STATES OF AFFAIRS AND THE EVOLUTION OF CARNAP'S SEMANTICS[1]

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As is well known, at some time in the 30s Carnap was 'converted' to semantics by Tarski's work. In his first works on the subject he used a curious blend of Wittgensteinian and Tarskian ideas in a characteristically Carnapian systematic setting. The Wittgensteinian ingredient of that mixture relied in the use of *states of affairs* in the semantic theory. But Alonzo Church, in his review of Carnap's *Introduction to Semantics (IS)*, attacked that Wittgensteinian component with a version of certain influential but fallacious argument — the one that has come to be known recently as the *slingshot*[2]. It seems that, as a consequence, Carnap modified his semantical ideas in important ways, so that, when he later went into the theoretical study of modalities, states of affairs had been lost to view.

It seems to me that the scope of Carnap's commitment to an intensional view of logic, when he began to work on 'semantic systems', has been largely overlooked, and, as a result, the nature of the change in viewpoint that followed Church's criticism has not been fully appreciated. Thus, my central concern here will be to bring out those two aspects of Carnap's development.

1. *The role of states of affairs.*

In a letter to Carnap dated on February 4th, 1938, Quine tells him how 'alarmed' he is by Carnap's 'new views', of which he has recently known through Hempel. What causes most distress to Quine is, it seems, that 'our language', that is, the language in which we conduct inquiry, should be — according to Carnap, as Quine understands him— intensional. The alarm

[2] See below, note 17.

must have been serious indeed, because in an admonition very much out of tune with the general mood of the epistolar interchanges between both thinkers, Quine writes: 'I fear that your principle of tolerance may finally lead you even to tolerate Hitler.' In his answer to Quine's letter seven days later, Carnap comments: 'Your sermon against my sin of intensionality has made a great impression upon me.' And he goes on reassuring Quine that he was using 'intensional meta-language only for certain purposes'[3]. But I think there is some evidence that the role that Carnap contemplated for intensional languages was at this stage significantly more important than this remark suggests.

The issue should be studied in relation to Carnap's planning of a whole *series* of books on Semantics some months later[4]. The third in the series would be dedicated to a study of the logic of modalities, which —as we will see— was considered by Carnap as the way to further investigate the chances for an intensional language for Semantics *as a whole*. Apparently, Carnap's expectation at the time of writing *IS* —the first of the planned books— was that such a use of an intensional language would be vindicated. But Carnap came short of giving a full-fledged account of the modalities. In a certain sense, the incomplete project was pursued several years later, and on a different track, by Kanger, Kripke, Hintikka, Kaplan and Montague[5].

One central motive in *IS* is the clarification of the concepts of *L-Truth* and *L-implication*, which for Carnap were meant in the wide sense of *analytical truth* and *analytical consequence*. The idea is that a sentence is *L-true* if its being true follows alone from the meaning or the semantic rules of the language it belongs to (§ 15). (Carnap does not have a more restricted concept of *logical truth*.) Thus, by clarifying those two *L*-concepts and other related *L*-concepts, he is in fact aiming at a general theory of meaning (or the semantic part of it, leaving pragmatics aside).

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[3] See Quine and Carnap (1990), 239, 240-241, and 245.

[4] The books *Introduction to Semantics, The Formalization of Logic*, and *Meaning and Necessity* — published respectively for the first time in the years 1942, 1943 and 1947 — were a partial realization of the project.

[5] Carnap himself pursued the project. In his own words in the preface (from the year 1958) to the one-volume edition of the two first books in the above mentioned series: 'Since then [that is, since 1947] I have studied various more comprehensive modal systems (..) but these investigations are not yet finished.' He never published any other work on general semantics, although he did leave a substantial set of notes unpublished.

Carnap's way to clarify the concepts of semantics consists in presenting several possibilities ('methods' as he calls them[6]) of defining or otherwise characterizing those concepts. He first introduces the fundamental logical concepts of *L-truth* and *L-implication*, and other *L*-concepts, as primitives, with a series of postulates to govern them (§ 14). But then (§ 20), a way is shown to define these concepts, and prove from the definition these postulates as theorems. This method, 'of a fundamentally different kind' (p. 134), is prominent in the book[7].

The new way of defining the fundamental concepts makes use of the concept of *L-range* as a primitive. Now, a way to informally explain this concept is in terms of states of affairs. States of affairs themselves are in turn explained informally relatively to languages, or what Carnap calls 'semantic systems'. He considers informally *maximal* states of affairs: the states of affairs of all objects 'dealt with' (his own term) in a semantic system with respect to all properties and relations 'dealt with' in such a system (p. 101). Any such state of affairs is called by Carnap an *L-state*. An *L-range* of a sentence is then the collection of *L*-states 'admitted' by it[8].

Consider now the class of all *L*-states with respect to a semantic system *S*; this is the *universal L-range* in *S*. Then, a sentence is *L-true* if and only if its range is the universal range. And a sentence *L-implies* another if its *L*-range is included in the *L*-range of that other sentence[9]

It is clear that Carnap identifies states of affairs with propositions[10], *L*-states with certain kinds of propositions, and thus *L*-ranges can be identi-

6 The word 'method' alludes to the fact that choice of possibility is for Carnap not a question of theory but of practical decision.

7 Carnap explains other possible 'methods' only in outline (§ 16, 85-88). Among them is Tarski's definition of logical consequence in Tarski (1936), the one that evolved in the following years to finally become the standard model-theoretic definition. Carnap mentions the problem it faces both in finding an explanation of the distinction between logical constants and descriptive signs, and because of 'the fact that logical relations may hold between the designata of the descriptive signs' (87). For Tarski's account, see Etchemendy (1990), Sher (1989) and (1991), and García-Carpintero (1993).

8 According to Carnap, when we understand a sentence, we know which states of affairs the sentence admits (96), and in this sense we know its truth-conditions (28). Thus, only from our understanding we know its L-range. Only semantic knowledge is required for this; no factual knowledge (96). Carnap gives credit to Wittgenstein for these ideas, alluding to their connection with the concept of logical truth (28-29). Indeed, he sees his task as generalizing Wittgenstein ideas in the exact environment provided by Tarskian methods.

9 Carnap (1942), § 20, 137.

10 Indeed Carnap mentions the use of the term 'proposition' that makes of it a terminological variant of 'state of affairs', as used by Wittgenstein (cf. 235).

fied with classes of propositions[11]. Carnap shows actually (§ 18) how to *define* L-states and L-ranges making use of a concept of L-truth *for propositions*. This last concept, however, is not defined in the book (which is why he could not but leave the concept of L-range as undefined in the presentation of the new method), but it is identified with the concept of necessity in some Lewisian system of modal logic (p. 93), although Carnap postpones the investigation of this issue for the third planned volume in the above mentioned series. Thus, we see that, as Carnap himself emphasizes, he was contemplating the investigation of systems of modal logic as part of the determination of the most convenient *metalanguage for semantics*[12].

So much for the *intensional way* for semantics[13]. But Carnap is well aware that the question of an extensional versus an intensional metalanguage for semantics is controversial. Indeed, he has also an *extensional way*. In § 19, he explores tentatively several kinds of extensional *ersatz* for states of affairs, among them state-descriptions[14], and he characterizes L-ranges in terms of them. However, it is clear in any case that the characterization of L-ranges so obtained relies on a concept of *L-truth* for sentences, and so cannot be used in defining that concept[15].

Thus, the issue of an intensional vs. an extensional metalanguage is left unsettled (pp. 118 and 243). This could not be otherwise, in the absence of

11 The use of the word 'proposition' for elements of L-ranges of sentences accords with the use of the term that makes of a proposition the *one* entity expressed by a sentence — a use endorsed by Carnap — only if a class of propositions can be itself a proposition; perhaps it helps to consider, instead of the class, some kind of disjunction — finite or infinite — of propositions.

12 Put it in a different way. If the concept of *L-truth* for propositions were defined, then L-ranges and L-states would also be defined, and through them, the (general) concept of logical truth for sentences. But clarification of the first concept required for Carnap clarification of the concept of necessity through investigation of *modal* systems.

13 Carnap himself resists in *Introduction to Semantics* the use of the term 'intensional' because, he says, this term was being used with another meaning, and he accordingly prefers to use 'non-extensional' instead. I do not know which other meaning he had in mind.

14 There is a guarantee that a state of affairs is designated by a state-description only if the language at issue has negation (107, 112-113). Carnap seems to see in this restriction a limitation for an account in terms of state-descriptions.

15 Thus Carnap has an additional reason for leaving L-ranges as primitive in the new way of defining L-truth. Indeed, in the book he 'tried to frame definitions and theorems in a neutral way, so as not to require the language used — especially the metalanguage used for semantics and syntax — either to be non-extensional or to be extensional' (92).

a theoretical account of a system of modalities that could be used as a meta-language for semantics. But we can well see which are Carnap's inclinations. He repeatedly manifests his interest in having such a system (see 54-55, 118, 143), and his intention ('plan') to contribute to that aim (pp. 55, 92). On the whole, even if more investigation is required to establish the preference for an intensional metalanguage —and, with it, an intensional account of the logical properties—, it would seem as if already 'certain considerations, especially in L-semantics, seem to point in this direction' (243)[16]. In this last passage, Carnap refers the reader back to §§ 16, 17 and 18 for the relevant considerations, but I think he is alluding to problems in other approaches (see notes 5 and 11) and to the promise he sees in the intensional way described above when it comes to *defining* the L-concepts.

2. *Church's criticism.*

In his review of *Introduction to Semantics*, Church argued against using propositions or states of affairs as semantical values of sentences. His argument is the following. Take any true but not logically true sentence, say φ, of a certain language L that contains the λ operator —a sentence then that, according to Carnap's 'primary usage', does not admit all states of affairs. Consider now the sentences of L '$(\lambda x)(x = x \land \neg\varphi) = \varnothing$' and '$\varnothing = \varnothing$', that we will call σ_1 and σ_2. Using a metalanguage that contains L, we have:

(1) '$(\lambda x)(x = x \land \neg\varphi) = \varnothing$' designates $(\lambda x)(x = x \land \neg\varphi) = \varnothing$.
(2) '$\varnothing = \varnothing$' designates $\varnothing = \varnothing$.

Now (Church assumes), '$(\lambda x)(x = x \land \neg\varphi)$' designates the same as '$\varnothing$', namely, the empty class. But then, by interchanging these co-designative terms in (1), we have:

(3) '$(\lambda x)(x = x \land \neg\varphi) = \varnothing$' designates $\varnothing = \varnothing$.

And so, by (2), it follows that '$(\lambda x)(x = x \land \neg\varphi) = \varnothing$' and '$\varnothing = \varnothing$' designate the same thing. But then, of course, what they designate can't be states

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[16] The cautious tone was undoubtedly encouraged by his (mainly epistolar at the crucial time) exchanges with Quine, as the recently published correspondence between them makes clear. The very special intellectual relationship between both thinkers has also to be taken into account.

of affairs or propositions: they can't designate the same class of states of affairs (L-range) or the same proposition, since σ_2 is L-true and σ_1 is not.

This is a version of the (in)famous argument that is nowadays called the 'slingshot'[17]. The argument originates in Frege's 'Sense and Reference', where Frege argues in favour of truth values as the referents or designata of sentences. But in Frege we find only an outline, and it is in Church's review where it appears for the first time as an explicit argument. In fact, Church is using Carnap against himself: '[Frege's] argument in support of this distinction lends itself to reproduction in more exact form by means of Carnap's semantical terminology'; see Church (1943), 301.

Now, the argument is not sound. In this version, the fallacy arises in the crucial assumption that '$(\lambda x)(x = x \wedge \neg\varphi) = \varnothing$' designates the same as '$\varnothing$' (Church, 1943, p. 300). This would be acceptable only if both signs designate classes, and this is, of course, what Church assumes, since he says that both designate the empty class. But he does not seem entitled to make that assumption, because it is not the only reasonable possibility. Indeed, we can think of them as designating properties intensionally conceived: *being the empty class* for '$\varnothing$'; or consider '$(\lambda x)(x \neq x)$' instead of '$\varnothing$' —as Church himself proposes—, if this is clearer. Then, in this latter case, it is not obvious at all that these expressions should co-designate, since, on any plausible account of 'property', the property of *being a self-dentical object such that* $\neg\varphi$ is not the property of *not being self-identical*. We can even give a reason similar to the good one given by Church for convincing us that σ_1 and σ_2 do not designate the same proposition, namely, that the second of the properties is 'logically contradictory' — no object can have it, and so it is a 'logical' property in some sense; not so the first property[18].

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[17] See Barwise and Perry (1981). There are several variants of what is basically the same argument, and which have been used time and again by Church, Quine and Davidson for somehow abashing intensional semantics. Gödel gave it a general, abstract, form. The uses of the argument are not coincident in Church, on the one side, and Quine and Davidson, on the other. Whereas the first uses it to separate reference-semantics from sense-semantics —extensional from intensional semantics—, Quine and Davidson use it as a powerful weapon against having any kind of intensional-level in semantics.

[18] This is a rough outline of the structure of the fallacy. See Barwise and Perry *op. cit.* for other versions of the argument and their respective criticism. Nevertheless, the full refutation of the argument should be given in relation to some general form of it, as Gödel's.

3. *The outcome.*

We know that when Carnap was working in the manuscript of what some years later became *Meaning and Necessity*, he was aware of the criticisms that Church and Quine had levelled against his account of semantics[19]. As he says —with his exceptional disposition to welcome criticism— he received much *stimulation* from them. What we finally have in the new book is the new semantic 'method' of intension and extension, which is the combined result of Carnap's exchanges with Church and Quine, and his own creativity. Thus, it is not easy to sort out the effect of Church's review.

One thing that strikes the reader immediately is that states of affairs have disappeared. They are mentioned just once, when Carnap states that state-descriptions (the new basic theoretical concept) 'represent Leibniz's possible worlds or Wittgenstein's possible states of affairs' (9). Thus Carnap has not lost entirely his intellectual affiliation in this respect. But we have to look at it more closely.

There is a method or procedure that seems now to Carnap 'the most convenient among those known at present for the semantical construction of a system of deductive logic' (9, note); moreover, it is —as he says— the same procedure he has used 'for modal logic [in his 1946 paper] and for inductive logic [in his 1945 paper].' This method turns out to be essentially the one that is found in § 19 of *IS* — the one that takes *L*-ranges as classes of state-descriptions. Naturally, as already pointed out above, Carnap has then no general definition 'of the new kind' of the *L*-concepts. This can pass unnoticed because Carnap actually presents the definition for one concrete system (10). Thus, apparently, the old aim, expressed in *IS*, of having a definition for 'systems in general' —a definition belonging to 'general semantics'— has been abandoned (indeed, there is no longer mention of 'general semantics').

But what is most important about Carnap's new stance is, I take it, his discussion, in chapter IV of *Meaning and Necessity*, of metalanguages for semantics. In the last section of the chapter, Carnap examines the chances for a thorough extensional metalanguage *even* for the semantics *of an intensional language*, and he sees then good prospects for it. Even though he finishes the chapter with a characteristic 'this problem requires further investigation' (172), it is clear that his position has changed a whole 180°.

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[19] See Schilpp (1963), 63, and Quine and Carnap (1990), 314.

The way is now paved for a new, thoroughly extensional semantics for modal logic and model-theoretic semantics in general[20].

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[20] It is significant that Kripke found it convenient to stress this point in his foundational 1959 paper. We can read there (p. 3): 'It is noteworthy that the theorems of this paper can be formalized in a metalanguage (such as Zermelo set theory) which is 'extensional', both in the sense of possessing set-theoretic axioms of extensionality *and* in the sense of postulating no sentential connectives other than the truth-functions. Thus it is seen that at least a certain non-trivial portion of the semantics of modality is available to an extensional logician.' (Kripke's emphasis)

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