

Underdetermination versus Indeterminacy¹

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Thomas Bonk has dedicated a book to analyzing the thesis of underdetermination of scientific theories, with a chapter exclusively devoted to the analysis of the relation between this idea and the indeterminacy of meaning. Both theses caused a revolution in the philosophic world in the sixties, generating a cascade of articles and doctoral theses. Agitation seems to have cooled down, but the point is still debated and it may be experiencing a renewed resurgence.

Both theses make their appearance in *Word and Object*, Quine's work from 1960, and they will be a constant in his ulterior writings, going under several reformulations and clarifications. Each one of these ideas, underdetermination of theories and indeterminacy of meaning, deserves a deep analysis by itself, but we will centre here specifically on the relation between them, since it has proved to be an excellent way of clarifying both ideas.

T. Bonk's work discusses the relations between both theses in chapter 6, named «Underdetermination and Indeterminacy». The sections of this chapter are: «Underdetermination and Translation», «Indeterminacy versus Underdetermination», «Empirical Investigations of Cognitive Meaning», «Indeterminacy and the Absence of Fact» and «Quine's Pragmatic Interpretation of Underdetermination». I will present here my own reconstruction of the issue, which should serve me to show the points I find obscure in Bonk's study.

1. Underdetermination

Underdetermination thesis can be formulated as follows: it consists in the possibility of two different but empirically equivalent scientific theories. However, this requires some Quinean apparatus. Quine has offered a powerful image of a scientific theory; in a nutshell: «Science is a ponderous linguistic structure, fabricated of theoretical terms linked by fabricated hypotheses, and keyed to observable events here and there.» (1975, p. 261). The only evidence of science is sensory information, which is expressed by *observational sentences*. These sentences are thus the ones that are exclusively linked to

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sensory stimulation and are therefore apt to be learnt by ostension, regardless of whether they have actually been so learnt or not. The truth conditions of an observation sentence for a subject S are thus determined by the sensory state (the patterns of stimulated nerve endings) that S has been conditioned to associate with the sentence. A sentence loses its observational character when sensory information is not enough to determine its truth conditions. Non-observational sentences are not directly linked to sensory stimulation, extra information is required.

The most important feature of the non-observational part of language of science is its holistic character. Holistic in two senses: confirmation holism and meaning holism. Quine's acceptance of verificationism, the idea that «the meaning of a statement is the method of empirically confirming or infirming it» (1951, p. 37), and of holism verificationsim, the idea that «theoretical sentences have their evidence not as single sentences but only as larger blocks of theory» (1969a, p. 80, the idea known as the Duhem-Quine thesis), generates meaning holism or, what amounts to the same, meaning indeterminacy.

The observational sentences that are deduced from this linguistic structure of a scientific theory are the *empirical content* of the theory. More accurately, the empirical content is constituted by the *observation categoricals*, observational sentences linked by the material conditional (e.g. «if it snows, then it is cold»). It is obvious that a theory cannot entail observation sentences in isolation, sentences as 'A rabbit there!', but observation conditionals, where the antecedent states the «boundary conditions» and the consequent is the checkable sentence. It is possible now to determine when two theories are empirically equivalent: when they have the same empirical content (Quine 1992, pp. 16-17). Now, the underdetermination thesis claims that two or more different physical theories –not merely different formulations of the same theory– «can be at odds with each other and yet compatible with all possible data», or more concretely: «they can be logically incompatible and empirically equivalent» (1970a, p. 209). Therefore, what now needs to be clarified is when two formulations are to count as formulations of different theories or of the same one, and the answer is that they are formulations of different theories when they are incompatible. Let us now pause on this idea of incompatibility:

Theories would be compatible if it is possible to render them identical by switching predicates in one of them, i. e., by a process of mapping predicates: «I propose to individuate theories thus: two formulations express the same theory if they are empirically equivalent and there is a reconstrual of predicates that transforms the one theory into a logical equivalent of the other.» (Quine 1975b, p. 235).

Empirical equivalence and impossibility of a full mapping of predicates are thus the factors that must converge to generate underdetermination. But what is the cause for this to happen? These two elements are a consequence of the nature of the scientific method. As it proceeds, observational sentences do not logically entail theoretical sentences; the relationship of logical implication only proceeds in the other direction. The scientist is therefore not univocally constrained in his theory construction process by the observation sentences she and her colleagues endorse. Given the «empirical slack» between the evidence and the theory, the «tenuousness of the connection between

observation sentences and theoretical ones», she enjoys considerable freedom in choosing the theoretical sentences from which she will derive the observation categoricals.²

It is possible to distinguish in Quine's reflections about underdetermination two types of incompatibility between scientific theories:

- (a) Theoretical incompatibility. There is no discovered way of converting one theory into the other by a mapping of predicates. This is a consequence of how theoretical terms are used in theories –the complexity of the connections that determine their «meaning»–; presumably, it will be difficult to map one theory into other if they do not share a certain structure.
- (b) Logical incompatibility. Once two theories have been shown to be convertible one into the other, it could be the case that one of them asserts a sentence that the other one rejects. Thus, if one theory affirms A and the other one affirms $\neg A$, given that they are empirically equivalent, A must be a theoretical sentence, so its translation is not a straightforward business. Therefore, we should assume, according to Dummett, that A does not have the same meaning in both theories. But, as L. Bergström argues (2004, p. 103), this argument «is too legalistic». If an empirically correct manual of translation from one theory to another were at our disposal where one maintains A and the other $\neg A$, we would have a genuine case of logical incompatibility. Why should we disregard this manual and change it if it is empirically adequate and that is all there is to meaning?

2. Indeterminacy

A classical formulation of the indeterminacy thesis affirms that

manuals for translating one language into another can be set up in divergent ways, all compatible with the totality of speech dispositions, yet incompatible with one another. In countless places they will diverge in giving, as their respective translations of a sentence of the one language, sentences of the other language which stand to each other in no sort of equivalence however loose. (Quine 1960, p. 27).

2 J. Peijnenburg and R. Hünnefeld affirm: «Clearly both indeterminacy and underdetermination are firmly rooted in holism, which is the base for the idea that a particular piece of evidence can be accounted for in many incompatible ways.» (2001, p. 19). But let us suppose that it is possible to determine for each theoretical sentence in isolation which observational categorical is to be derived from it. Theoretical sentences would wear, as well, their empirical meaning in their sleeve. Holism, and indeterminacy with it, would dispel while underdetermination not, as the scientist could still come up with different theoretical sentences to entail the same set of observational ones. Deductivism, but not holism, would be the cause of underdetermination (s., for interesting comments about this question, T. Bonk 2008, p. 219). Anyway, if it were possible to specify the observation categoricals that each theoretical sentence implies, it would be also possible simply to substitute the theoretical sentences by the observation categoricals –what Quine calls a «tight fit»–. This possibility is what Craig's theorem seems to offer. Given that, for any rather complex theory, it does not seem a plausible tactic, the suggested possibility is not a realistic one, so we can consider that holism is a stronger argument in favour of underdetermination than the one-direction implication from theoretical sentences to observation categoricals. (About the impossibility of applying Craig's theorem to physical theories, s. I. McDiarmid 2008 or H. Putnam 1965).

The reasons for indeterminacy are (a) what Dummet called the inextricability thesis, namely, the idea that meanings and empirical beliefs are indissolubly linked and (b) the holism that affects our web of beliefs. The result of indeterminacy is that if the total set (not only the observed one) of speech (or more broadly, behaviour) dispositions of a speaker does not determine if the meaning of his sentence *S* is the one given by a manual of translation *T* or the one given by a different and incompatible one *T'*, then there is no fact of the matter as if *S* means what *T* claims or what *T'* does. The idea is: if no evidence –verbal and non-verbal behaviour– can settle the correct choice between different alternatives, then meaning is indeterminate. The fact that all possible evidence leaves room for different alternatives, i.e., underdetermination, implies indeterminacy. The similarity of indeterminacy and underdetermination is obvious: in the latter, it is possible to build different scientific theories compatible with all possible evidence; in the former, it is possible to interpret a speaker in different ways –ascribing different meanings to his utterances– all of them compatible with all possible evidence. The conclusion Quine draws from indeterminacy is his well-known scepticism about meanings understood in the traditional way, meanings as propositions or thoughts –that is, semantic antirealism–. The conclusion from underdetermination is, surprisingly, not an analogue one, scientific antirealism, but a vague reflection about «what is practically feasible» when theorizing (Quine 1975b, p. 241).

3. Underdetermination vs. Indeterminacy

Quine offers two answers to the previous question:

a) Indeterminacy, not underdetermination

Quine has claimed that «the indeterminacy of translation is not just inherited as a special case of the underdetermination of our theory of nature. It is parallel but additional.» (1969c, p. 303). One of the major virtues of Bonk's exposition is its clarity about this point. The author says:

‘Parallel’ refers to the methodological similarities between the two cases, while ‘additional’ indicates the persistence of underdetermination of semantic notions if there were no empirical irresolubility in the natural sciences, and all physical facts were ideally known. (T. Bonk 2008, p. 221).

Indeed, the parallelism appears clearly: there is a similar methodology in the construction of a translation manual and of a scientific theory, however different they may be in purpose and nature. Thus, if the hypothetic-deductive method is one reason for underdetermination in the case of science (s. note 1), given that the scientist's and the linguist's methodology are so similar, the same line of argument can be followed in the case of semantics. T. Bonk says here:

The underdetermination of «global science» is, if we follow Quine, caused by the need to use concepts referring to non-observables, hence by deductivism (which gives rise to confirmation holism) with stimulus-observation sentences as potential

falsifiers or confirmers. Similarly, indeterminacy in *radical* translation arises if the translator has nothing to go on but agreement or disagreement with directly observed behaviour on the part of the native speaker, verbal and non-verbal alike (...) The similarity is striking on the *methodological* level: the trial and error method in devising translations for more «complex» sentences about non-observables in the target language, the linguists' quasi-Duhemian procedures, and the use of simplicity considerations. (*Ibid.*, p. 219).

Therefore: «Anyone who grants the underdetermination of «global science» should be inclined to embrace the indeterminacy thesis (...) with regard to translation as well: the methodology is similar in all respects.» (*Ibid.*, p. 215).

Quine goes on to offer two arguments to the question about where the parallel fails. One is designed to show that scientific theories are underdetermined, not indetermined, and the other to show that meaning is indetermined, not merely underdetermined. This latter says:

The point about indeterminacy of translation is that it withstands even all this truth, the whole truth about nature. This is what I mean by saying that, where indeterminacy of translation applies, there is no real question of right choice; there is no fact of the matter even to within the acknowledged under-determination of a theory of nature. (Quine 1969c, p. 303).

b) *Underdetermination, not indeterminacy*

It is to explain why physical theories are underdetermined and not indetermined what has proved to be more difficult for Quine and those who have followed him in this. I will argue here that it has proved so difficult because it is not possible: underdetermination suffices, in any area, semantics or physics, to render indeterminacy.

Quine says here: «[T]heory is physics is an ultimate parameter. There is no legitimate first philosophy, higher or firmer than physics, to which to appeal over physicists' heads.» (Quine *ibid.*) Quine is appealing here to the negative side of his naturalism. Quine's naturalism contains a negative and a positive aspect. The negative one is the above mentioned antifoundationalism for science –that «it is within science itself, and not in some prior philosophy that reality is to be identified and described» (Quine 1981, p. 21)–; the positive one is the thesis that it is solely science that can tell us the truth about nature (and about man, as a part of it). This last idea is to be seen as scientific realism. Quine considered himself not just a realist, but «a robust realist».

3. Bonk's position

Bonk's exposition of the tension between underdetermination and indeterminacy is, in general, excellent. Two elements, anyhow, cast an uncomfortable shadow on it.

a) *Methodological and Ontological Parallelism and First Person Perspective*

As already said, T. Bonk stresses, rightly in our view, that the parallel between science and linguistics is «striking in the methodological level» (p. 219). Nevertheless, he tries soon after to establish a strong difference between the posits of both types of theories. The author asks: «How plausible is it to apply the *posit-hypothesis-test* model to mind and language (the intensional apparatus), and treat them as *theoretical posits* on par with electrons in micro-physics and black holes in cosmology?» (P. 222). T. Bonk adds that if the posits of sciences «figure in laws and explanation, and are indispensable in accounting for the phenomena in mature theories», so do, «if we follow Chomsky» (as if we should!) the «categorical objects of modern (psycho-)linguistics, like phrase boundaries, inborn conceptual categories, rules for forming regular past tense forms, etc.» The conclusion then is that «they are scientifically respectable». Even «psychological objects and mechanisms like the Freudian concept «repression» (...) are perhaps methodologically suspect, but ideally satisfy the criterion as well».

Although the author is rather belligerent against underdetermination throughout the book –he criticizes Chomsky’s position of speaking «as if the thesis were unproblematic and plenty of uncontested examples were at hand» (p. 221)–, he seems in the present discussion to have accepted it for the sake of the argument, and those of us who consider underdetermination a rather plausible idea, thank him for that; but the author is not defending here that, given that underdetermination is not a plausible conjecture, neither is indeterminacy –this line of argument is annulated because, as we have seen, indeterminacy would persist even if our global scientific theory were determined–. The author is defending here a strong realism about meanings and intentional states. On what ground?

T. Bonk defence of this «semantic and psychological realism» with respect to certain «entities» is based on an appellation to first person authority. According to the author, entities such as

propositions, ideas, sentence meanings, thoughts, etc. (...) can count as fallible «posits» and as «theoretical» only with respect to *other* persons. That I have thoughts and that my sentences have determinate meaning is not something I am free to entertain as a fallible hypothesis in any interesting way. (*Op. Cit.*, p. 222).

This supposes to ignore Davidson’s explanation of how indeterminacy and first person authority with respect to the meanings of her words do not conflict. What «semantic first person authority» requires is that the speaker knows in a direct way what her words mean. This fact, following Davidson, is built into the same concept of speaking a language. If someone is a speaker of a language –i. e., she does not simply make random noises–, she applies her words in the way she learnt to do it, so it does not even make sense to say that she does not know what her words mean. Indeterminacy or inscrutability simply point out that it is always possible to offer different descriptions of the verbal behaviour of a speaker. In what sense different?

Let us lay indeterminacy aside here and concentrate on inscrutability.³ What a semantic theory must do for a speaker is to give the truth conditions of her sentences –roughly, the situations in which the speaker is disposed to utter the sentence–, and what inscrutability tells us is that this can be made in different ways, using different concepts. Davidson offers so innocuous an example as this: «It doesn't matter whether you say Sam is to the left of Susan, or that Susan is to the right of Sam.» (Davidson 1999: 596). Analogously, recalling Quine's famous example, it does not matter if you translate the sentence 'Gavagai' of a speaker as 'There is a rabbit there' or as 'There is a rabbit stage there'. At the end, we will have two empirically adequate descriptions of the speaker's verbal behaviour, but the speaker knows, in a direct way (she need not interpret herself), in what circumstances she is disposed to apply her sentence 'Gavagai'.

Appellation to first person authority was a line of attack against inscrutability inaugurated by Searle's article from 1987 «Indeterminacy, Empiricism and First Person». Searle says: «If my English-speaking neighbour, having read Quine, decides that he can't tell whether by 'rabbit' I mean rabbit, undetached rabbit part, or rabbit stage, then so much the worse for him. When I saw a rabbit recently, as I did in fact, and I called it a rabbit, I meant rabbit.» (Searle 1987, p. 126). But this line of argument was impugned by Føllesdal's article from 1990, «Indeterminacy and Mental States». After Føllesdal's paper, it should be clear that the appellation to the first person *à la* Searle is rooted in a miscomprehension of Quine's and Davidson's argument. Føllesdal stresses that it makes no sense to say that I refer to this or that with my terms, for inscrutability thesis is based on the sententiality principle: terms do not refer in isolation, terms make contributions to the meaning of the sentences holophrastically considered.

There is another dangerous element in this naïve resort to first person. How could T. Bonk explain that meanings are determined for the first person? Before two different but empirically equivalent translation manuals, what kind of evidence could settle the question? As Quine himself put the point, why does Chomsky think that it is his grammar the one which kids are born endowed with and not an extensionally equivalent one?⁴

3 One misses here a clear distinction between indeterminacy and inscrutability. Indeterminacy is, as already seen, the idea that it is always possible to give different empirical correct translations (meanings) of one sentence; inscrutability the idea that it is always possible to give different empirical correct references (*denotata*) of one term. Inscrutability, despite all its critics, was considered by Quine as «trivial and indisputable». It is possible to figure out a simple way of changing the reference of the terms of a language maintaining the same truth value of all the sentences; this ways are the *proxy functions*. Proxy functions are «one-to-one reinterpretations of objective reference. They leave the truth values of the sentences undisturbed» (Quine 1995, p. 72). We must remember that sentences, not terms, are the primary vehicle of meaning for Quine; terms only come into play in ulterior stages, when sentences must be analyzed in order to find proper patterns inside them.

4 Quine says about the Chomskian doctrine:

...suppose again a language for which we have two extensionally equivalent systems of grammar; two extensionally equivalent recursive definitions of well-formed strings. According to one of these systems, the immediate constituents for a certain sentence are 'AB' and 'C'; according to the other system they are 'A' and 'BC'. The enigmatic doctrine under consideration says that one of these analyses is right, and the other wrong, by tacit consensus of native speakers. How do we find out which is right? (Quine 1970, p. 221). ;

T. Bonk points out that grammar is not subject to indeterminacy: «the native's syntax, or grammar, is discernable and is thus not subject to the indeterminacy of translation» (p. 212), and fair enough as far as we speak about grammar in the usual sense, as the strings of phonemes considered as well-formed sentences by the speakers, but not in the Chomskian sense, as the trees where the concrete grammatical rules are derived of.

c) *Indeterminacy, Physicalism, Behaviourism*

There is an uneasy point about indeterminacy that goes through almost all the bibliography about it; it is its relationship with physicalism and behaviourism. T. Bonk offers in his book, exclusively, a Quinean view of indeterminacy, and this gives rise to a physicalistic and behaviouristic reading of the thesis. The author sees indeterminacy strongly committed to both behaviourism and physicalism. The behaviourist reading affirms that «[a]greement or disagreement with overt (verbal and non-verbal) behavior of the native speaker is the exclusive and maximal basis for judging the correctness of a translation manual» (p. 223). The physicalist reading says: «The exclusive and ultimate data basis on which to assess the correctness of a translation manual (...) is the totality of physical and neurophysiological facts (or, the best and ideally unique systematization thereof) about a native speaker's cognitive processes and her environment.» (p. 224). Now, the author claims that the behaviourist and the physicalist readings «function as substantive premises that are required to turn cases of empirical irresolubility into instances of «michophysical» or «observational» indeterminacy» (p. 225).

But empirical irresolubility, in the case of meanings or beliefs, renders indeterminacy even without these additional supports. Let us formulate the question the other way round. What kind of evidence could determine if the one-word sentence 'Gavagai' means 'Rabbit' or 'Undetached rabbit part'? We can make a list, following V. M. Gee (2005), of the elements that could possibly determine the meaning. Take beliefs: what makes a belief of someone a belief about rabbits and not about undetached rabbit parts? The same applies to desires. Take «internal language»; even if someone said to herself: «whenever you say 'rabbit', do refer to rabbits and not to undetached rabbit parts», once the term has been spoken, it could be interpreted by another speaker as referring to undetached rabbit parts –and even by the speaker herself–. Other elements can be thought up –as the evolutive history–, and always with same result: *no matter what kind of evidence, physicalist, behaviourist or as mentalist as you please, indeterminacy is unavoidable*. Moreover, Davidson has defended indeterminacy in the context of his semantic theory, which has as basis the *intentional* attitude of holding a sentence true.⁵ To defend that our mind is apt to determine univocally that our term 'rabbit' refers to rabbits and that we want a rabbit and not an undetached rabbit part, as Searle's theory of the «Intentional Content» does, commits ourselves with a magical theory of the mind, as M. Devitt has pointed out (1990, pp. 98f).

Quine himself praised Føllesdal's exposition of indeterminacy because it made apparent that only a limited behaviourism is required:

What matters is just that linguistic meaning is a function of observable behavior in observable circumstances. (...)

5 Davidson says:

But radical interpretation should rest on evidence that does not assume knowledge of meanings or detailed knowledge of beliefs.

A good place to begin is with the attitude of holding a sentence true, of accepting it as true. This is, of course, a belief, but it is a single attitude applicable to all sentences, and so does not ask us to be able to make finely discriminated distinctions among beliefs. (Davidson 1973, p. 134).

Broader behaviorism is irrelevant; physicalism is irrelevant; monism is irrelevant. One can wallow in the rankest mentalistic ontology without affecting the indeterminacy of translation. (Quine 1990, 110)

And, as we have seen, not even that limited linguistic behaviourism is necessarily required.

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