle of tolerance — or of the conventionality of linguistic forms, or frameworks — developed naturally into the view set forth in ‘Empiricism, Semantics and Ontology’. The main thesis of that paper had actually been formulated much earlier. In his first lecture in *Philosophy and Logical Syntax* (1935) he wrote:

Between the Realist and the Idealist there is full agreement as to the question of the reality of things of such and such sort, *i.e.* of the possibility of locating elements of such and such sort in the system of the physical world. The disagreement begins only when the question about the Reality of the physical world as a whole is raised. But this question has no sense, because the reality of anything is nothing else than the possibility of its being placed in a certain system, in this case, in the space-time-system of the physical world, and such a question has sense only if it concerns elements or parts, not if it concerns the system itself. (pp.19-20)

What this passage shows is his awareness of the so-called external/internal distinction in questions of ontology. But whereas here he holds that the external question would be without sense — as would any answer to it ( a *pseudo-thesis*) — he has moved, by the time of writing ‘Empiricism, Semantics and Ontology’, to the more moderate view that the external question can only be answered by making a pragmatic decision as to choice of framework. He now maintains a neutral stance on ontological questions — on the existence of material objects, or of abstract entities such as numbers or classes — by posing these as *external* questions about the theoretical utility of adopting one linguistic framework for one’s scientific investigations rather than another. *Internal* questions, concerning the existence (according to a theory) of entities of such-and-such a kind, were to be understood as questions posed to the theory itself, *within* the chosen linguistic framework, once that framework had been adopted and the theory developed within it. But there could be no ultimate truth of the metaphysical matter as

to what sorts of things existed, necessarily or otherwise. All one could do was advance various pragmatic considerations justifying the adoption of one linguistic framework rather than another.

Carnap's view of internal questions of existence is remarkably similar to that of Quine set out in his essay 'On What There Is'. Famously, to be is to be the value of a bound variable; and all the better if the bound variables are those of first order sentences of a given theory. All one can judge, according to Quine, is not what there is *tout court*, but rather only what there is by the lights of a given theory. One cannot have ontological commitments oneself, as it were, without a reasonably developed theory of the world involving such quantifications. Not only does one have to rebuild one's raft plank by plank while afloat, but one has to be *on* some raft or other in order to be able to claim 'Water, water, everywhere...' (or even 'Water, water, *somewhere*...')!

This interesting chapter in the development of these highly influential views in ontology is best capped with an extract from Carnap's letter from Santa Fe, dated 15 August 1949:

Was there a telepathic connection which made us think simultaneously of the possibility of meeting? I am so glad that after eight years it will at last be possible. ... I read with great interest your paper "On What There Is". I was very glad to find at the end your plea for "tolerance and experimental spirit". This is exactly the same attitude for which I plead in my paper (and which I expressed almost in the same terms, even before having read yours). Much in your discussion is illuminating: but it seems to me that there is still an underlying basic ambiguity. To formulate it in the terminology of my present paper, there seems to me to be a lack of distinction between two questions: the question of existence *within* a framework and the question of the existence of the framework itself. Well, we shall then discuss these things and many others when you are here.

## 7 The splintering of specialisms

The theses and distributions of emphasis in the philosophical programme shaped by Carnap and Quine have spawned an enormous literature. I want in this section to draw attention to just a few major areas of current interest that derive from their work in this way, and which I think will be crucial in shaping our future philosophical understanding of mind, language and reality. In mentioning these areas separately I do not of course mean to

imply that they are independent from each other. On the contrary — it is the density of their interconnections that is partly responsible for their importance. Under pressure of space, my remarks can only be schematic.

## 7.1 The status of content

Quine's attack on the analytic/synthetic distinction, his anti-ideational stance, his questioning of the determinacy of translation, his stress on constitutive holism in the face of systematicity, his fettering of such meanings as there may be to observable patterns of stimulation and behavioural response, made the *sui generis* investigation of content an unfashionable task. In due course, however, the pendulum swung from behaviourist methodology back to Cartesian intuition: introspective intuition about mental and semantic content. No longer would contemporary philosophers heed the admonition<sup>40</sup>:

The view which attributes to intuition a superior and more penetrating power of knowledge, capable of leading beyond the contents of sense experience and not to be confined by the shackles of conceptual thought — this view is rejected.

Kripke's reflections on the *queerness* of content<sup>41</sup> — its normative dimension — and Boghossian's attempted refutation of various forms of irrealism about content<sup>42</sup>, mark the rehabilitation of a philosophical staple. It had been preceded by modalist theorising about essence, identity and origin; by the injection of *haecceity* into metaphysical necessity<sup>43</sup>; and the general development of extravagant possible worlds frameworks<sup>44</sup> to accommodate resurgent intuitions about possibility, necessity and counterfactuality.

The philosophy of mind and of language has re-opened the question of the status of content under the influence, curiously enough, of the naturalising impetus of cognitive science. The current debate over whether objects and states of affairs external to the speaker (or thinker) can enter constitutively

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<sup>40</sup> *WW* p.309

<sup>41</sup> *Wittgenstein on Rules and Private Language*, Blackwell, 1982

<sup>42</sup> 'The Status of Content', *Philosophical Review* 99, 1990, pp.157-84

<sup>43</sup> S.Kripke, *Naming and Necessity*, Blackwell, 2nd edn., 1980

<sup>44</sup> S.Kripke, 'Semantical considerations on modal logic', *Acta Philosophica Fennica* 1963, *Modal and Many-Valued Logics*, pp.83-94; D.Lewis, *Counterfactuals*, Blackwell and Harvard University Press, 1973 and *On the Plurality of Worlds*, Blackwell, 1986; K.Fine, 'First-order Modal Theories. I. Sets', *Noûs* 15, 1981, pp.177-205; 'First-order Modal Theories. II. Propositions', *Studia Logica* 39, 1980, pp.159-202; 'First-order Modal Theories. III. Facts', *Synthese* 53, 1982, pp.43-122.

into the identity conditions for content probably owes some of its impetus to ecological theories of perception. I refer here to what is known as the problem of *wide v. narrow* content. Do external objects enter constitutively into the identity conditions of the thinker's mental contents? — or can a full account of his or her mental life be provided on the Carnapian basis of *methodological solipsism*?<sup>45</sup> Likewise, can external objects enter constitutively into the identity conditions for those semantic contents attached to expressions of the speaker's language?<sup>46</sup> And how are the two kinds of content related? The fundamental tenet of analytical philosophy — that thought requires talk — is being re-considered by those who have asked how language could have evolved.<sup>47</sup>, and by those who enquire after a language of thought distinct from any acquired natural language<sup>48</sup>. (Quine comes close to asking this question, but confines himself, in *The Roots of Reference*, to enquiring after the *psychogenesis* of various kinds of reference, for the individual language learner. This is a different question from that of how the *whole community* could have developed a language involving such reference, and various logical operators, in the first place. The latter question is to be answered by a suitable *glottogonic* theory.)

## 7.2 Reductionism and supervenience

The challenge to reductionism (the second dogma) was convincing, and reinforced by the scope and explanatory power of the biological sciences, which

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<sup>45</sup>For arguments for an affirmative answer to the first question, see Tyler Burge, 'Individualism and the Mental', in P.A.French, T.A.Uehling Jr., and H.K.Wettstein (eds.), *Midwest Studies in Philosophy, vol.4, Studies in Epistemology*, Minneapolis, University of Minnesota Press, 1979, pp.73-121; 'Individualism and Psychology', *Philosophical Review* 95, 1986, pp.3-45; 'Intellectual Norms and Foundations of Mind', *Journal of Philosophy* 83, 1986, pp.697-720. For arguments to the contrary, see J.Fodor, *Psychosemantics*. More recently Fodor has confessed to being so fazed by the subtlety of his own arguments in this work that he has written an article trying to re-state them: 'A Modal Argument for Narrow Content', *Journal of Philosophy* 88, 1991, pp.5-26.

<sup>46</sup>For arguments for an affirmative answer, see Putnam's 'The Meaning of "Meaning"', loc.cit.

<sup>47</sup>see Chapter 9 of my *Anti-Realism and Logic*, Oxford University Press, 1987; 'Intentionality, syntactic structure and the evolution of language', in C.Hookway (ed.), *Minds, Machines and Evolution*, Cambridge University Press, 1984, pp.73-103; and (with F.von Schilcher) *Philosophy, Evolution and Human Nature*, Routledge and Kegan Paul, 1984, esp. ch.4

<sup>48</sup>J.Fodor, *The Language of Thought*, Harvard University Press, 1979 and *Psychosemantics*, MIT Press 1987

are especially intractable to the would-be reductionist<sup>49</sup>. Yet the success of scientific explanations at all levels — postulating level-specific causal mechanisms operating on *congeries* of matter organized in more or less complex ways — has re-inforced physicalism or materialism as the right metaphysic for the world as we are coming to know it. This underlying physicalism — or physical determinationism, as it has been usefully called<sup>50</sup> — combined with the autonomy of different levels of theoretical explanation, has led to the doctrine of *supervenience*. Higher level facts supervene on lower level facts, but the theories describing the former may not be reducible to the theories describing the latter<sup>51</sup>.

The exact nature of supervenience may itself be a question for both philosophy and science; or perhaps for only one of them. One cannot quite tell whether one has here a form of solution or a new form of the original puzzle. If the mental, for example, supervenes on the physical, then is the many-one determination from below a species of *causal* determination, or a metaphysically obscure variety of epiphenomenal free-riding? And what account are we to give (to connect with the previous topic) of how our *reasons* for action (mentalistically described) give rise to the actions themselves (and their purely physical consequences)?<sup>52</sup>

### 7.3 Realism *v.* anti-realism and choice of logic

Ironically, the old logical positivist insistence on the analyticity of logic, combined with the very behaviourism about language learning and meaning mastery that is the hallmark of Quine's philosophy, has led some thinkers to take radical issue with Quine on a fundamental metaphysical point. I think here of Dummett's rejection of the principle of bivalence<sup>53</sup>, and with it the law of excluded middle, and his attempt to justify intuitionistic logic by appeal to the *manifestation requirement*. This requirement is thoroughly

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<sup>49</sup>See my 'Reductionism and holism in biology', in T.J.Horder, J.A.Witkowski and C.C.Wylie, *A History of Embryology*, Cambridge University Press, 1985, pp.407-33. See also F.J.Ayala and T.D.Dobzhansky (eds.) *Studies in the Philosophy of Biology*, Macmillan, 1974.

<sup>50</sup>G.Hellman and F.Thompson, 'Physicalism: ontology, determination and reduction', *Journal of Philosophy* 72, 1975, pp.551-64

<sup>51</sup>For an account of the reasons why physical determinationism (or supervenience) does not entail reducibility, see my 'Beth's Theorem and Reductionism', *Pacific Philosophical Quarterly* 66,1985, pp.342-54

<sup>52</sup>D.Davidson, 'Actions, Reasons and Causes', *Journal of Philosophy* 60, 1963

<sup>53</sup>*Truth and Other Enigmas*, Duckworth, 1978, esp. his essays 'Truth' and 'The philosophical basis of intuitionistic logic'



only speculate. Some theorists, notably the intuitionists, favor another logic, and there is nothing in the observable circumstances of our utterances that need persuade them to assign meaning to our two-valued scheme. (p.78)

In making analyticity hinge ... on a community-wide uniformity in the learning of certain words, we reopen the question of analyticity of logical truths; for what about disagreement over logical truths, e.g. on the part of intuitionists? We should find perhaps that some logical truths are analytic and some not ... Perhaps ... the law of excluded middle, though true by our lights, should be seen as synthetic. (p.80)

Light needs to be thrown on these lights. Continuing allegiance to bivalence and excluded middle might be justified within the Quinean scheme by an appeal to systematicity, or elegance or simplicity. The pragmatist appeals to global desiderata when detailed internal justifications cannot be constructed. One retreats to the holist or conventionalist account: we use excluded middle all the time; we need it for our investigations; in some sense it contributes, holistically, to the meanings of the logical operators; so we are justified in retaining it. The trouble is that this species of justification can be taken apart step by step, and found wanting at every step. Closer analysis reveals that we do *not* need excluded middle in science<sup>58</sup>; so whatever ‘contribution’ it may make, holistically, to alleged ‘meanings’ of logical operators is a contribution we could decline to accept. If logic is analytic, and grasp of meaning is manifestable in observable behaviour, the correct logic, unsupplemented by metaphysical speculation, is some form of intuitionistic logic<sup>59</sup>.

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<sup>58</sup>See my ‘Minimal Logic is Adequate for Popperian Science’, *British Journal for Philosophy of Science* 36, 1985, pp.325-9. The result is strengthened in *Anti-Realism and Logic*, op.cit.

<sup>59</sup>I have argued (in *Anti-Realism and Logic*) that the correct logic is what I call intuitionistic relevant logic (*IR*). It results from *relevantising* logics in a uniform way, so as always to achieve epistemic gain. To every ‘ordinary’ proof of a sequent there will be a *relevant* proof of a sub-sequent. The method was first developed, for classical logic, in my paper ‘Perfect Validity, Entailment and Paraconsistency’, *Studia Logica* 43, 1984, pp.179-98. For the intuitionistic version, see Part II of *Anti-Realism and Logic*. I have since shown (‘Intuitionistic mathematics does not need *ex falso quodlibet*’, unpublished) that *IR* allows one to relevantize intuitionistic mathematics. This is because it secures every ordinary intuitionistic consequence of any consistent set of premisses (and provides a *reductio* of any inconsistent set). Yet relevance is preserved in that the logic is free of the Lewis paradoxes. The logic also promises significant computational savings in proof-search, because of the way relevance of premisses to conclusions is analysed and exploited. This contrasts significantly with other kinds of relevance logic, which yield more complex

Quine has identified five milestones of empiricism<sup>60</sup>: the shift from ideas to words; the shift of semantic focus from terms to sentences; thence to systems of sentences; abandonment of the analytic-synthetic dualism; and naturalism. I believe this fifth milestone points the way to a sixth: semantic anti-realism. For naturalism implies it.<sup>61</sup> And semantic anti-realism in turn requires the abandonment of classical logic.

#### 7.4 Fine-structure of theories and rational revisability; prospects for a criterion of cognitive significance

The anti-realist critique exploits the principle of compositionality — that meanings of complex expressions are compounded out of the meanings of their constituents — in addition to its assumption of the determinacy of sentence meaning. This assumption can only be justified by first disposing of the doubts raised by the thesis of (if not the argument for) the indeterminacy of translation. This industry has kept several workers busy<sup>62</sup>. Compositionality, or *molecularity*, is the denial of holism in its constitutive semantic aspect. For the purposes of the anti-realist’s revisionist critique of classical logic, it suffices to rescue compositionality on just the logical operators. The extra-logical vocabulary of the language could still form a globally separable blend of local holisms<sup>63</sup>. To be sure, evidential holism continues

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decision problems than the ones for their ‘non-relevant’ counterparts. For example, by a classic result of Cook, classical propositional logic is NP-complete (‘The Complexity of Theorem-Proving Procedures’, *Proc. 3rd Annual ACM Symposium on Theory of Computing*, 1971, pp.151-158); whereas the Anderson-Belnap system  $R$  is undecidable, and even the decidable fragment  $LR$  that is obtained from  $R$  by dropping the distributivity axiom is at best ESPACE-hard (an unpublished result of A.Urquhart). Yet there is no increase in the complexity of the decision problem (= PSPACE-complete, by a result of R.Statman, ‘Intuitionistic Propositional Logic is Polynomial Space Complete’, *Theoretical Computer Science* 9, 1979, pp.67-72) when one passes from intuitionistic propositional logic to  $IR$ . See my *Autologic* (in preparation), esp. ch.1.

<sup>60</sup>‘Five Milestones of Empiricism’, pp.67-72 in *Theories and Things*, Harvard University Press, 1981

<sup>61</sup>I have argued for this in *Anti-Realism and Logic*. For an independent voicing of the same conclusion, but not *necessarily* an endorsement (despite his fn.7 on p162) of the same logical revisionism, see J.Skorupski, ‘Anti-realism: cognitive role and semantic content’, in J.Butterfield (ed.), *Language, Mind and Logic*, Cambridge University Press, 1986, pp.151-167.

<sup>62</sup>R.Kirk, *Translation Determined*, Oxford University Press, 1987; see also my *Anti-Realism and Logic*, ch.4.

<sup>63</sup>see my ‘Holism, Molecularity and Truth’, in B.Taylor (ed.), *Michael Dummett: Contributions to Philosophy*, Nijhoff, 1987, pp.31-58.

to hold; but it becomes the commonplace that revision upon *reductio ad absurdum* can only proceed when we are clear about all the assumptions that have participated in the *reductio*. Carnap put it lucidly at §82 of the *Syntax* as follows (for ‘protocol-sentence’ read ‘observation sentence’ for a more modern ring):

... laws have the character of *hypotheses* in relation to the protocol sentences; sentences of the form of protocol-sentences may be L-consequences of the laws, but a law cannot be an L-consequence of any finite synthetic class of protocol-sentences. The laws are not inferred from protocol-sentences, but are selected and laid down on the grounds of the existing protocol-sentences, which are always being re-examined with the help of the ever-emerging new protocol-sentences. ... There is in the strict sense no refutation (falsification) of an hypothesis; for even when it proves to be L-incompatible with certain protocol-sentences, there always exists the possibility of maintaining the hypothesis and renouncing acknowledgment of the protocol-sentences. Still less is there in the strict sense a complete confirmation (verification) of an hypothesis ... for the deduction of sentences having the form of protocol-sentences the remaining hypotheses must also be used. Thus *the test applies, at bottom, not to a single hypothesis but to the whole system of physics as a system of hypotheses* (Duhem, Poincaré).<sup>64</sup>

What I am at pains to deny, however, is the attempted move from any concession of *evidential* holism to a conception of the meaning of a sentence as constitutively dependent on those of all others.

If we dig our heels in against the pessimistic excess of an extreme semantic holism, two recently tarnished prospects re-present themselves. One is the prospect of accounting for rational theory revision. The move from one theory, currently refuted *en bloc*, to another theory, apparently not yet refuted, must surely have some justificatory fine structure (at least in the case where no conceptual revolution is involved, through the wholesale introduction of new implicitly defined notions). In pursuit of this prospect we have the current investigations of theory dynamics<sup>65</sup>, attracting special attention because of its computational applications in data bases.

The second prospect, if fulfilled, would help mitigate the otherwise pro-holistic implications of the concession just made, to the effect that there can be implicit definition of new notions by postulating (testable) theories

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<sup>64</sup>emphasis in original

<sup>65</sup>P.Gärdenfors, *Knowledge in Flux*, MIT Press, 1988

involving them. *Of course* highly theoretical terms depend, for their meaning, on the theories in which they are embedded. But they depend also on the multifarious ways in which those theories make contact with empirical reality, and are supported or disconfirmed by observation. The second prospect should now be obvious: can we not resurrect some notion of cognitive significance by attending carefully to the ways in which the confirming or infirming influence of observational sentences trickles in to the theoretical hypotheses involving the new terms? Is it not simply dogmatically defeatist to insist (as Quine does in *The Roots of Reference* at p.64):

To trace out the meaning of an eternal sentence deep inside the theory ... we have nothing to go on but its multifarious connections within the theory and ultimately, indirectly, with the periphery. Each of these strands being describable only by its interrelations with others, there ceases to be any clear sense in asking the meaning of a single such sentence at all.

We ought to distinguish between two projects about whose prospects one might be pessimistic:

- (1) specifying precisely the meanings of individual sentences (within the context of a theory), and
- (2) licensing individual sentences as cognitively significant (within the context of a theory) *whatever their individual meanings may be.*

The first concerns what Dummett has called *molecularity*. The second concerns what might be called *molarity* — whether the sentences have bite. Quine's pessimism about the former need not translate into pessimism about the latter.

The vicissitudes of the logical empiricist's criterion of cognitive significance have been experienced proffered definition by proffered definition. There is as yet no principled disproof of the possibility of its formulation, a disproof that would justify defeatism on (2). The task of explication is too challenging for one to throw in the towel. Quine himself wrote (*Roots of Reference*, p.34)

In the fullness of time (the child) gets to producing sentences that bear no very clear relation even to observable circumstances in the past or future; sentences, these, of myth or theory or conjecture. The

best of these sentences do enjoy some kind of connection still with observation, but the philosophers who devote themselves to the logic and methodology of science have been hard put to it to say in explicit detail just what the appropriate connections might be.

I believe there is still the prospect of fashioning a criterion that would correctly trace the lines of impregnation by empirical meaning from periphery inwards: a criterion that will mark out ‘the best of these sentences’<sup>66</sup>. If ever the basic tenets of logical positivism enjoy a cyclical second airing, the formulation of a criterion of cognitive significance will be unfinished business most worthy of attention.

## 7.5 Ambitious semantics and liberalized ontology

Similar defeatism was expressed about the possibility of a semantics for intensional discourse — involving modalities and verbs of propositional attitude. Much of Quine’s grade B idiom has been elevated to extended grade A status by methods in semantics deriving from work by Carnap and others in modal logic. Montague semantics<sup>67</sup> and Barwise-Perry situation semantics<sup>68</sup> are two of the developments I have in mind here. The price paid for taking introspective intuition about content as part of the empirical basis for an all-inclusive theory of meaning and inference is, as we can now see with the benefit of hindsight, a measure of ontological enrichment (though some would say: ontological excess). At the time of writing the *Syntax*, Carnap would not have foreseen this. In §2, *Languages as Calculi*, however, he anticipates the later extension of formal methods (albeit *semantic* methods) to treat natural languages — or at least, their most important fragments:

The method of syntax ... will not only prove useful in the logical analysis of scientific theories — it will also help in the *logical analysis of the word-languages*. Although here ... we shall be dealing with symbolic languages, the syntactical concepts and rules — not in detail but in their general character — may also be applied to the analysis

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<sup>66</sup>I have tried to formulate a criterion that pays as much attention to transmission of falsity as it does to transmission of truth, and that uses proof-theoretic techniques to isolate those lines of transmission. It appears to be free of the usual collapses of the kind wrought by Church, Ullian and others on Ayer’s original criterion and its subsequent patched versions. See my ‘Cognitive significance reclaimed: or, how to take a breath of fresh Ayer’ (unpublished).

<sup>67</sup>*Formal Philosophy*, ed. R.Thomason, Yale University Press, 1975

<sup>68</sup>*Situations and Attitudes*, MIT Press, 1983

of the incredibly complicated word-languages. The direct analysis of these, which has been prevalent hitherto, must inevitably fail, just as a physicist would be frustrated were he from the outset to attempt to relate his laws to natural things — trees, stones and so on. ... the syntactical property of a particular word-language, such as English, or of particular classes of word-languages, or of a particular sub-language of a word-language, is best represented and investigated in comparison with a constructed language which serves as a system of reference.

## 7.6 Naturalized epistemology and the possibility of a science of the mind; and the resurgence of subjectivity

This century has seen the materialization of mind, and the development of causal theories<sup>69</sup> of reference, meaning, perception and knowledge<sup>70</sup>. Darwinian thinking has extended into the domain of cognitive<sup>71</sup>, social and moral science. We are more inclined to accept the possibility of individually innate pre-dispositions or abilities, and even the view that our norms of reasoning and personal conduct could have an evolutionary basis<sup>72</sup>. We now

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<sup>69</sup>Included among these are those evolutionary theories that put forward naturally selected *functions* to endow physical tokens with their powers of representation, so as to make them tokens of a particular semantic type.

<sup>70</sup>A list of major contributions here, in addition to Quine's 'Epistemology Naturalized', would include works of D.Davidson, esp. 'Mental Events' and 'The Material Mind', in *Essays on Actions and Events*, Clarendon Press, 1980; J.J.C.Smart, 'Sensations and Brain Process', *Philosophical Review* 68, 1959, pp.141-56; U.T.Place, 'Is Consciousness a Brain Process?', *British Journal of Psychology* 47, 1956, pp.44-50; D.M.Armstrong, *A Materialist Theory of the Mind*, Routledge and Kegan Paul, 1968; H.P.Grice, 'The Causal Theory of Perception', *Proceedings of the Aristotelian Society Supplementary Volume* 35, 1961; G.Evans, 'The Causal Theory of Names', *Proceedings of the Aristotelian Society Supplementary Volume* 47, 1973, pp.187-208; H.Field, 'Tarski's theory of truth', *The Journal of Philosophy* 69, 1972, pp.347-75; H.Putnam, 'The Meaning of "Meaning"', in *Mind, Language and Reality, Philosophical Papers Vol.1*, Cambridge University Press, 1975, pp.215-71; D.Stampe, 'Toward a Causal Theory of Linguistic Representation', in P.A.French, T.E.Uehling, Jr. and H.K.Wettstein (eds.), *Contemporary Perspectives in the Philosophy of Language*, University of Minnesota Press, 1979, pp.81-102; F.Dretske, *Knowledge and the Flow of Information*, Blackwell, 1981; A.Goldman, 'A Causal Theory of Knowing', *Journal of Philosophy* 64, 1967, pp.355-72; R.Nozick, *Philosophical Explanations*, Harvard University Press, 1981; R.Millikan, *Language, Thought and Other Biological Categories*, MIT Press, 1984; to name but a few.

<sup>71</sup>See my 'In defence of evolutionary epistemology', *Theoria* 49, 1983, pp.32-48; and E.Sober, 'Revisability, a priori truth, and evolution', *Australasian Journal of Philosophy* 59, 1981, pp.68-85.

<sup>72</sup>see *Philosophy, Evolution and Human Nature, op.cit.*, for an extensive list of references. For what is meant by 'an evolutionary basis' in this connection, see my 'Evolu-

have a convincing scientific explanation of how they might have arisen (from mutations of the genes that code for the subvening physiological structures) and then been favoured by natural selection. Quine's innate standards of perceptual similarity, which could underly Carnap's *Ähnlichkeitserinnerungen*, and which form the basis of his account of perceptual knowledge and language learning, are in this regard quite unobjectionable.

But it is difficult to see how to admit such standards as innate, while at the same time being unwilling to admit *other* innate mechanisms that could help to account for the richness and variety of our abilities and experiences. The modularity of the mind/brain by evolutionary accretion could harbour innate generative mechanisms subserving a whole range of cognitive and linguistic competences<sup>73</sup>. Perhaps Quine's own behaviourist methodology is all too synchronic, ignoring the potential contribution (to the determination of grasp of meaning, conceptual repertoire, and intelligent behaviour) of innate mechanisms joining forces with current bombardment of nerve endings<sup>74</sup>.

Despite the current wave-crest of naturalising philosophy, however, there are voices counselling that something crucial is being left out of the 'big picture'. The potential Achilles heel of physicalism and modern empiricism is there in the *Aufbau* itself, when Carnap explains what his method of quasi-analysis amounts to. It is *not* meant to capture 'phenomenological reality' — the subjective aspect of perceptual experience on the part of the perceiver. It is meant only to recover the same discriminations and similarities described by the observer, whose experiential contents are to be recapitulated in their logical form alone. And this is where those of 'first philosophical' bent are most likely to focus their concerns. Vivid intuitions and introspective deliverances are pitted against what they see as the impoverishing constraint of the third-person perspective, hamstrung by the quasi-analytic or extensional method. Inter-*subjectivity*, on this view, would have to go well beyond the mere 'objectivity' that arises from corroboration of beliefs about a shared subject matter. Entification may well begin at arm's length; but *qualia* reside right inside the mind/brain<sup>75</sup>. Thus we have seen function-

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tionary *v.* evolved ethics', *Philosophy* 58, 1983, pp.289-302. See also R.Axelrod, *The Evolution of Co-operation*, Basic Books, New York, 1984.

<sup>73</sup>but see my 'Two problems for evolutionary epistemology: psychic reality and the emergence of norms', *Ratio* n.s.1, 1988, pp.47-63

<sup>74</sup>This line of thought is pushed in an interesting critique of Dummett by J.Burgess, 'Dummett's Case for Intuitionism', *History and Philosophy of Logic* 5, 1984, pp.177-94

<sup>75</sup>Not that the logical positivist would have denied this, or even been concerned about it: "Subjectively experienced qualities — redness, pleasure — are as such only experiences, not knowledge; physical optics admits only what is in principle understandable by a blind

alism defending itself against the alleged omission of qualia<sup>76</sup>. And then, quite apart from whether my green could be your red and *vice versa*, we have the champion of a distinctive process of what might be thought of as *Gestalt*-integration over time, delivering as definite integrals *what it is like to be an X*, for  $X = \text{human being, bat, koala, sturgeon, octopus, oyster, paramecium, ...}$ <sup>77</sup>

Despite this philosophical insistence on the primacy of the perceiver's metaphorical insides, our perceptual, ratiocinative and motor abilities are now the focus of intense scientific model-building, and especially *computational* investigations<sup>78</sup>. The philosophical climate in which cognitive science has found greater receptivity is due in large measure to the naturalising efforts of Quine and other epistemologists who have sought to make philosophy continuous with science. There are still dissenting voices *within* the naturalizing camp, however. Some writers clearly regard the computational model of mind as offering too little to capture the essence of (even *qualia-free*) mentation and understanding. This misgiving about the computational model is expressed in the same breath as the view that intentionality is nevertheless still something fundamentally *biological*<sup>79</sup>. There are also, of course, dissenting voices *outside* the naturalising camp. These writers have taken especial comfort from Gödel's celebrated incompleteness theorem for arithmetic to argue that human minds must transcend machines<sup>80</sup>. Finally, there

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man too." (*WW* p.310) Dennett, however, is one contemporary thinker who *does* deny qualia even this much marginal respectability: see his 'Quining Qualia', in A.Marcel and E.Bisiach (eds.), *Consciousness in Contemporary Science*, Oxford, 1989.

<sup>76</sup>These discussions usually focus on the problem of the inverted spectrum. One qualia-minded contributor to the debate is Frank ('I am what is sometimes known as a "qualia freak"') Jackson, 'Epiphenomenal Qualia', *Philosophical Quarterly* 32, 1982, pp.127-36. One functionalist who thinks qualia can be accommodated is Sydney Shoemaker, 'Functionalism and Qualia', *Philosophical Studies* 27, 1975, pp.291-315; 'The Inverted Spectrum', *Journal of Philosophy* 79, 1982, pp.357-81.

<sup>77</sup>T.Nagel, 'On What It Is Like To Be A Bat', *Philosophical Review* 83, 1974, pp.435-50 (reprinted in *Mortal Questions*). The arbitrary list of kinds of creature is mine, not his.

<sup>78</sup>The original inspiration for work in artificial intelligence derives from Alan Turing's classic paper 'Computing Machinery and Intelligence', *Mind* 59, 1950, pp.433-60.

<sup>79</sup>I am thinking here of John Searle's use of his famous 'Chinese Room Argument' to challenge the orthodox computationalist view of the mind. See his 'Minds, Brains, Programs', *The Behavioural and Brain Sciences* 3, 1980, pp.417-57. The chorus of opposition to Searle's view, especially from within the AI community, is too extensive to document here.

<sup>80</sup>See J.R.Lucas, 'Minds, Machines, and Gödel', in A.R.Anderson (ed.), *Minds and Machines*, Prentice-Hall, 1964. For counters to Lucas's argument, see D.R.Hofstadter, *Gödel, Escher, Bach: an Eternal Golden Braid*, Harvester, 1979, at pp.475-7; and *Philosophy*,

is Hilary Putnam, one of the founding fathers of functionalism, who has now disowned it, for a complicated web of reasons having little to do with qualia, permuted or absent<sup>81</sup>. For Putnam now, mental states cannot *be* computational states, although they might be emergent from and supervenient upon the latter.

After Carnap's quasi-analytic construction of the heteropsychological in the *Aufbau*, the next steps towards a naturalistic account of mental phenomena were taken by Wittgenstein and Ryle<sup>82</sup>. The mental had to be understood in terms of dispositions to behaviour. Quine is chary about dispositions, seeing them as promissory notes for a fuller scientific account of underlying structures and mechanisms. The promissory note was inflated to high-denomination currency with the advent of functionalism, according to which mental states were to be identified as functional states in a dispositional transition table that mediated between sensory input, both endogeneous and exogeneous, and motor output. I do not know whether it would be fair to lay at his door the subsequent extreme lurch to eliminative materialism<sup>83</sup>, which stresses the scientific as the *only* source of truth, one which must *displace* the folk theory of the mental. But I think it is fair to say that it was largely as a result of Quine's pioneering efforts that a climate of thought was created in which eliminative materialism could receive serious consideration<sup>84</sup>.

## 7.7 Radical interpretation

Davidson's method of radical interpretation<sup>85</sup> is both an outgrowth from Quine's thought-experiment about radical translation, and a response to a problem touched on above — that of getting clear about the relative rôles of semantic content and mental content. Semantic contents have to be assigned to sentences of a public language. Mental contents have to be ascribed to

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*Evolution and Human Nature*, *op. cit.*, ch.4, sec.8.

<sup>81</sup>see his *Representation and Reality*, MIT Press, 1988.

<sup>82</sup>Ryle's famous notion of a category mistake echoed Carnap's notion of *Sphärenvermengung* in the *Aufbau*.

<sup>83</sup>Churchland, 'Eliminative Materialism and Propositional Attitudes', *Journal of Philosophy* 78, 1981; S.Stitch, *From Folk Psychology to Cognitive Science*, MIT Press, 1983

<sup>84</sup>The folk have struck back: *cf.* L.Rudder-Baker, *Saving Belief*, Princeton, 1988; F.Jackson and P.Pettit, 'In Defence of Folk Psychology', *Philosophical Studies* 59, 1990, pp.31-54.

<sup>85</sup>'Radical Interpretation', *Dialectica* 27, 1973, pp.313-28. See also the other essays collected in *Inquiries into Truth and Interpretation* (1984) and in *Essays on Actions and Events* (1980), both Clarendon Press, Oxford.

rational agents, in the form of their beliefs and desires. The task of radical interpretation is to attribute these contents to their respective bearers all in one go, holistically on the evidence. Given beliefs and desires, one could triangulate from observed behaviour to the meanings of the sentences in the mouth of the agent; given a meaning assignment and beliefs, one could triangulate to desires; given a meaning assignment and desires, one could triangulate to beliefs. But all three are coeval; there is no independent route to a first pair, from which to determine the third. So one proceeds in such a way as to fix such truth-conditions for sentences, and assign such reasonable beliefs and desires to agents, as to maximize the apparent truth of their assertions (the principle of charity) and to make intelligible as wide a range as possible of their other, non-linguistic, intentional actions. Constraints of recursive syntax in the ascription of truth-conditions, together with evolutionarily wired drives or psychological needs, and evolutionarily tuned perceptual mechanisms, conspire to produce what determinacy there may be in our interpretation of what they think about the world, want within it, and mean about it by their words.

The other hallmark of Davidsonian philosophy, which marks it as an extension of Quine's, is his explicit conception of reasons as causes, within a framework of anomalous monism, in which there are no psycho-physical bridge laws. Davidson conceives of the complete causal story as running at the physical level. By contrast, our psychological stories, whereby we interpret agents' language, attribute to them beliefs and desires, and use these to make their intentional actions intelligible, have to eschew ultimate causal crunch. The psychological story is indispensable, autonomous, for our understanding of rational, communicative beings as such; but it cannot be reduced to the story at the physical level, and it cedes causation to the latter. Whether the enigma of mental causation is thereby solved is another matter.

## **7.8 Reality of causes and dispositions; are laws more than accidentally true generalizations?**

The metaphysical picture emerging from these contemporary labours (apart from entertaining qualia or possible worlds) is a materialist one (as Putnam puts it, the only metaphysical picture that has contemporary 'clout'<sup>86</sup>). The circle of intensional notions (belief, desire, meaning, intention, reason) may

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<sup>86</sup>'Why there isn't a ready-made world', in *Realism and Reason, Collected Philosophical Papers Vol.3*, Cambridge University Press, pp.205-228; at p.208.

not be theoretically reducible to the physical, but good explanations are on offer as to how the circle could emerge through the complex behaviour of agents in their social interactions<sup>87</sup>. The conceptual bedrock for this style of what might be called *supervenience explications* is the notion of *cause*<sup>88</sup>. And how *this* notion is to be analyzed or explicated remains one of the deepest philosophical puzzles of our time. It remains to be seen whether we have to accept (at the one extreme) that the world is simply gilded or stained by the human mind, rather than cemented together by causal processes; or whether (at the other extreme) we have to accept that Nature is infused with reason. Can we not somehow make better, non-Humean and non-Kantian sense of the notion, without appealing to counterfactuals or possible worlds<sup>89</sup>, or conditional probabilities<sup>90</sup>, or insufficient but necessary parts of unnecessary but sufficient conditions<sup>91</sup>, or relations between universals<sup>92</sup>,

<sup>87</sup>See especially H.P.Grice, 'Meaning', *Philosophical Review* 66, 1957, pp.377-88; D.Lewis, *Convention, op. cit.*; and J.Bennett, *Linguistic Behaviour*, Cambridge University Press, 1976. In my 'Intentionality, Syntactic Structure and the Evolution of Language', *loc. cit.*, I attempt to fill a lacuna in Bennett's account, by showing how the recursive resources of a natural language could have evolved, and how the outcome of forces of selection for their retention would be community-wide conventions governing the use of expression-forming operators. See also my 'Conventional Necessity and the Contingency of Convention', *Dialectica* 41, 1987, pp.79-95.

<sup>88</sup>We prescind here from the question of whether supervenience itself is a species of (inter-level) causation. The notion of cause is still the fundamental *explicandum* at the subvening level, even if supervenience itself is something other than inter-level causation.

<sup>89</sup>David Lewis, 'Causation', *Journal of Philosophy* 70, 1973, pp.556-67 (reprinted, with Postscripts, in *Philosophical Papers Vol.II*, Oxford University Press, 1986, pp.159-213).

<sup>90</sup>Peter Menzies, 'Probabilistic causation and causal processes: a critique of Lewis', *Philosophy of Science* 56, 1989, pp.642-663. Menzies's analysis is in terms, very roughly, of chains of events each member of which makes the next one more probable. His preferred interpretation of these probabilities is as (non-standard) conditional chances. The single case-chances would be credences of an ideal subject — idealized with respect to rationality and information possessed (personal communication). In other words, some form of ideal subjectivism is the proposed interpretation of the notion of probability involved in the analysis of causation. Should any such analysis ever go through without leaning on the details of the interpretation of the notion of probability itself (as Menzies's analysis appears to go through) then we would have, *prima facie*, as many notions of cause as there are competing notions of probability: subjective, objective, logical, frequentist, ... The correct choice here is as much beset with metaphysical presupposition, and pregnant with metaphysical consequences, as is the correct account of causation — should any be available. How to make good this claim against even the frequentist conception, which was the preferred option of the Logical Positivists, is beyond the scope of this discussion.

<sup>91</sup>John Mackie, *The Cement of the Universe*, Oxford University Press, 1974

<sup>92</sup>David Armstrong, *What is a Law of Nature?*, Cambridge University Press, 1983; Michael Tooley, *Canadian Journal of Philosophy* 7, 1977

or second order relations between events<sup>93</sup> or consciousness<sup>94</sup>, or necessary pre-conditioning by the understanding in the generation of experience<sup>95</sup>, or mental projection<sup>96</sup>, or plain old human interest (perhaps described as ‘contextually determined explanatory relevance’)<sup>97</sup>? Quine would have us make do with the flow of energy, described by an extensional physics<sup>98</sup>. One cannot say what Carnap’s view, today, would have been on that score. In the flow of energy only certain eddies are *salient* to our causal diagnoses on which the rest is to rest; and that, as Davidson once said of the logical grammar of the verb ‘believes’, may well remain to haunt us. *Man befürchtet, dass hinter diesen Begriff Gefahren der Metaphysik lauern ...*

## 8 Concluding remarks

From the outset, Carnap and Quine shared a commitment to naturalism that would oppose them to any synthetic *a priori*’s. In his early work, at least, Carnap shared also Quine’s extensionalism. This vision of the world, at that time, was extraordinarily austere. Their genius lay in exploring its recapitulative riches. Basing linguistic understanding on observable behaviour, and mental life on causal processes, and revelling in the rigour and power of logico-mathematical method, they bequeathed to us an unprecedented legacy of conceptual analysis, philosophical insight and self-imposed intellectual discipline.

Despite their subsequent divergences over the disputed necessities enshrined in our manners of thinking and speaking, they conditioned the temper of a whole region of philosophical discourse. I believe future progress will lie in those directions in which their work emphatically points. These

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<sup>93</sup> John Bigelow and Robert Pargetter, ‘Metaphysics of Causation’, *Erkenntnis* 33, 1990, pp.89-119

<sup>94</sup> Quantum mechanics?

<sup>95</sup> Immanuel Kant, *Critique of Pure Reason*

<sup>96</sup> David Hume, *Treatise on Human Nature*; Simon Blackburn, *Spreading the Word*, Oxford University Press, 1984

<sup>97</sup> Bas van Fraassen, *The Scientific Image*, Clarendon Press, 1980, at p126; Hilary Putnam, ‘Why Reason Can’t Be Naturalized’, in *Realism and Reason, Collected Philosophical Papers Vol.3*, Cambridge University Press, 1983, pp.229-47

<sup>98</sup> On a bolder, perhaps even more thoroughgoing physicalist view, it might be identified (as a metaphysical necessity, in the manner of ‘Water is  $H_2O$ ’) with the *exchange of virtual particles*. This is a view put forward by Adrian Heathcote, in ‘A theory of causality: causality = interaction (as defined by a suitable quantum field theory)’, *Erkenntnis* 31, 1989, pp.77-108.

include the following:

1. The search for a deeper understanding of *scientific method*. I believe in the prospect of some sort of computationally constrained understanding of the most important notions from the pragmatist and empiricist tradition in philosophy of science. Such notions include cognitive significance, theoretical economy and simplicity<sup>99</sup>, explanatory coherence<sup>100</sup>, and minimum mutilation on revision<sup>101</sup>.
2. Knowledgeable appreciation of the *implications of scientific theories for our account of the human condition*. No longer can the philosopher ignore fundamental physics, evolutionary biology, cognitive psychology, theoretical linguistics and neurobiology.
3. The search for a deeper understanding, in the light of those special sciences, of the *interconnections between thought, talk and sensory experience*.
4. Clarification of what might be called the modern metaphysician's *conceptual organisation*. What fundamental notions are coeval, irreducible, interdefinable, or subvening and supervening in their extensions? What is the priority ordering, by these lights, of *causation, probability, time, dispositions, functions, propensities, individuals, events, classes?* and — dare I ask — of *universals, possible worlds, concepts, meanings?*

On our best theory, we got here by accident. We seem to be very much part of the natural world. Yet some of our representations are of ourselves as somehow *transcending* the natural world in which we find ourselves. Our mental and social world seems full of rules, categories, forms — apparently hard-edged, normative, constitutive of thought and experience.

Carnap and Quine, in their various uncompromising phases — anti-metaphysical, pragmatic, extensional, syntactic, behaviouristic, physicalistic — fought an heroic battle for a more modest self-conception that, according to modern science, better befits our species' place in the universe. Reason can have no higher goal than its own naturalization. Our two philosophers, in William James's image, have grafted their new ideas “upon the ancient

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<sup>99</sup>cf. E. Sober, *Simplicity*, Clarendon Press, Oxford, 1976

<sup>100</sup>Cf. P. Thagard, *Computational Philosophy of Science*, MIT Press, 1988

<sup>101</sup>Cf. P. Gärdenfors, *Knowledge in Flux*, *op. cit.*

body of truth, which thus grows much as a tree grows by the activity of a new layer of cambium.”<sup>102</sup> For this we should be grateful. It falls to the rest of us to resolve the remaining tensions ... and to keep pruning.

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<sup>102</sup>loc.cit., p.36