

MEANING AS SEMANTICAL SUPERSTRUCTURE : A UNIVERSAL THEORY OF MEANING, TRUTH AND DENOTATION ?

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... any hope of a universal method of interpretation must be abandoned. ... it makes no sense to ask for a theory that would yield an explicit interpretation for any utterance in any (possible) language.

Davidson [35], pp. 315-316.

1. The supposed theories of meaning and reference and some of their problems.

It is one thing to give a general theory of or semantics for truth, or even for truth and significance, and thereby provide for the main ingredients of a full theory of referential (or denotation style) notions. It is quite another, so it is commonly enough claimed (following Quine [1]), to characterise any of the notions of the full theory of meaning — synonymy, sense, entailment, and so forth. The extent to which this popular dogma — one of the newer dogmas of empiricism — is correct, is an issue even within empiricist semantics. For empiricism splits on the issue, and the dogma is opposed by another dogma, of a different brand of empiricism, according to which the theory of truth furnishes all that is required for the full theory of meaning¹. It is not difficult to see why there are two options for empiricism on this issue: although an apparently intensional theory like the theory of sense cannot be retained as a separate theory given empiricist perceptions and restrictions (as [3] explains), the theory can be retained if it is reduced to an empirically admissible base, such as an extensional theory of reference. In fact, though it is only incidental to what follows, neither brand of empiricism can be correct; for though the full theory of meaning can be erected on the basis of an appropriate theory of truth upon

generalizing well-known connections, the underlying theory of truth has to exceed empirically admissible bases (see s 2).

The theory of meaning is said, at least by the first empiricist party, to be in much worse shape than the rather satisfactory theory of reference² — a claim denied by members of the second, heterogeneous, party (e.g. Kemeny [14]), who argue that a satisfactory theory of meaning requires no more apparatus than is required for the theory of reference. But according to criticism coming from quite different empiricist quarters (cf. Pap [20], also Black [21]), the whole semantical enterprise is in bad shape, and, it is sometimes added, should be given away. Each of these claims has a point, as will emerge. There is a division between the theories, but it is not technically such a sharp separation; and both theories have been left in unsatisfactory shape. It certainly is the case, furthermore, that the general semantical enterprise has its problems, which it will be our gloomy business to investigate; but these problems do not lie where critics of the whole semantical enterprise have supposed. What is called for in meeting the problems is elaboration of the semantical theory, not its premature abandonment; for, despite its problems, it offers the only clear prospect for providing a convincing general theory of meaning. (Of course some, e.g. Black [21], following the later Wittgenstein, would deny that such a theory is needed.) Nor are the most serious problems that threaten the theory of meaning those that empiricists think they have located: as regards the main problems parts of the theory of meaning are in little worse shape than the theory of reference.

Further examination of some of the more important notions of the theories of meaning and reference begins to cast doubt on the adequacy of the underlying empiricist distinction. Let us recall what these notions are taken to be:

The main concepts in the theory of meaning, apart from meaning itself, are *synonymy* (or sameness of meaning), *significance* (or possession of meaning), and *analyticity* (or truth by virtue of meaning). Another is *entailment*, or analyticity of the conditional. The main concepts in the theory of reference are *naming*, *truth*, *denotation* (or truth of), and *extension*. Another is the notion of *values* of variables. ([1], p. 130).

The list is not intended to be complete; for example Quine subsequently mentions ([1], p. 132) definability as belonging to the

theory of reference. Important omissions from the listing for theory of meaning from the point of view of what follows are the notions of *property* and *proposition* and, correspondingly, of *property identity* and *propositional identity*. Isn't the distinction of theories just a restatement of the old distinction between intensional notions and extensional ones, and equally inoffensive? It is not quite a restatement, and various issues are prejudged. For example, the notion of *value* of a variable may be either extensional or intensional; and a variable may, as suggested in Carnap [13], have both extensional and intensional values and thus, so to speak, bridge the gap between extensions and intensions. Again, the notion of *significance* did not fall clearly within the traditional extensional/intensional distinction, and there are important options as to how the distinction should be extended, if it is, to include it. According to one option (argued for in [10]) significance is logically on a par with truth and falsity, and an *extensional* logic should start with at least the three values t, f, and n (for nonsignificance or nonsense), not just the classical two, t and f. Correspondingly, an adequate extensional base from which to explain intensional notions is going, on this view, to be at least a three-valued one, with significance already included as part of the enlarged theory of reference.

Another defect, incorporated in the theory that accompanies the distinction, lies in the assumption that all the notions of the theory of meaning are, as it were, out of the same box, that given a definition of one (or logical apparatus for such a definition) all the remainder can be satisfactorily characterised. The assumption is seriously mistaken. Analyticity, which is a modal notion, is not adequate to characterise entailment — or the conditional. For these notions are ultramodal and require semantical apparatus beyond the complete possible worlds of modal logic, or their modal-theoretic analogues (see, e.g. [23]), Entailment in turn is not adequate to characterise synonymy; for example, that A entails A coentails that A entails A & A, but the law of identity does not have the same sense as the law of tautology. Synonymy requires a discrimination of worlds, or models, not needed to characterise entailment; it is of a higher level of intensionality. These objections tell against both the first and the second empiricist parties; for both make the mistaken assumption.

To avoid these defects in the classification and its accompanying theory, it is perhaps better to return to something like the older, extensional/intensional distinction (in one of its senses which applies properly to semantical notions) to distinguish intensional semantical

notions from extensional ones, and to recognise that there are different levels of intensionality. These levels of intensionality are distinguished through the class of worlds, or models, required in the analysis, a matter reflected syntactically through admissible intersubstitutivity conditions (for more details see [24]). Although the traditional distinction between intensional and extensional notions can be made out satisfactorily enough — for example semantically (as in [10], chapter 7), with extensional notions those that can be evaluated at the base world of models, i.e. in effect with respect to the actual world, and intensional notions those which involve taking account of worlds beyond the actual — there is nonetheless an intertwining of these notions : most important, the recursive characterisation of extensional notions, such as truth and denotation, involves the intensional — semantically, the appeal to worlds beyond the actual. The reason is this : — Even a theory of truth, if it is to be satisfactory and have sufficient generality, has to account for truths stated in intensional discourse — this of course is why a theory of truth is going to be able to account for intensional notions such as meaning, but in being able to so account it exceeds admissible empirical bases. For an adequate theory of truth has, in the end when all the partial models have been worked through, to account for truth in the case of natural language statements; and so it has to cope with intensional discourse³. Because intensional discourse has to be encompassed in the theory of truth, the general semantical framework of a satisfactory theory has to include worlds far beyond the actual, or the like. But in including these — especially impossible worlds, which are essential for example, for the semantical analysis of propositional attitudes such as belief (see [14]) — it far exceeds what is empirically admissible. By including these worlds, however, the *full* theory of truth offers a framework for definitions of central intensional notions, such as meaning : but a less extensive modelling, with worlds restricted to the actual or to those of modal logics, would *not* suffice.

2. *Why a detailed semantical approach to the problem of meaning ?*

There is another important respect in which not just any theory of truth offers an appropriate framework, a more syntactical respect. For whether meaning can be characterised in terms of the apparatus required for a theory of truth depends critically on other aspects of the underlying theory of truth, particularly on its depth of analysis of sentence structure, but also on the extent to which it encompasses features such as context. For example, not much of a theory of

meaning is going to emerge from the important though rather uninformative equivalence

$qu(p)$ is true iff p

(or its contextual elaboration, as in [10]). For one thing such an equivalence provides no details of sentence components, and so is hardly likely to furnish a basis for a semantical definition of synonymy of such sentence constituents as sentence subjects or adverbs. A satisfactory theory of a semantical cast is going to have to be one whose analysis deals with ultimate constituents of sentences, in the way that recursive characterisations do — indeed, to indicate the direction of travel, in the way that the recursive characterisation of the (almost) universal semantics of [4], [7] and [17] do.

But why, it may reasonably be asked — when so much turns on syntactical features, should the definition sought be a semantical one? Why not adopt a syntactical characterisation of meaning, for example along the following familiar lines: — define the sense of 'b' as the property abstract of all expressions synonymous with 'b', define synonymy in terms of intersubstitutivity conditions preserving appropriate connections, e.g. truth represented syntactically by way of material equivalence. That is to say, 'a' is synonymous with 'b', a s b for short, is defined Leibnitz-style as $(f) (f(a) \equiv f(b))$. While this *salva veritate* account has much to recommend it and a corrected version of it should emerge from a satisfactory semantical theory, the account appears mistaken unless the class of sentence-frames in which replacement is permitted is severely restricted (the reasons are set out in [29], [14] and [15]); and the syntactical account has several other drawbacks, for example, it works at best only for intralinguistic synonymy, it fails to allow adequately for contextual matters, and so on.

A common mistake with many attempts⁴ at formal characterisations — not just of such notions as synonymy and extensionality but of a wide range of the other notions (e.g. confirmation, evidence, preference) — has been excessive reliance on syntactical approaches, rather than, what should have been attempted, semantic or pragmatic characterisations. Syntactical approaches tend to force over-strong postulates on notions characterised; to discourage the introduction of new, undefined, but perhaps essential, predicates; to overemphasize the fitting of notions characterised into received but often inadequate logical frameworks; and to encourage the absorption of non-linguistic contextual conditions, where they do not belong, in the very formulation of sentences. The result is all too frequently distortion or inadequate characterisation. This is not to disparage attempts at formal

characterisations — any methodologically sound, and properly assessable, approach to the problems of truth and meaning has to aim for these — but rather to caution against expectation of success with, or over-reliance on, purely syntactical approaches⁵.

There are, then, at least two (interconnected) methods for going about the business of giving a formal analysis of intensional notions, a syntactical approach and a pragmatico-semantic method, i.e. a semantic method which takes the account of context (cf. [6] and [7]). The syntactical method is typified by attempts, of the sort we have glanced at, to account for equivalential relations like synonymy and propositional identity in terms of intersubstitutivity of expressions in sentence frames preserving some requisite notion, usually truth (but this semantic intrusion is quickly eliminated syntactically in favour of material equivalence). There are several reasons for thinking that the syntactical method is considerably less general than the semantic method. It is evident, and can presumably be proved using a universal semantics, that whatever can be done syntactically also be done by the semantic method, and often, one would want to add, done better. The converse does not hold, and the extent to which the semantic method outpaces the syntactical — known from the classical limitative theorems of Gödel, Tarski and others — is well illustrated by the case of interlinguistic synonymy of sentences. Unless synthesized languages such as Anglo-French and Maori-Arabic are devised — an enterprise that raises severe problems and threatens criteria for synonymy with circularity — substitutivity tests fail entirely, for chunks of English cannot in general be substituted in French sentence frames preserving even well-formation. But a common semantic model structure can be devised for parts of English and French — there will be different interpretation functions, but need be no damaging translation — and synonymy of sentences in the different language can then be accounted for in terms of the common model structure (cf. s 9). The case of a truth definition itself offers another illustration. The prospects for obtaining other than fairly trivial syntactical characterisations are, especially in the important case of intensional discourse, bleak, indeed classically impossible for certain rich languages, whereas a semantic characterisation can be much deeper, and at the same time furnish the apparatus for a semantic characterisation of meaning. For all these reasons the approach in what follows is explicitly semantic, or, more accurately, semantic with a dash of the pragmatic.

3. *The general semantical framework, and the two-tier theory.*

A general semantical theory, furnishing a model-relative truth definition for every logic and language, and thus a basis for a universal semantics, can be obtained by building on previous work, notably [4] and [7] and improvements thereon⁶. But, once again, the semantics should include all worlds, actual, possible, impossible, and erratic : for any restriction on the wide class of worlds required in the analysis, in particular to the possible worlds of modal semantics or to the single actual world of purely extensional semantical analysis, destroys the generality of the theory, and renders it inadequate to the range of intensional functors of actual language whose behaviour a full theory of truth has to account for (a matter gone into in detail elsewhere, e.g. [9] and [10]).

Such a general theory of truth, which can account for intensional discourse, already provides a basis and framework for the main components of a theory of meaning. However it does not provide the theory, but only the framework. To obtain satisfactory theories of synonymy and sense and of entailment and propositional identity, for example, further construction work has to be done. A general theory of meaning and of intensional notions, is, to continue the metaphor, a necessary superstructure which fits onto and completes the theory of truth. But the superstructure can have many different designs even when the truth substructure is already determined.

There are many previous engineers who have observed the main structural principles and designed their edifices accordingly — Wittgenstein, Tarski, Carnap, Kemeny and Montague to mention some of the most important innovators among them. All these semantical engineers have been seriously hampered both by inadequacies in the truth substructures on which they based their superstructure designs — either by the inadequacies of the languages they considered to the discourse that has to be accounted for, or, more important in the case of more adequate languages, by the limitations of their semantical apparatus, in particular again the limitation to possible worlds and to consistent theories — and by severe limitations in superstructure technology, especially that supposed to take care of higher level intensional notions such as synonymy and meaning which typically got treated as if they were modal notions — indeed in leading designs the significantly different levels of intensionality have all been collapsed to the initial modal level. These inadequacies in previous designs provide some of the excuses for the newer and more elaborate plans sketched here : of course the newer plans — which still remain far from perfect — have

tried to take advantage of the virtuous features of earlier designs, and especially the work of Kemeny (in [4]). In fact, almost everything said has been said before, yet almost everything has to be reassembled and resaid and practically nothing can be left quite as it was.

The new design is of a two-tier construction with the second, model, tier largely a copy of the first, world, tier. In a discriminating general semantical theory (of the sort [24] is intended to represent) the worlds or situations are classified, semantically important worlds or classes of worlds being separated out. For example, the base or actual world T of a model M , the world at which truth in M is assessed, is distinguished among the regular worlds, those of class O , of M . The regular worlds are in turn a subclass of the normal worlds, i.e. $O \subset K$. Thus far the structure of M , with components T , O , and K , is simply that adopted in semantical analyses of relevant implication and entailment; but for the analysis of higher levels of intensionality than modal and entailmental levels further classes of worlds enter the picture, in particular the class W of all worlds and certain regularly featuring subclasses of W , e.g. classes J and N of [24]. Thus a general model of M takes the structural form $\langle T, O, K, W, \dots, I \rangle$ — the exact or final form of the first tier M will not matter for the theory to be outlined⁷ — with I a valuation or interpretation defined on initial formulae of the language and on worlds and contexts. Function I may also supply relations on worlds for each constant of the language, or such relations may be independently supplied by the model structure.

In the universal semantics of [7], upon an elaboration of which the two-tier theory builds, there are essentially two stages in determining a model :

(i) The general framework of assignments for each initial formula is set up;

(ii) Modelling conditions are imposed to ensure that every theorem is true in the model.

This is achieved in the elaborated semantics presupposed by requiring that the modelling conditions corresponding to each axiom and to each rule hold for each world a in O . For the two-tier theory stages (i) and (ii) are separated, and *frameworks* or *basic models* which satisfy (i) but perhaps not (ii) are also considered. In other words, a framework is like a model except that it may not conform to the modelling conditions imposed. (In the general extensional case studied by Kemeny [4], frameworks are called *semi-models*; in [7] they are called *basic models*.)

The universal semantics defines, for every framework and every

world or world-context pair b of that framework, an interpretation $I(A, b)$ for every wff in sentence A of the language under investigation; $I(A, b)$ has one of the values 1 (holds) or 0 (does not hold) — or, on the significance enlargement of the semantical theory, which will be allowed for, n (does not significantly hold). Relative to a framework M , truth is holding at the base world T of the framework, i.e. A is *true in M* iff $I(A, T) = 1$; and non-significance is failing to hold significantly at T , i.e. A is *significant in M*, iff $I(A, T) \neq n$. Neither truth nor significance are so far defined in an absolute, i.e. a framework-independent, way. The absolute notions defined in the universal theory of [7], like those of logic textbooks expounding the routine semantics of quantification theory, are *validity*, i.e. truth in every model, and *satisfiability*, i.e. truth in some model: not truth or denotation or any of the intensional notions a really general theory should explicate.

That is to say, by way of summary, the universal semantics of [7] does not provide satisfactory metatheoretic analyses of *any* of the main terms usually listed as belonging to the theories of meaning and reference without further — and, as it turns out, problematic — ado. What are characterised in a model-independent way in such semantics are such notions as validity and satisfiability, not even such central semantical notions as meaning or truth. Admittedly the semantics does define, or allow one to define, truth and meaning in a model-relative fashion; for example, in the course of defining validity of a statement in the universal semantics truth in a model is defined, as holding in the base world of the model.

But what is required to define truth itself is a distinguished (basic) model. For once a *real*, or factual, model M is distinguished among the class of models truth is readily definable in terms of holding in the base world of the real model, i.e. A is *true* if $I(A, T) = 1$, where T is the base world of M and I is the interpretation function of M . Similarly, given a real model, meaning can be defined as a function on it, more specifically as a function from worlds and contexts of the real model to values in the appropriate domains of the model. Observe, moreover, that the role of M (or sT , in a more revealing way of writing it) in the class of models sW is like that of base world T in class W .

It soon appears that other model-theoretic analogues of worlds are going to be needed, a class sO of regular models, or interpretations, in order to define necessity, possibility and other modal notions in an absolute way, a class sK of normal models to define entailment absolutely, and so on. Such a classification of models already appears in a rudimentary form in Kemeny [4], where interpretations, sO , are

a proper subclass of semi-models, sW , and a real interpretation, sT , is distinguished in sO . Such a truncated classification is however quite inadequate for proper characterisation of more highly intensional notions; for these a fuller second tier, with more discriminatory power, is wanted.

The idea of the two-tier theory is this : firstly, that a second tier can be constructed, that models can be classified along the plan of the classification of worlds and secondly, that given this classification, absolute notions can be defined in much the way that model-relative notions have been defined. Corresponding to models there are, then, *realisations* (to assign an old term an appropriate new role) : a realisation sM is a structure of the form $\langle sT, sO, sK, sW, \dots \rangle$: it is the second tier. Given that sW has already been characterised by the universal semantics, there are two main problems in obtaining satisfactory absolute characterisations of such notions as truth, entailment and meaning : (1) devising appropriate definitions in terms of elements of sM — a task already accomplished for several important lower level notions — and (2) characterising the appropriate elements of sM on which the definition depends, e.g., sT in the case of truth, sO for analyticity, and sK for entailment. Attempting to solve these problems for specific semantical notions will be the primary objective of subsequent sections.

In view of the philosophical and semantical importance of many of the notions for which the characterisation problems arise, it is surprising that it is sometimes said, e.g. by Cresswell ([6], p. 204), that *all* that is required of semantics is to furnish a theory of interpretation, i.e. of valuation functions at each index in every model. Required for what ? one is inclined to ask. It is certainly not good enough for philosophical purposes, for the model-independent accounts of truth, propositional identity, sense, and so on, which are expected to flow from an adequate semantical theory. It should transpire, however, that a suitable theory of interpretation *when supplemented* — notably by a model-independent definition of truth and by the elements of (1) above — does supply everything. Elsewhere ([8] in particular) Cresswell himself is concerned to offer semantical analyses of synonymy and propositional identity, so his claim is perhaps best read contextually, as a criticism of the way in which others (e.g. Montague [23]) have gone about setting up their theories of sense and synonymy — as if some sort of Fregean sense-reference theory really had, despite its manifold defects, to be incorporated into the semantical scheme of things.

Much more emerges, however, from the claim that all that is required of a semantics is a theory of interpretation. Firstly, insofar

as the semantical theory aims to be appropriately general, and to encompass semantically closed natural languages, a serious dilemma arises. The reason is that among the specific terms to be analyzed, and for which a theory is required, are such terms as *sense* and *synonymy*, i.e. what is said not to be required is required. But, secondly, these analyses are of terms within the language, whereas the usual analyses are of metalinguistic terms. This raises the question — closed off by Tarski ([16] and [18]) and Carnap [13] but recently reopened with the readmission of semantically closed languages — as to what the semantical enterprise should be about, whether it should be of terms within the language or should be of metalinguistic terms. The study of entailment has made the answer clearer : there should be analyses of both sorts, and where the object language contains a satisfactory entailment connective there should be agreement between the object language notion and the metalinguistic analysis, e.g. $\vdash A \Rightarrow B$ iff that A entails that B. This illustrates the fundamental *principle of tier agreement*, which will be applied repeatedly in obtaining metalinguistic analyses from systemic ones.

Should the structures of the levels of language theory be observed in the metalinguistic case, the analysis of the object language notion will be more comprehensive than that of the metalinguistic analysis; for the semantical analysis of the systemic notion has to account for iterated occurrences, e.g. of the entailment connective, whereas the analysis of the metalinguistic relation is essentially only a first-degree matter, that is iterated occurrences need not be accounted for. In what follows the analyses proposed and examined will be metalinguistic ones; but these should be regarded only as a prelude to more complex analyses of systemic notions. The larger and quite essential undertaking is supposed, of course, to encounter insuperable obstacles, deriving from the semantical paradoxes and their like : such analyses are said to immerse us in inconsistency and in all the problems of semantically closed languages (for a recent statement of this Tarskian position, see Chihara [31]). However the fact is that many semantically closed languages — natural languages in particular — are perfectly in order logically as they are (cf. [22], which meets the criticisms of [31]).

With a genuinely universal semantics we do have all that is said to be required of semantics in the *narrow* sense — for though we are far from having satisfactory semantical analyses for a great many natural language constructions, we do possess a universal theory which furnishes adequate modellings for a very wide class of languages. In this respect the situation is not dissimilar from that in many other

areas : for example, we have a general meteorological theory (which consists essentially of an assemblage of aerodynamical and thermodynamic laws) but we are unable, for several reasons, to apply it in very many concrete cases, especially those of weather prediction; and likewise we have a universal theory of optimisation which however can only be applied in some very special cases, often because we lack the extra information required to apply it elsewhere. With the universal semantics it is much the same : we lack the further details for fitting specific constructions and terms within the general framework; and this implies too that often we do not really know how general the general framework needs to be for specific languages. That is to say, a narrower class of modellings of languages than the universal one may suffice for specific languages and classes of them⁸ ; the universal theory may be a lot more general than need be, or is desirable, for handling them. A simple example is provided by the class of normal Lewis modal logics : although the universal semantical theory grinds out semantics for these logics, some of the apparatus used is unnecessary, and simpler and more informative relational (Kripke) semantics can be provided in every case.

But in a proper wider sense, a "universal" semantics has to solve the characterisation problems for the main semantical notions.

4. The problem of distinguishing real models.

A serious but curiously neglected problem is how to determine or select — or to avoid selecting — a model in terms of which truth and meaning can be defined in a model-independent way. There are various strategies, some of them rather devious, that have been tried. For example, Leibnitz can be taken as proposing that one choose the best possible model, an optimisation recipe that gets transformed in modern work to the more subjective proposal that one choose the preferred; Kemeny ([4], p. 2) invites the author of a system to select a model or (later, p. 8, in more strong-arm fashion) insists that he supply such a model; Tarski (in [16] and elsewhere) and Carnap (e.g. in [13]) require that a translation of the object language into the metalanguage be supplied; Cresswell ([18], p. 38 ff), adapting Wittgenstein [19], supposes that we are given some model built from a set B of "basic particular situations".

It emerges from the case of truth definitions that none of these strategies is without substantial difficulties. A first problem is circularity. For what is required, in order that the definition of 'statement A is true in selected framework M' should provide us with a definition of truth, of 'A (of L) is true', is that the framework M

selected is a *correct* one, one whose base world T is the actual world, that is the class of true statements. Thus in order to define truth we have already, in effect, to be supplied with the class of truths, T. An irremediable circularity thus appears to have crept into the business of giving a semantical definition of truth. To avoid this problem resort is made to independent criteria for selecting M. But none of the recipes proposed is unproblematic. Consider the optimisation recipes. Sadly it is all too evident that the model in which we live, so to speak, is far from optimal and certainly far from what many would prefer, or choose, if given the option; and hence it is evident that when selection of the model is made in such ways incorrect assignments can result, truths coming out as false (e.g. because not preferred), and falsehoods coming out as true (e.g. because preferred). Nor is it enough that apparatus which determines the model be given; for all the notions of the theory of reference, the model has to be *given correctly*. If it is simply given it may be given for reasons apparently quite other than truth, e.g. because of simplicity or for mere usefulness⁹ — in which case the method would provide a way of reinstating a pragmatic “theory of truth”.

In this way it becomes evident that each theory of truth can furnish its own criteria for determining M. Thus according to the correspondence theory M is simply the factual model with the interpretation function I giving the correspondence relation; according to the coherence theory M is that model which coheres with experience; and so on. Tradition issues as to truth appear again in the issue of the determination of M (or T and I).

Despite this reappearance of philosophical issues at the base of the semantical account, it has seemed to many that the Tarski-Carnap requirement of a translation of the object language (for which truth is defined) into the metalanguage, enables an escape from these difficulties, and so from a charge of circularity. But the translation requirement does not escape the issues but only serves to obscure what is going on. For suppose the translation is incorrect (e.g. because based on a defective account of truth, or of what is true) or even dishonest. This is tantamount to determining M incorrectly (or dishonestly), since in the same way incorrect assignments will result. The Tarski-Carnap method may well go wrong, that is to say, except with uninterpreted object languages where there is no cross-check on correctness, but where, correspondingly, the question of truth really does not enter. Suppose however we are dealing with an already interpreted or understood language, say with a (semantically open) fragment of English which includes statements such as ‘Pharlap is a horse’, and let us choose our translation I (rules of designation in

Carnap's sense in [13] as follows : $I(\text{Pharlap}) = \text{Porky the pig}$, and $I(\text{is a horse}) = \lambda x \text{ horse}(x)$. Then by the rule of truth for atomic sentences (cf. [13], p. 5)

$I(\text{Pharlap is a horse}) = 1$ iff $(\lambda x \text{ horse}(x))(\text{Porky the pig})$;
i.e. iff $\text{horse}(\text{Porky the pig})$;

that is 'Pharlap is a horse' is true (in the fragment of English) iff Porky the pig is a horse. It is evident that the translation is incorrect since it leads to falsehood, as 'Pharlap is a horse' is true whereas 'Porky the pig is a horse' is not true; and it is also evident that the source of incorrectness is the use of an already understood object language which has a different intended interpretation I , i.e. for which $I(\text{Pharlap}) = \text{Pharlap (the horse)}$. For an uninterpreted object language for which the translation given just did supply the intended interpretation there would be no such possibility of incorrectness. Yet, perhaps surprisingly, the use of incorrect translations leads to no violation of Tarski's convention T ([16], p. 187-88); for "Pharlap is a horse" is a name of the English sentence 'Pharlap is a horse' and 'Porky the pig is a horse' is the translation of "Pharlap is a horse" into the metalanguage (and 'is true' is tantamount to 'Tr' by the class abstraction principle). It follows that, contrary to widespread claims and to Tarski's large assumption incorporated in the very formulation of convention T, satisfaction of convention T is not sufficient for an adequate definition of truth. This inadequacy will become more conspicuous once we have seen that the translation requirement is equivalent to choice of a basic model; for then it turns out that any choice of a model, not just the choice of a real model M , will bring out convention T. Convention T, like the unqualified translation requirement, is no help in determining M , unless the translation involved is correct — as an identity translation, with $I(A) = A$, which includes the object language in the metalanguage, will generally be.

In the case of extensional languages, the specification of a translation in the intended sense (that of rules of designation) is equivalent, as Kemeny points out ([4], p. 14 ff.), to the specification of a basic model. It is simplest to illustrate the equivalence argument in the case of an applied quantificational logic Q , but the argument extends straightforwardly to Church's simple type-theoretic language (as Kemeny explains). Suppose, firstly, a model for Q is given : it will consist of a domain D of individuals and an interpretation function I defined on initial expressions of Q , say subject terms and predicates, and taking subject terms to individuals of D and predicates to relations on elements of D . Define a new function I' as follows : where t is a subject term $I'(t) = I(t)$, and where f is a predicate $I'(f) =$

instantiates $I(f)$. Then I' provides a translation, almost exactly as in Carnap ([13], p. 4); indeed it is valuable to take Carnap's main example in [13] as a working illustration. Suppose, conversely, that a translation tr is provided, i.e. a function taking initial expressions of Q into appropriate metalanguage expressions, say subject terms into subject terms and predicates into relations. Define an interpretation I thus: $I(t) = tr(t)$ for subject term t , and $I(f) = \lambda x(tr(f))(x)$. Then $\langle D, D \rangle$ where $D = \{t : tr(t)\}$ provides an interpretation of Q matching tr .

Since translations are tantamount to basic models, the problem of selection of a real model automatically transfers to a problem of selection of a translation — to the determination of a correct translation. In the case we are concerned with, that of intensional languages, the interrelation is more complex, basic models corresponding to translations at each world of the model (or alternatively to translations not just of initial expressions, but of complex expressions as well — but then recursiveness is sacrificed).

That the received, translation, method — which really assumes a selection — does not properly consider correctness can be seen from another angle, from the fact that on the received account a thesis of a system L , any system, cannot be false. But of course the theses of a theory or language, or even a logic, can be false. Some principles of classical logic are false (see [28]). Thus a satisfactory recipe for the determination of M will have to allow for the possibility that M is only a framework, not a model. In case framework M for system L is a model, L will be said to be *in order* (in effect, it has a *normal* truth definition in Wang's sense in [25]).

In order to see how the actual Tarski-Carnap-Kemeny procedure — as distinct from the general theory they elaborate — can provide a reliable guide for determining framework M , even in the case of intensional languages, consider how truth is assessed where an interpreted language or system is involved. Suppose, for example, that the object language is Portuguese and the metalanguage, or universal language, is English. There are two requirements to be met, not just one; namely (i) correctness of translation, and (ii) material adequacy in the sense of convention T . There is a most important special case where requirement (i) is automatically met, that where the object language — no matter how comprehensive — is included in the metalanguage or, better, in the universal language (Curry's replacement, in [17], for the metalanguage). While this inclusion offers a reliable insurance against incorrect translation (by using an identity translation), it does not ensure that convention T will be satisfied; for many frameworks T will fail. This suggests, what is legitimate, defining the real, or factual framework M as an arbitrarily

selected basic model for which convention T holds for every sentence. That is, $M =_{\text{Df}} \xi M(A)(I(A,T) = 1 \text{ iff } A)$. In the case of extensional languages, where the interpretation of every wff can be recursively determined in terms of that of its components and variants just in the base world T , it would suffice to require convention T for every *initial* wff; but for intensional languages a more comprehensive connection is necessary, as such a single-world recursive procedure is impossible. Almost needless to say, there will be an element of circularity — but not a damaging element — in subsequent semantical definitions which make use of M . For example, truth is going to be determined in terms of truth in M , where M is picked out as a framework which gets the facts right as stated in the metalanguage. To this rather limited extent the definition writes in a correspondence theory of truth.

The general case where the object language differs from the metalanguage is not so neatly disposed of. But it is clear what in principle would suffice. Were we given a *correct* translation of the object language into the metalanguage, with $tr(A)$ translating A , then M could be determined as an arbitrarily selected framework M such that, for every sentence A , $I(A, T) = 1$ iff $tr(A)$ ¹⁰. The trouble with this resolution of the problem, technically satisfactory though it seems, is that we want the semantics to be applied to tell us *when* a translation is correct, not to depend on a correct translation or interpretation being fed in at the beginning (cf. Davidson [2] and [35]). There are, as might be expected, devious ways around this problem, the following of which will be adopted: — let the universal language contain quotation-mark names of all the sentences of the object language; there is a case for saying that English, as universal language, satisfies this condition. Let the universal language also contain the predicate of sentence names, 'is the case' ('is so', 'is a fact', or the like, e.g. 'is true'). Define M as an arbitrary framework M such that, for every sentence A , $I(A, T) = 1$ iff ' A ' is the case. In short, choose $tr(A)$ as: ' A ' is the case. Now it will certainly be objected that the circularity is going to be damaging. But really the situation is scarcely worse than with the identity translation.

At this point it is fair to mention some of the things the semantical account of truth, at least as here represented, is not intended to accomplish. It is not intended to provide a full theory of truth: for example, it says nothing directly about how truth is tested, about methods of verification of statements. It leaves open a great many issues concerning truth, e.g. whether there are different sorts of truth not encompassed, whether there are (or can be) different tests of truth, and if so what they are. It does however

provide a substantial foundation on which a fuller theory of truth can be built. For it does define truth for an arbitrary object language. But coupling the semantical theory with surrounding theories such as those of evidence, which complete the fuller theory of truth, is further, and unfinished, semantical business.

5. *Semantical definitions of core extensional notions : truth and satisfaction.*

The problem of determining M was the chief problem that lay in the way of characterising extensional notions, given that the obstacle course designed by Black [21], Pap [20] and others for semantical accounts can be got around¹¹.

Recall that given a language, or a logic on a language, L a class of models with respect to which L is sound and complete is delivered by a universal semantics (e.g. that of [7]). Now define the *factual*, real or absolute L -framework M among these frameworks thus : M is an arbitrarily selected framework M such that requirement T holds : namely for every wff A of the language, $I(A, T) = 1$ iff A (or, more generally, iff $tr(A)$) where I is the interpretation function and T the base world of the model M (and $tr(A)$ is a correct translation of A).

Where A is a closed wff of L , i.e. contains no free variables, A is *true (as formulated in L)* iff $I(A, T) = 1$. To gain comparison with the usually defined notion, 'as formulated in L ' is often abbreviated to 'in L ' and is sometimes omitted altogether. There are familiar options as to what to say concerning wff containing free variables, e.g. that the question of truth does not arise, that they are true iff their universal closures are, and so forth. Another option is to let the metalanguage decide the matter, and to simply drop the restriction, in the definition given, to closed wff. One simple way of taking up the universal closure option is to define A is *true (in L)* as follows : $I(A, T) = 1$ for every factual framework M , where a framework is factual iff it meets requirement T ¹².

Nothing in these definitions excludes intensional generalisation of the orthodox Kemeny-Tarski definition according to which a logic guarantees the truth of its own theses. Consider an uninterpreted logic or, where the logic L is interpreted, consider a reinterpretation. An *admissible* translation, atr , for model M for L is a translation function, defined at least from sentences of L into sentences of the universal language, such that, for every sentence A of L , $I(A, T) = 1$ iff $atr(A)$. Assume, as for instance in Kemeny [4], that L has an admissible translation for some model. In fact, in view of the completeness of L , there will always be an admissible translation. For

let M be the canonical model M_c of L used in establishing completeness and let $atr_c(A)$ be $A \in T_c$ where T_c is the base world of M_c : then atr_c is an admissible translation. Now define the *L-guaranteeing factual* model M_G as an arbitrarily selected model M which has an admissible translation. M_G is a model of how things in fact are according to L . Then, where A is a sentence of L , A is *true according to L* iff $I_G(A, T_G) = 1$.

It follows that, for every thesis A of L , A is true according to L . This establishes an interesting, analytic, form of conventionalism: *every theory is correct according to its own lights. But what is true according to L may not be true — even in L* . Falsity and non-significance are defined in each case in a parallel fashion. Let the determining model for truth in, or according to, L be M_G . Then A is *false ...* iff $I_G(A, T_G) = 0$, and A is *non-significant ...* $I_G(A, T_G) = n$.

If a bivalent universal semantics is adopted semantic versions of the two-valued laws of thought are forthcoming both for truth in L and for truth according to L , e.g. no sentence is both true and false, but every sentence is either true or false. With the trivalent semantics suggested, a somewhat different set of semantic formulations of laws of thought naturally emerges: though no wff is both true and false, or both true and non-significant or both false and non-significant, some sentences are neither true nor false, because non-significant. However every sentence is either true, false or non-significant — a result that would fail if a polyvalent universal semantics which allowed for other values such as incompleteness were chosen. In any case, whether the semantics is bivalent or polyvalent, expected versions of the famous convention T emerge at once, namely A is true in L iff $tr(A)$ (iff A , in the special inclusion case), and A is true according to L iff $atr(A)$. Similarly in the trivalent case, A is non-significant in L iff $tr(A)$ is non-significant (assuming of course that the *iff* is appropriately 3-valued, i.e. it represents a connective like \approx of [10]).

The accounts, whether bivalent or polyvalent, can be recast in terms of satisfaction, with satisfaction as primitive in place of truth or with satisfaction defined. For the second option define a satisfaction relation, for example, as follows: — a valuation v (or interpretation I) *satisfies* wff A (or makes A hold) *at a in* model structure S iff A holds at a on v in S (i.e. in S $I(A, a) = 1$), and v *satisfies A in S* iff A is true on v in S . Then A is true in $M = \langle S; v \rangle$ if v in S satisfies A ; and A is true iff I satisfies A (in S). Similarly, in the trivalent working example, A is non-significant iff I does not significantly satisfy A .

6. *Semantical vindication of the denotative theory of meaning.*

Define a *denotative theory* of meaning in the accepted fashion, as one which provides 'by a general formula, some entity or thing as the meaning of a linguistic expression' Caton [30]. Then as a corollary of universal semantics (corollary (IX) to theorem 2 of [7]) :

Every logic formulable on a free λ -categorical language (and hence every language) has a denotative theory of meaning.

For define *the interpretation of A_α* (or what A_α is *about*) in model M as $I(A_\alpha)$, and *the interpretation of A_α* as $I(A_\alpha)$. Since every logic or language (of the specified type) has a semantics which defines an interpretation function I for each model and since a factual model can be distinguished, a denotative meaning, in the sense of interpretation, is provided by a general recipe for each linguistic expression of the logic or language. Moreover, to complete the argument for the corollary, meaning so supplied is always an object — on the semantics invoked a function, and so, in a precise sense, a rule for the application of A_α in every situation and context. In particular, the rule giving the denotative meaning of a declarative sentence A_0 holds at a or not (or not significantly). Thus the denotative theory affords a basis for the synthesis of various apparently diverse and conflicting theories of meaning, for example denotative theories and use theories (for a readily convertible syntactically-based synthesis of theories of meaning, see [29]). It also furnishes all that has been said to be required of a theory of meaning (cf. again Cresswell [6], Davidson [2], p. 7). It does not, however, furnish all that ought to be required from a theory of meaning. For example — except in fortuitous circumstances where the language studied does not include quotational devices or functors with quotational features but nonetheless is rich enough to distinguish logically equivalent expressions with distinct senses — $I(A_\alpha)$ does not provide the sense of A_α , $s(A_\alpha)$, in the expected sense, in which A_α is synonymous with B_α iff $s(A_\alpha) = s(B_\alpha)$. The denotative theory has, in short, to be supplemented at least by accounts of synonymy and sense — not to mention such matters as metaphor — before a full theory of meaning emerges.

Interpretation, or "denotative meaning", is, in the case of rich languages, a highly intensional notion: the corresponding extensional notion is denotation (in the wide, non-intuitive, sense discussed in [10]). The *denotation of A_α* is defined as $I(A_\alpha, T)$, i.e.

$I(A_\alpha)(T)$. Hence the denotation of a subject term, e.g. of D_1 , is an object (in Meinong's sense) and the denotation of a declarative sentence, e.g. of C_0 , is a truth-value. Thus — apart from the Meinongian slant incorporated through the presupposed neutral metalanguage of [7], and apart from the more complex substitutivity conditions, demanded by highly intensional languages — the account of denotation is Fregean. However denotation is now but a special case of interpretation, and so also, it will turn out, is sense; that is, *both sense and denotation are unified through the underlying, familiar notion of interpretation*: both denotation and sense are restrictions of the interpretation function.

Meaning, whether as interpretation or sense or content, is being explicated then as a function. So much is a commonplace of modern semantics¹³; only the details of the accounts given differ, importantly, e.g. as to the range of languages considered, the types of worlds admitted, and so on. There is another difference however that needs to be entered: the semantics presupposed are not simply set-theoretic, and in particular neither functions nor properties are construed in terms of sets. It is true that the underlying universal semantics can be read set-theoretically and that there are some technical results to be drawn from the possibility of such a construal: but the set-theoretic rendition is not the intended one. Accordingly the universal semantics, properly rendered, can agree with the obvious fact that meanings are not sets, and do not have the right categorial properties to (significantly) be sets, e.g. meanings cannot have members, there cannot significantly be a power set of a meaning, and so forth. Meanings and senses are functions, but not sets, because functions are not all sets, though, of course, each function has an extensional, set-theoretic, representation by way of a set of ordered pairs.

Much of the semantical work of Montague [23] and his successors is rendered philosophically naive through extensional identifications, through set-theoretical reductions¹⁴, and the treatment of merely isomorphic structures as if they were identical. Nowhere is this more evident than in the treatment of intensional notions, where meanings, senses, propositions, contents, properties, one and all, are supposed to reappear as sets. The naivety is avoided by adoption of — what is no embarrassment, and involves no great difficulties since a fragment of English, for instance, will suffice — an intensional metalanguage.

Before venturing semantical definitions of sense and synonymy, there are immediate notions in the second tier to consider; and these are, incidentally, instructive both because they help show what sort

of definitions are unsatisfactory, and because they provide a simpler setting in which to tackle some of the problems that have lain in the way of more satisfactory accounts.

7. Kemeny's interpretations, and semantical definitions for modal notions.

The classical metatheoretical accounts of modal notions, such as necessity, and possibility, run into a severe obstacle in the form of incompleteness theorems and the possibility of non-standard models. In particular, the exact class of necessary truths of arithmetic cannot be captured *classically* by any recursive axiomatisation. Hence an account of logical necessity, intended to include arithmetic, in terms of truth in all models would be inadequate because some necessary truths would be deleted by unintended non-standard models. For incompletely axiomatised theories there are, classically, too many models, so a subclass of models, which Kemeny calls *interpretations*, has somehow to be distinguished. Much of Kemeny's [4] is devoted to marking out interpretations among models, and indeed his new approach consists primarily of a method for distinguishing interpretations (see [4], p. 19). This is at variance with the assumed approach in the case of truth where whatever is true according to the theory is true : why shouldn't whatever is necessary according to the axiomatisation be necessary ? But while incorrect axiomatisation of an understood theory is not allowed, incomplete axiomatisation is : 'we are forced to allow for models that were not intended as models' (p. 18). For uninterpreted systems there is however so such incompleteness. The underlying vacillation between uninterpreted and already interpreted systems, written into much modern thinking on logical and semantical systems, including Kemeny's, in fact leads to a serious flaw in Kemeny's 'satisfactory semantic theory' ([4], p. 19).

Kemeny's new approach is as follows : — it is assumed that such object system L is semantically determinate, that is to say that

in addition to the formal presentation of L we are given (1) one model, M^* , which has been designated for the purpose of translating from L of ML and (2) an indication of which constants are extralogical (Definition 13, p. 19).

Then *interpretations* are defined as those models that differ from M^* only in the assignment to extra-logical constants. Finally, modal notions — and also many non-modal notions, e.g. implication and

synonymy — are defined in terms of interpretations. Now according to Kemeny, the author of a system is obliged to select M^* , i.e. the factual model M (see [4], pp. 2, 13, 14); he is the person who “gives” M^* . Suppose however, to reveal the flaw, the author perversely, or ignorantly, or for other reasons, selects a non-standard model, that we are given a non-standard model M . Then all the interpretations will likewise be non-standard, since they agree with M in assignments to logical constants. As a result the accounts of modal notions err seriously, e.g. the account of necessity in terms of validity in all interpretations can establish an unnecessary non-standard, and in the ordinary sense “unintended”, statements. The upshot is that, as in the case of truth for already (even partly) interpreted systems, the designer of a system is not free to choose the interpretation. He has to choose both M and the logical constants *correctly*: and we are not just given M and a listing of logical constants, we have to be given the right packages.

As with truth there are two cases, that for uninterpreted or reinterpreted systems, and that for languages that are already (partly) interpreted or have intended interpretations. Kemeny’s account falls unsatisfactorily between the cases. Consider first the uninterpreted case, or reinterpretation case, *where the system sets its modelling*. Then there are no unintended models, there is no call for a subclass of interpretations. Necessity just is truth in all models. More precisely, extending the *according to* jargon, A is *necessary according to* L iff A is true in all L models, and A is *possible according to* L iff A is true in some L model. Necessity according to L just is validity (or universality, in the sense of Kemeny [4]), and possibility according to L just is satisfiability. By the universal semantics *exactly* the theorems of L are necessary according to L (contrast [4], p. 23 ff.). So any theory can determine what is necessary according to it — another apparent fillip for conventionalism.

The account of necessity according to L conforms to the principle of agreement between the two tiers, enunciated when the two-tier theory was being sketched. The informal connections are as follows :

— For every model M , $I_M(A, T_M) = 1$ iff A is necessary

iff $\Box A$ is true

iff $I_G(\Box A, T_G) = 1$

iff, for every world x in O_G , $I_G(A, x) = 1$.

In short, the accounts coincide upon equating regular worlds with models; and the equation appears in order since each subclass is distinguished as that where all theorems hold.

Kemeny would like to adopt an account of necessity (or Atrueness) in terms of universality, but shrinks from it because of

incompleteness. He tries to

assure that interpretations are distinguished from models only insofar as is necessitated by logical incompleteness. If we could make our systems complete, at least in principle, we could identify Atrueness with validity in all models ([4], p. 23).

But (as argued in [26]), even in the case of richer theories such as arithmetic, incompleteness theorems do not rule out non-classical formalisations, which are in principle at least complete. Admittedly the resulting systems will be negation inconsistent, when thesis completeness is achieved by semantically closing the language, but they need not be trivial, i.e. they may be consistent in Kemeny's sense. It is doubtful, then, that Kemeny's reasons for distinguishing interpretations from models hold up once non-classical formalisations are properly considered.

The situation with respect to an interpreted system is different. What is necessary according to a system may well differ from what is necessary. Neither correctness nor completeness of a system with respect to its intended models can be assumed. In particular, if M is not a model, only a framework, the assessment of necessity cannot be restricted to models or a subclass thereof. Such a restriction may not be warranted even when L is in order, since the theses of L , though L true, may not be necessarily true. To characterise necessity in this case let us adopt, for want of a better initial strategy, Kemeny's modernisation of the old recipe: true in virtue of its logical form, or, more specifically, true whatever assignments are made to the non-logical constants. The strategy has the serious disadvantage of requiring an advance, and correct, classification of constants into logical and extralogical divisions — a classification, already enjoying some notoreity, which encounters new difficulties when highly intensional languages are modelled, and which the semantical theory so far developed has managed to avoid. An *M logical variant* is a framework that differs from M only in the assignments to extralogical constants. A is *necessary (with respect to L)* iff A is true in all M logical variants. Hence what is necessary wrt L is true in L , but some theses of L may not be necessary wrt L . What is necessary according to L is not what is necessary wrt L if L is either unsound or incomplete.

Lurking behind the account of necessity wrt L , and likewise that of truth in L , is the ideal of an absolute language-invariant notion of necessity, and likewise of truth. Necessity wrt L is supposed to be assessed in terms of what is necessary — period. Similarly for truth.

Once the levels theory is got rid of — a worthy but not immediate objective — there is no bar to language-independent definitions of semantic notions, but it still needs to be shown that the defined terms have appropriate invariance properties, e.g. invariance under translation (cf. [4], § 8). Moving outside the orthodoxy of the levels theory does however suggest strategies for improved, less language dependent, definitions of semantical notions, in particular definitions which do away with such devices as the division of constants — definitions which can then be fitted back within the narrow confines of the levels theory. One strategy applies the principle of agreement. Given, what ought to be admissible, iteration of semantical functors, the *problems of invariant characterisation all reduce to the problem, already tackled, of characterisation of truth*. Consider, for example, necessity. A is necessary iff A is necessarily true, i.e. iff $\Box A$ is true. But $I(\Box A, T) = 1$ iff for every regular world x , i.e. every x in O , $I(A, x) = 1$. Now apply the principle of agreement. Select a class of *regular* frameworks, one $M(x)$ for each world x in O , as follows: — $M(x)$ is an arbitrarily selected framework such that, for every wff B , $I_{M(x)}(B, T_{M(x)}) = I(B, x)$. Then, by the informal arguments, A is *necessary* iff for every regular framework M in the class, $I_M(A, T_M) = 1$. Given M the regular frameworks of the class can be defined; and then *necessity in L* can be defined, as above, shortcircuiting the informal verification circuit. A similar strategy can be exploited in the case of other semantical notions. That is, the appropriate second tier can be distinguished, by way of truth, using the corresponding first tier. This is the strategy that will be adopted, not just for necessity, but for such notions as entailment¹⁵.

8. Normal frameworks, and semantical definitions for first-degree entailment notions.

Entailment cannot be adequately defined, even at the first degree, in terms of modal notions (see [27], especially § 29.12). The same holds for logical consequence, coentailment and propositional identity. Thus the semantical definitions for these notions proposed by Tarski and others, which are all couched in essentially modal terms, are bound to be defective. To define entailment notions semantically, models or interpretations are not enough; it is essential to look at frameworks which are not models, where theorems fail — else such paradoxes as that every sentence entails every theorem are unavoidable on the expected inclusion definition of entailment. Given the appropriate class of frameworks, *normal* frameworks, the inclusion definition is simply: A *entails* B (*vis à vis* L) iff for every

normal framework M , if $I_M(A, T_M) = 1$ then, materially, $I_M(B, T_M) = 1$. The only problem is to define normal frameworks. But this problem has been solved (to my satisfaction at least) in the systemic case (see [28]). Using the principle of agreement, the solution can be transferred (as in § 7) to the metalinguistic case. There are two cases, and they are treated similarly. To define entailment *in* L , define a class of normal frameworks $M(z)$, one for each world z in K , as follows: — $M(z) =_{\text{Df}} \xi M(B)(I_M(B, T_M) = I(B, z))$. To define entailment *according to* L , define a different class of L -normal frameworks, using I_G in place of I .

The pattern of definition is the same for coentailment and for what coincides at the first, but not at higher degrees, with coentailment, namely, minimal propositional identity (so at least it is argued elsewhere: see [14]). That is, A is (*minimally*) *propositionally identical with* B (*vis à vis* L) iff for every normal framework M , $I_M(A, T_M) = I_M(B, T_M)$. (This definition, unlike the entailment definition, suffices for polyvalent cases.) The most plausible objection to this definition is that a class of normal frameworks is not liberal enough, and that additional frameworks are needed to discriminate distinct propositions which use of normal frameworks only would conflate¹⁶. Technically it is not difficult to expand the class of normal frameworks to various other more comprehensive classes of frameworks, some of them naturally motivated; and philosophically there is, it seems, some basis for the expansion. Where there is a genuine, and conspicuous, basis for the expansion is with such notions as synonymy.

9. Wider frameworks, and semantical definitions for synonymy notions.

Carnap, Kemeny, Montague and other semanticists have attempted to treat synonymy, like entailment, as a modal notion. For example, Kemeny defines phrases as synonymous if they have the same value in every interpretation ([4], p. 22): according to Kemeny, 'this is the weakest acceptable criterion of synonymy'. But really it is quite unacceptable, since it makes all necessary sentences synonymous, all logically impossible sentences synonymous, and so on. And even hardened semanticists have realised that such an account is unacceptable and have cast around for alternatives, but what they have come up with is, for the most part, also unacceptable (intensional isomorphism, as in [13], is perhaps the classic example).

A superior lower bound on synonymy is provided by normal frameworks; and an upper bound is given by the class of all

frameworks. But the upper bound is evidently too generous in the case of languages, such as natural ones, which contain unsegregated quotation devices or functions, even when the objective is to define *literal* sense. For example, the synonymy claim, Brother \underline{s} male sibling, is often adopted as a paradigm, yet the assertion ‘The vicar preached an interesting sermon on brothers’ does not mean the same as, and does not appear to entail, the assertion ‘The vicar preached an interesting sermon on male siblings’; and the situation is worse with sentences like ‘The debate was about brother earth’, where non-literal meanings and associations enter. But meaning in the full sense which includes the non-literal aspects is already accounted for by the interpretation function I^{17} . The problem is to characterise sense in the literal sense in which ‘brother’ is synonymous with ‘male sibling’.

In the quest for an account of literal meaning there are optional paths (which tend however to converge) along which to proceed here. One option — the less satisfactory by a good margin — is to start with synonymies written in by the evaluation rules to all frameworks, and to purge the language of quasi-quotational functors, which are to be analysed in terms of explicit quotation later on. This deprives us of direct semantical analyses of quotation and of the rich variety of functors that involve it, and also of direct analyses of the non-literal components of meaning. The preferred option is to have initial synonymies imposed by semantical rules for a proper subclass of frameworks called *wider* frameworks. All the specialised frameworks previously introduced are subclasses of wider frameworks. Then, for every structure label α , A_α is synonymous with B_α (vis à vis L) iff for every wider framework M, $I_M(A_\alpha)(T_M) = I_M(B_\alpha)(T_M)$.

The problem is to determine where, between normal frameworks and all frameworks, wider frameworks lie. For, unlike the case of entailment, there is no ready-made systemic account of synonymy to fall back upon.¹⁸ Nevertheless the problem is rendered more tractable by shifting it back to the systemic stage. Then what is needed, for each framework, is a class U of *literal* (and non-quotational) worlds, with $K \subset U \subset W$. For initial synonymies, supplied by a dictionary for the language, identical valuations will be supplied for each situation a in U; e.g. if according to the dictionary A_α has the same sense as B_α , i.e. $A_\alpha \underline{s} B_\alpha$ is an initial synonymy, then for $a \in U$, $I(A_\alpha)(a) = I(B_\alpha)(a)$. That is, initial synonymies are transformed into semantical constraints on situations in U. The fact that some initial data has to be supplied — syntactically, in the form of dictionary, by way of “meaning postulates” and so on — is no

serious limit on semantical analyses : such contingent data as that symbolised in 'brother $\underset{s}{\sim}$ male sibling', has, scarcely necessary to say, to be supplied from without. In addition, it is supposed that functors come in two kinds, those whose semantical assessment at situations in U requires no appeal to situations beyond U , and those whose assessment goes beyond U , quotational functors. Again, the rules for semantic evaluation have to be written in : like the rules for assessing the entailment functor they are determined using (partly) external conditions of adequacy. Providing separate semantical rules for each sort of function in the language is a perhaps tiresome, but inevitable, part of the semantical procedure. With this information, semantical development can forge ahead. The desired underlying metalinguistic distinctions are then recovered from the systemic distinctions by way of the principle of tier agreement. In particular, the *sense* of A_α , $s(A_\alpha)$, is the restriction of function $I_M(A_\alpha)$ to literal worlds : hence when $A_\alpha \underset{s}{\sim} B_\alpha$ then $s(A_\alpha) = s(B_\alpha)$, and conversely.

The syntactical upshot is transparent : quite generally for any parts of speech, if $A_\alpha \underset{s}{\sim} B_\alpha$ iff for every non-quotational functor $\Phi_{\alpha\alpha}$, $\Phi_{\alpha\alpha} A_\alpha$ iff $\Phi_{\alpha\alpha} B_\alpha$ (precisely the syntactical account proposed in [29]). Most of the many logical properties of synonymy flow from this connection. In particular, synonymy is an identity, an equivalence relation preserving intersubstitutivity in an important class of sentence contexts, non-quotational ones. There are two respects, however, in which this account falls short, as regards contextual variation and concerning interlinguistic synonymy. The semantical theory, unlike its syntactical consequences, can be straightforwardly enlarged to take account of these important issues.

Each model M can be seen as comprising a single interpretation function I and a model structure S , i.e. $M = \langle S; I \rangle$; for interlinguistic synonymy the interpretation function is replaced by two interpretation functors, one for each of the languages concerned. An *enlarged* framework for logics on languages (or languages) L_1 and L_2 is a structure EM of the form $\langle S; I^{L_1}, I^{L_2} \rangle$, where I^{L_1} is an interpretation for L_1 and I^{L_2} for L_2 . Observe that the model structure is invariant; so the class U of literal worlds, in particular, does not require re-specification. Then phrase A_α of L_1 is *synonymous with* B_α of L_2 (*vis à vis* L_1 and L_2), $A_\alpha \overset{L_1}{\sim} B_\alpha \overset{L_2}$ for short, iff for every wider enlarged framework $EM = \langle S; I^{L_1}, I^{L_2} \rangle$, $I^{L_1}(A_\alpha)(T_{L_1}) = I^{L_2}(B_\alpha)(T_{L_2})$. The extended systemic connection from which the determination of wider enlarged models derives is : $A_\alpha \overset{L_1}{\sim} B_\alpha \overset{L_2}$ iff, for every a in U , $I^{L_1}(A_\alpha)(a) = I^{L_2}(B_\alpha)(a)$. Naturally, for the semantical analysis to work, initial interlinguistic synonymies have, in effect, to be written in at the bottom : no

abstract semantics is going to supply, free, an empirically-determined dictionary which translates initial phrases of one language into those of another. Even semantical magic has its limits. The definition proposed also applies only where the phrase structures of the languages correspond — something that will presumably always happen at least in some cases, e.g. that of sentences. But languages with radically different syntactic structures, e.g. with different initial structure labels, raise difficulties for the initial specification of enlarged models. Indeed several features of enlarged models have deliberately been left indeterminate, to be taken up more precisely as the semantic art improves. Some smaller margin of indeterminacy in how details are taken up should, in any case, remain as residue, reflecting the fact that the notion of synonymy to be explicated — though clearly different from what most semanticists have supposed it to be — is not a sharply delineated one.

The general pragmatico-semantical theory so far developed has another weakness, compensating for which will also be left largely for the future, namely the very limited extent to which the theory actually takes account of aspects of context — even if the main technical apparatus is already encompassed in the theory, and each interpretation function I strictly depends on a context parameter among others. The issue of context is important for any theory of meaning and synonymy. For, in one sense 'I am hot' said by x means something different from 'I am hot' as said by y ; but in another sense they mean the same. This can be expressed, in a way that has a substantial basis in English, by saying that the sentences have the same *sense* but different *content*. Thus *sense* is a semantic notion not changed by changing (non-metaphorical) contexts, whereas *content* is a fully pragmatic notion for which context can make a real difference. This notion of content, *liberal* content, should be distinguished from another notion of content, *informational* content or information, which is an entailmental notion defined in terms of normal frameworks (the logic and semantics of information are studied in [22]). Informationally $\sim\sim A$ has the same content as A , but literally they differ. Correspondingly there are two determinate notions of proposition and so of propositional identity, the **first** degree entailmental notions already introduced which provide the lower bound on the determinables, and notions which amount to literal content and literal content identity that furnish an upper bound on the determinable notions, proposition and propositional identity. The logical determinable/determinate distinction here invoked is explained in more detail in [10]; the leading idea, which has some analogy with that of systematic ambiguity, is however that

the one unambiguous determinable notion such as that of proposition or of universality can have several different determinates falling under it. The parameter that varies in the case of *proposition* is the variable k in the semantical quantifier: for every k -type framework.

Literal content depends both on sense and on context. For where context c_1 differs from context c_2 , $A_0(c_1)$ has a different content from $A_0(c_2)$. To formalise the theory of literal content it is advantageous to introduce context indicators into the syntax (as in [10]), something that can be done definitionally here. Then A_α in context c_1 has the same content as B_α in context c_2 , $A_\alpha(c_1) = B_\alpha(c_2)$ for short, iff $A_\alpha \dot{\sim} B_\alpha$ and $c_1 = c_2$. Strong identity of content is by no means the only content identity notion of ordinary philosophical interest: contingent identity of content, which also yields a determinant of *statement*, is at least as important. For example 'I am hot' as said by x , though not identical in the strong way with 'x is hot' as said by x in an otherwise similar context, is contingently identical with the latter. (Contingent content identity is discussed in [29]).

10. *Oversights : dynamic languages and logics.*

The programmatic semantic theory of meaning, truth and denotation sketched out is evidently short of detail on several important issues, for example, the precise form of the intensional ontologically-neutral metalanguage presupposed, the role of context and how it functions in determining meaning, the constraints on wide frameworks, and the types of ambiguity that the theory recognises. But there are other facets of a full theory of meaning that have been entirely overlooked, in particular all those features that have to do with language change and the dynamic aspects of meaning and denotation¹⁹.

A language is not a static thing, but changes from day to day and from generation to generation. If formal investigations are to get to grips with living language, the static account of a formal language, bequeathed to us by Hilbert's Göttingen group, needs to be exploded to a dynamic account. Present day formal languages and logics can be seen as static sections, momentary snapshots, of evolving, dynamic languages. This fact suggests an initial plan for characterising dynamic languages, in terms of their static instances. First of all a language has, like a person, a lifetime, from time t_1 to t_2 say. At t_1 it is born or created, at t_2 it dies; in between it may develop, flourish, decline. A *dynamic* (free λ -categorical) *language* is a symbolic

system such that each instant of its lifetime is a static (free λ -categorical) language. This describes, though in an excessively liberal way, a language in the (accepted) symbolic sense. There is much more, of course, to a *natural* language than merely being a symbolic system; such a language may even amount, through associated features, to a form of life in Wittgenstein's sense. But even to capture the symbolic core of a natural language in a formal way would be a sufficient achievement. The trouble with the characterisation suggested is that it allows a structure with a lifetime of three days which is Hindi on the first day, Maori on the second and Swahili on the third, to rank as a dynamic language. Evidently the static components of a language have to be appropriately related; the issue of identity conditions for a language undergoing change has, in short, arisen. The problem is but an interesting special case of the general problem of the identity of things changing over time : almost every feature of a language can change — words certainly, parts of speech yes, grammar, yes — but none may change too rapidly or with excessive discontinuity. Similar problems of identity over time in principle arise with respect to a logic on a language; its axioms and rules can only change in a *controlled* way — as subject to conditions C, to use some mock-up formalism. A dynamic logic LD on a language is represented by a sequence of logics LD_i on languages over the language lifetime ($t_1 \leq i \leq t_2$) subject to set of conditions C on the sequence. Important as it is to determine conditions C (e.g. from reflection on the general features of languages viewed as extended temporal objects), a determination is not needed for a general semantical analysis of LD; for whatever the conditions they can transfer from conditions on a sequence of static languages to conditions on a sequence of static (basic) models. Then a model for LD is represented by a sequence of models for LD_i . A genuine model for LD, i.e. a genuine model sequence, can in turn be distinguished. It is then a straightforward matter to account, in a rudimentary way, for such matters as meaning change.

NOTES

¹See e.g. Kemeny [4], p. 11; Davidson [2]; Hintikka [12]; but the thesis, like so much in this area, really goes back through Carnap [13] to Wittgenstein [19] and beyond.

²The reasons for this criticism are well-known (e.g. from Quine [1]); they concern, in particular, referential opacity, the problem of

meaning postulates, the problem of characterising logical constants, and the contrast of the theory of sense with the theory of truth where Tarski's convention T and its analogues are supposed to give great control. Replies to the criticism are also well-known: for details see, e.g. Kemeny [4], and also [5].

³This claim is defended, along with a *qualified* version of the Moore-Wittgenstein thesis that intensional discourse is perfectly in order as it is, *ad nauseum* elsewhere, e.g. [9], [10] and [11]. For the qualifications see [11].

⁴More than enough by the author, particularly in initial attempts to formalise Meinong's theory of objects.

⁵Much of this has been said more fully and satisfactorily by Carnap in his semantical works; see the references cited in [13].

⁶The universal semantics of [7], which includes and very considerably extends that underlying [4], may be in turn enlarged and improved. In particular, the conditions on structure labels of free λ -categorical languages may be further relaxed, by introducing an ordering relation on structure labels (as in [34]). In this way the universal theory can *directly* encompass both transfinite type theories, such as that of Andrews [33], and the very substantial enlargements on what can be said in type-theoretical languages incorporated in Rennie [34]. Also the theory may be made polyvalent, to take due account of such values as non-significance and, perhaps, incompleteness. And its generality can be demonstrated; e.g. it can be shown to include all quantificational devices.

The availability of such a theory undermines Davidson's claims, selectively quoted at the outset. Davidson's argument seems to be that a universal theory of meaning must include a universal theory of truth, which is impossible because of the semantic paradoxes; so a universal theory of meaning is impossible. (Of course the idea of such a universal theory *makes sense*). The argument fails because the semantic paradoxes do not render a universal theory of truth impossible: as universal semantics furnish semantics for inconsistent languages and languages containing paradoxes along with all other language, paradoxes and contradictions offer no impediment.

⁷The fuller picture of [24] can be likened to that of an onion or artichoke; but it has yet to be determined how many layers the language onion has. But it is plain that the possible world approach has peeled off too many layers of the onion leaving only a far too meagre theory. However the unsympathetic reader may be tempted to liken the fuller picture to Dante's Inferno.

⁸ The class that *in fact* suffices for *natural* languages — however those are eventually characterised — should furnish the *language universals* in the linguists' sense.

⁹ For similar reasons Quine's central thesis (as discerned and criticised in [32]), that a pragmatically selected canonical language limns the most general traits of reality, is fundamentally mistaken.

¹⁰ The translation should, of course, meet certain conditions, e.g. it should be a recursive specification from initial syntactical components, and it should be derivable that, where tr_1 and tr_2 are two translation functions, $tr_1(A_0)$ iff $tr_2(A_0)$. Because of the latter, essential, condition, any correct translation will suffice, in particular a trivial one if it can be found.

¹¹ Several of these objections, especially those of Pap, have already been met, in part at least, by Kemeny (see [4], pp. 1–2); replies to the remainder will have to be reserved for another occasion.

¹² Another way, Kemeny's way, is to define *A* is true in *L* in terms of *A*'s validity in the factual model structure, i.e. in terms of *A*'s being true on every valuation in the factual model structure, where the factual model structure *S* in effect results from *M* by deleting *I*: but use of this definition involves assumptions it is preferable to avoid in a general theory.

¹³ The functional account of intensionality seems to have been glimpsed by Carnap (see [13], where special cases are sketched). The quite general thesis that intensions are functions from worlds to corresponding extensions was apparently proposed by Schock.

¹⁴ For a standard, inadequate, reply to this sort of objection see Cresswell ([8], Postscript, pp. 46-7). The reply fails to meet the objections because there are any number of people who though they know that propositions, for example, are not sets, are not clear what they are.

¹⁵ Another strategy tries to make use of the fact that whatever is said is said in some language, of the appealing hypothesis that whatever can be said ought to be sayable in some single suitably comprehensive (or ultimate) language, and of the emerging (coherence) idea that absoluteness really derives from system comparison, in the end with the ultimate language. For example, *A* really is true in *L* because *A* is true in system super-*L* (or meta-*L*, as in §§ 4–5), which is used as a measure of truth in *L*. If this strategy can succeed in the case of truth, why not apply it in the case of other semantical notions? But the method has its problems (some of which we have glimpsed with truth) and unless coupled with further

strategies, such as metasystemic analysis, it is not impressively informative.

¹⁶The definitions of propositional identity yield definitions of *proposition*. A proposition is given by — is *not* identical with — a class of normal frameworks. As to how the definitions go in the trivalent case, see [10], § 7.2.

¹⁷In this limited respect, and given that M can be distinguished, Cresswell [6] is right : see § 3.

¹⁸Or at least none that I am prepared to fall back upon.

¹⁹There are other features of language bound up with the full theory of meaning that can however be theoretically separated from it, e.g. issues of language learning, semantic competence, etc.

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