

Bolzano, Quine and Logical Truth*

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"Carnap and Logical Truth" was written within a few years of the publication of "Two Dogmas of Empiricism". It is in many ways an extension of Quine's époque-making discussion of analyticity. One novel feature of the paper resides in the distinction Quine draws between two ways for a sentence to meet the criteria for logical truth. On the one hand a sentence may fulfil the "formal definition"¹ of logical truth: a sentence may remain true under variation of the non-logical vocabulary. On the other hand, the same sentence may fulfil the "epistemic requirement" on logical truth: a sentence may be logically certain, a notion Quine considered cashing out, commenting on Carnap, in terms of truth by virtue of meaning. Quine writes:

Though formulated with reference to language, the above clarification [the definition of logical truth] does not of itself hint that logical truths owe their truth to language. What we have thus far is only a delimitation of the class, *per accidens* if you please. Afterwards the linguistic doctrine of logical truth, which is an epistemological doctrine, goes on to say that logical truths are true by virtue purely of the intended meanings, or intended usage, of the logical words." (1966b, 110)

As Quine sees it, inasmuch as analyticity concerns the "possibility of logical certainty", the notion that does the philosophically interesting work in the theory is that of "truth by virtue purely of language". Quine's remark is important. What it implies is that the variation-based treatment that underlies the formal definition of

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¹ I use the term "formal" here for the following reason: According to the common understanding, a proposition whose truth remains constant under variation of its non-logical vocabulary is also true by virtue merely of its form: the part of the vocabulary that occurs essentially in a logical truth is what makes up its "logical form" or as Quine puts it a "certain skeleton of symbolic make-up" (Quine 1966a, 80).

logical truth, while it may serve to delimit the class of logical truths does not at once account for our intuitions concerning epistemic necessity. This in turn helps us understand why so many have had qualms with the formal definition of logical truth: if the *raison d'être* of logical truth is the epistemic requirement, the formal definition may ultimately hit the target by mere accident, yielding sentences that are intuitively analytic without accounting for our intuitions concerning epistemic necessity.²

In this paper, I compare Quine's discussion of logical truth to Bolzano's theory of "logical analyticity". It is by now a received view that Bolzano largely anticipated Quine's views on logical truth, a conclusion Quine himself was retroactively prompted to draw:

"[M]y much cited definition of logical truth was meant only as an improved exposition of a long-current idea. So I was not taken aback at Bar-Hillel's finding the idea in Bolzano [...]" (Quine 1960, 65; see also 1966b, 110)

According to the standard interpretation, the similarity between Bolzano and Quine comes from the fact that they are both "demarcating logic [...] with the help of a set of logical particles which are held constant, while the other non-logical expressions are freely substituted for each other".³ This interpretation assumes that Bolzano and Quine share at least some substantial views about what makes a term a "logical" term. I think that this interpretation is largely mistaken. My paper has four parts. In the first part, I give some background to Bolzano's theory, focusing on his views on syntax and form. In the second part, I show why it is mistaken to assume that Bolzano and Quine mean the same when they speak of logical concepts/words. In the third part of the paper I discuss Bolzano's views on logical truth and sentences that can be turned into logical truth by putting synonyms for synonyms. I conclude by asking whether Bolzano's position

² Etchemendy (1988, 99) makes a similar point with reference to Bolzano and Tarski.

³ "Comments on Quine" (Follesdal 1980, 29, my emphasis)

allows him to fulfil the epistemic requirement (and answer, with a twist, in the affirmative).

According to Bolzano to define a logical property or relation is to describe a property or relation that is borne by one or more objective, abstract entities Bolzano calls '*Sätze an sich*' and '*Vorstellungen an sich*' - and which, for the sake of brevity, I will call 'propositions' and 'ideas'. The greater part of Bolzano's monumental *Theory of Science* (1837) consists in a systematic description of the various properties and relations of propositions and ideas. It involves a series of implicit and explicit definitions that are thoroughly discussed and compared to the views of others.⁴ One of the most interesting and original features of Bolzano's theory is his account of the form or structure of propositions and ideas. By contrast to his immediate predecessors, Bolzano sees a great deal of intrapropositional articulation and his analyses of the latter are extensive. Bolzano not only distinguishes between "object-ideas" and "property-ideas", he also represents syntactic subcategories - with corresponding uppercase and lowercase schematic letters, e.g. 'A' and 'b' respectively⁵ - in the vocabulary and marks a rupture with classical Aristotelian notations that do not. In Bolzano, propositions and ideas are built on the basis of an (in principle) finite primitive set of ideas and of determinate (recursive) rules. Among the rules he lays down are the following - I introduce the square brackets to form designations for ideas and propositions:

- There are simple and complex object-ideas. Simple ideas are treated as unstructured. (Cf. 1837, §56, 243ff.)

⁴ Bolzano stipulates, for instance, that ideas are the subpropositional parts of propositions (1837 §48, §123), that ideas and propositions are not real (*wirklich*) (1837 §54, §122), that ideas and propositions have a content (*Inhalt*) (1837 §56) and, unless they are "objectless" (1837 §67), an extension (*Umfang*) (1837 §66, §130), that ideas are either simple (1837 §61) or complex (1837 §56), that there are singular ideas as well as general ones (1837 §68), and so on. Bolzano offers definitions of the relevant notions: content, complexity, simplicity, extension, objectuality, etc. and introduces a number of further distinctions: ideas can be redundant (1837 §69), real or imaginary (1837 §70), they can be intuitive or conceptual (1837 §72, §75), as can propositions (1837 §133).

⁵ In this respect, Bolzano's notation is the opposite of current logical practices.

- A complex object-idea [A] is typically attributive i.e. of the form [Something which has a] where [which has] is an idea-forming operator (cf. 1837, §60, 259ff.).
- All propositions have the form 'A has b'.⁶ (Cf. 1837, §127, 9f) If the subject-idea [A] of a proposition [A has b] is complex, its analysis is: [Something which has a has b]. (Cf. 1837, §§58–59, 251ff.)⁷

As Bolzano sees it, the role of certain types of ideas (such as [has] and [which has]) is to connect other types of ideas (such as [human], [creature] and [mortality]) to compose more complex ideas (e.g. [Creatures which have humanity]) or propositions (e.g. [Humans have mortality]). Though Bolzano does not explicitly generalize, he would agree to say that all ideas of the first kind "pertain to logic". On what is perhaps the most natural interpretation, and *de facto* the default interpretation, what Bolzano means with "logical concepts" in this context is taken to be roughly what Quine means with "logical words": in both case we are dealing with a type of terms that play a role in determining the logical form: grammatical "particles"; what is otherwise called a "logical constant".⁸

Let us assume the following list of uncontroversial logical constants: the signs for negation, conjunction, disjunction, conditionality, and the first-order quantifiers. Two points ought to be made. The first thing to note is that Bolzano's list of logical constants - the terms he uses to designate the first kind of ideas above - significantly departs from the list of logical constants recognised as uncontroversial. The only clear-cut cases of logical constants in Bolzano are the

⁶ Bolzano also claims that 'A has b' and 'A is B' are logically equivalent. In what follows, for simplicity's sake, I will favour the 'A is B' form.

⁷ As we will see, Bolzano thinks that propositions that have apparently different forms like "p or q" or "if p, then q" can be reduced to this form.

⁸ Of course, logical constants are signs, not concepts but this difference is somewhat immaterial here - at least it is not the one that matters. In what follows I will apply what Bolzano says of logical concepts *mutatis mutandis* to the terms that are used to designate them.

name-forming operator 'which has' and the sentence-forming operator 'has'. The reason for this is that Bolzano in the *Theory of Science* presents an alternative way to regiment the grammar of natural language. Part of Bolzano's project was to eliminate the traditional logical vocabulary (including: 'or', 'not', 'and', 'if,... then...', 'all' and 'some') in order to accommodate the idea that all propositions ultimately have the form 'A has b'. His syntax is accordingly substantially different from both traditional Aristotelian logic and standard first order logic. Commentators often assume that Bolzano's emphasis on the 'A has b' form implies that Bolzanian propositions are "uniform" in structure. (See, for instance, Textor 1997, 182) Bolzano's project however is highly sophisticated and fruitful. What Bolzano economizes in terms of logical connectives and quantifiers, he spends in various other ways. Take for instance conjunction and disjunction. According to Bolzano, the latter are not expressed through logical particles but through predicates that are ascribed to "collections" of propositions. To say that Pierre is tall and Marie is hungry, on Bolzano's account, is to say that the collection of the two propositions: [Pierre is tall], [Marie is hungry]} is a collection of truths. (1837, §192, 300, 301). To say that either it is raining or grass is green is to say that the collection of the two propositions: {[It is raining], [Grass is green]} contains at least one truth. (1837, §166, 205)⁹ If one adds to these analyses Bolzano's systematic treatment of sentential negation (1837, §141, 63), conditionality (1837, §164, 199, 200), universal quantification (1837, §147, 77ff), existential quantification (1837, §172, 215) and relational predicates¹⁰ and introduces minimal notational devices, what one gets is a language whose expressive power is at least as significant as that of first order predicate logic. Resorting to a range of meta-linguistic devices, Bolzano has, to put the case

⁹ For Bolzano's treatment of exclusive disjunction, see (1837 §166, 204).

¹⁰ I mention this only because it is relevant to the point about the expressive power of Bolzano's logic. To say that Pierre loves Marie, on Bolzano's account, is to say that Pierre and Marie form a (structured) collection of a certain type (=loving). (1837, §80, 381)

briefly, the means to express an equivalent for virtually every first order sentence, including relational statements involving multiple quantifiers.¹¹

Different syntaxes are bound to yield different lists of logical constants. In spite of having a different list of logical concepts/words, if Bolzano understands by 'logical concept' what Quine understands by 'logical word' their definitions of logical truth/analyticity might still coincide. The problem, upon further examination - and this is also the second point - is that what Bolzano means with 'logical concept' is not what Quine means by 'logical word'.¹² Unlike Quine's list of logical words, Bolzano's list of terms designating logical concepts is not restricted to logical constants, that is, to "particles" whose role is to determine logical form. In addition to including (his version of the set of) logical constants, Bolzano's list also includes categorial determinations and metalogical concepts. Formal ontological categories such as [something], [collection] and [object], on the one hand, and metalogical notions such as [propositions], [ideas], [objectuality] and [analyticity], on the other all "pertain to logic" on Bolzano's account.¹³ The point here is that, for Bolzano, to say of a concept or term that it pertains to logic does not imply that it is "formal" and this is an important distinction with Quine (and most contemporary views).¹⁴ The claim that Bolzano's aim is similar to Quine in that they both seek to "demarcate logic" with the help of a set of "logical particles" (Follesdal 1980) is misleading: it assumes that they both understand the notion of a logical word (or concept) in the same manner, which is not the case. As Bolzano sees it, what's distinctive of logical concepts is not the role they play in determining logical form. More generally, Bolzano does not conceive of what's distinctive of logic as its formality.¹⁵

¹¹ I argue for this in (Lapointe 2011, 53-58)

¹² Morscher (2003) makes a similar suggestion. My thanks go to Morscher for a stimulating discussion of this issue.

¹³ For a list of ideas or concepts Bolzano assumes pertain to logic, see (Bolzano 1837, §315, 240). I'm grateful to Edgar Morscher for very enlightening input (in discussion) on this point.

¹⁴ Cf. (Quine 1966b, 110) where Quine provides a list of logical words.

¹⁵ On this, see (Lapointe 2012).

This is not to say that Bolzano does not have a philosophically interesting and workable account of logical form. Bolzano cashes out the notion of form on the basis of a substitutional procedure. If we follow Bolzano, the form of a proposition is one of its properties, namely the property it shares with all other propositions whose parts are connected in the same manner. Bolzano writes:

One can distinguish two kinds of properties in objects that are composed of several parts: those such that by stating them one specifies which are the parts of which it is composed without determining the manner of its composition; and those that deal with the latter. But since we usually call the parts of which an object is constituted, taken together, its matter and the manner of their connection its form, one can call a property-idea which only states the parts of an object *an idea of its matter*, by contrast, one that describes the manner of the connection between these parts an *idea of its form*. (1837, §81, 389f)

More precisely, what one describes when one describes the structure or form of a proposition is something it shares with the class of propositions that is "generated" - the expression should be understood metaphorically since propositions are ontologically robust entities that cannot be created, modified or destroyed - if we consider some of its parts as arbitrarily "variable". Bolzano explains:

[...] we consider the form of propositions and ideas when we keep an eye only on what they have in common with many others, that is, when we speak of entire species or genera of the latter. [. . .] one calls a species or genus of proposition formal if in order to determine it one only needs to specify certain parts that appear in these ideas or propositions while the rest of the parts which one calls the stuff or matter remain arbitrary." (1837 §12, 51)

But Bolzano's use of the notion of form is not unequivocal. At (1837, §81, 393) Bolzano maintains that propositions, in virtue of belonging to a certain class, "fall under" a certain form. The proposition:

[Caius who is a man is mortal],

for instance, falls under the form:

'X who is A is B'

On this account, 'X who is A is B' is a "determinate connection of words or signs" through which the class to which [Caius who is a man is mortal] belongs can be "represented". (See 1837 §81, 393) Of course, on this understanding of 'form', a propositional form is no longer a property of classes of propositions: it is a linguistic expression that uses schematic letters to represent sets of substitution instances. On this account, a schematic expression represents the set of all substitution instances we obtain by arbitrarily varying the relevant components in a given proposition. Note that while it is not unequivocal Bolzano's use of the notion of form - to designate the structural property *per se* and to designate the schematic expression that represents this property - is also unproblematic. A schematic expression (the form of a proposition in the second sense) always represents a structural property (the form of a proposition in the first sense) and the only way to have cognitive access to the property is through the schematic expression. The idea that the form of [Caius who is a man is mortal] is 'X who is A is B' implies both that the expression 'X who is A is B' represents the set of all propositions that have the same structure as [Caius who is a man is mortal] and that we can generate that set by considering the propositions that are expressed when we arbitrarily substitute the components designated by the schematic letters.

On Bolzano's view, one of the purposes of logic is to describe the interesting semantic regularities that can be discovered through the substitutional method. To this extent, it deals with "formal" properties of propositions - where 'formal' means precisely: discovered through the substitutional method. Take analyticity, the notion on the basis of which Bolzano defines logical analyticity:

If however there is even only one single idea in a proposition that may

be exchanged arbitrarily without altering its truth or falsity; i.e. if all propositions which turn up through the exchange of this idea with any other are all true or all false provided only that they have objectuality, then this property of the proposition is remarkable enough to be distinguished from all others for which this is not the case.
(1837, §148, 83)

It is worth noting that for Bolzano 'analytic' refers to both analytical truths (e.g. [Caius who is a bachelor is unmarried]) and analytical falsehoods (e.g. [Caius who is morally depraved deserves abiding happiness]). In order to be analytic a proposition must fulfill two conditions. First, it must contain at least one variable component. In the previous two examples, that component is [Caius]. Second, all its referential (Bolzano says "objectual") variants must be equiveridical - variants whose subject-idea is referential must be either all true or all false. Bolzano needs to specify that the variants must be objectual - call this the "objectuality restriction". This becomes obvious when we consider how easy it is to turn a proposition into a falsehood by substituting an idea that makes the subject-idea non-referential. For Bolzano, all propositions whose subject-concept is objectless are vacuously false. Take:

[Caius who is a bachelor is unmarried]

This proposition cannot be Bolzano-analytic (with respect to [Caius]) unless we reject from the range of acceptable substitution instances, variants thereof such as:

[Triangle who is a bachelor is unmarried]

or

[Mitt Romney who is a bachelor is unmarried]

whose subject-idea [Triangle/Mitt Romney who is a bachelor] is empty (in the latter case: as a matter of fact) and therefore make the proposition vacuously false.

On Bolzano's account there is no such thing as a proposition that would be straightforwardly analytic. Propositions, if they are analytic, are analytic *with respect to determinate components*. The predicate that applies to a proposition is not therefore 'is analytic' but 'is analytic with respect to ...', where '...' is filled by an expression that designates a variable component in the relevant proposition. In this respect, the property (for the collection of all objectual variants of a proposition) of being equiveridical is indistinguishable from the property (for a propositional form) of having only true substitutional instances. To say that:

'Caius who is a man is mortal'

is analytic with respect to 'Caius' and to say that all interpretations of:

'X who is a man is mortal'

are true amounts to the same. But if this is the case, 'is analytic with respect to ...' is, like the universal quantifier of first order predicate logic, an operator that binds a variable to express generality.

What this means is that Bolzano apparently mistook the problem to which a theory of analyticity is meant to be a solution to be that of generality not, as seems desirable, that of accounting for our intuitions concerning epistemic necessity. Let me make four remarks. First, I think that Bolzano was indeed confused on this point. But, second, whether or not Bolzano ultimately succeeds in providing a theory that fulfils the epistemic requirement on analyticity - more on this in what follows - his accomplishment is nonetheless remarkable. By tackling the problem of generality, Bolzano has the merit of bridging an important gap in

the logic of the time. It is usually assumed that prior to Frege, no satisfactory account of generality and quantification was available. In fact, Bolzano offered the first systematic treatment of generality and one, as I have argued elsewhere, consistent with expressive resources as rich as those of first order logic.¹⁶ Third, despite the fact that Bolzano's definition of analyticity offers a fairly clear description of substitutional quantification he is not faced with the usual objection to the latter. Bolzano deals not primarily with sentences and words but with their meaning, that is, ideas and propositions. Since there is in principle a name for every idea – and since there is (at least) one idea for every object, there is a “name” for every object. For this reason, though Bolzano's approach to quantification is substitutional, he is not liable to the reproach according to which his interpretation of the universal quantifier cannot account for every state of the world: the resources he assumes are at his disposal are in principle as rich as necessary to provide a complete description of the domain the theory is about.

Finally, and most importantly, Bolzano makes an important distinction between propositions such as:

[Caius who is a man is mortal]

and

[Caius who is a man is a man]

What's interesting about propositions of the second type on Bolzano's account, in addition to the fact that they are analytic, is the following:

In order to appraise the analytic nature of the [latter kind of] propositions no other than logical knowledge is necessary, since the concepts which form the invariable part of these propositions all

¹⁶ See (Lapointe 2011, 43-68) for a thorough discussion of this point.

belong to logic. On the other hand, for the appraisal of the truth and falsity of propositions like [the first one] a wholly different kind of knowledge is required, since concepts alien to logic intrude. This distinction, I admit, is rather unstable, as the whole domain of concepts belonging to logic is not circumscribed to the extent that controversies could not arise at times. Nevertheless, it might be profitable to keep this distinction in mind. Hence propositions like those [...] may be called logically analytic, or analytic in the narrower sense. (Bolzano 1837 §148, 84)

When commentators claim that Bolzano anticipated Quine's views on logical truth, what they have in mind is this passage. If one wanted to emphasize the connection between Bolzano and Quine, one could put the difference between [Caius who is a man is mortal], i.e. propositions analytic in the broader sense and [Caius who is a man is a man], i.e. logically analytic propositions in the following terms:

(i) In logically analytic propositions, all non logical concepts are considered to be arbitrarily variable, that is, only logical concepts occur in them "essentially".

(ii) We can know that logically analytic propositions are analytic by virtue of mere "logical knowledge".

(iii) We can know that logically analytic propositions are true or false on the basis of logical cognitions alone since they contain only logical concepts essentially.

(iv) The distinction between logically analytic propositions and other analytic propositions rests on the distinction between logical and non-logical components.

It is worth noting at once with respect to (iv) that Bolzano's definition of logical analyticity raises the problem of demarcating the logical concepts from the non-logical ones. Though, as we have seen, Bolzano's list of logical concepts is not reducible to the standard list of logical constants, he still faces the problem of finding a demarcation criterion for what he considers constitutes the logical. As the quotation makes clear, Bolzano believed that it is most likely impossible to delimit the domain of purely logical concepts exclusively and exhaustively. But

without such a demarcation between logical and non-logical concepts, a definition of logical analyticity that rests on this demarcation is inapplicable. Since the definition Quine considers does not present an advantage in this respect, I will abstract from the problem.

(i) amounts to a definition of logical analyticity in Bolzano's sense and can be put in the following terms:

A proposition S is logically analytically true if and only if S contains only logical terms essentially and all objectual variants of S are true

Bolzano defines logical analyticity as a special case of analyticity in the broader sense. While analytic propositions in the broader sense contain (at least) one non-logical term inessentially, in logically analytic propositions, all non-logical terms are inessential. Bolzano's is an interesting definitional strategy. In "Two Dogmas..." Quine goes the other way around, attempting to establish the notion of a sentence analytic in the broader sense on the basis of the narrower notion of a logical truth, bringing into play the notion of synonymy. What's interesting about Bolzano's definitional strategy is that he defines both the broader and the narrower notion without recourse to synonymy, on the basis of the same acceptable resources: the notion of truth and the substitutional method. To this extent, Bolzano seems to avoid Quine's notorious problem of finding a criterion for sameness of meaning that does not presuppose some notion of analyticity. More on this directly.

What (ii) claims is that we have privileged recognitional access to logically analytic propositions: we can know that logically analytic propositions are logically analytic by virtue of "purely logical cognition". Bolzano suggests in (iii) why this might be so: in logically analytic propositions, only logical concepts occur essentially (only the parts that belong to logic are invariable). The argument seems to be that since only the logical components are "fixed", only logical terms need to be interpreted, and so we only need "logical knowledge" for

the task. Whatever this implies one thing must be emphasized: Bolzano is not in a position to claim that being knowable by virtue of logical cognition alone is a distinctive feature of logical analyticity. The reason for this is the following. As we have seen, in addition to logical constants, Bolzano also includes in the logical vocabulary categorial determination and metalogical concepts so that a proposition can contain only logical concepts essentially - and thus be cognizable by virtue of logical cognition alone - without thereby being logically analytic. On Bolzano's account, only logical concepts occur essentially in both:

(1) [Caius who is a man is a man]

and

(2) [[Something] is objectual]

But only (1) is logically analytic. (2) is not. Of course one might want to argue that there is a distinction in principle between genuinely logical/formal concepts or terms such as 'is' (or 'has') and categorial determinations and metalogical notions and that only "genuinely logical terms" - logical constants - should be considered to be essential. But the point is that (2) is synthetic whether we consider the occurrence of categorial determinations and metalogical notions to be essential or not. If we consider [[something]] and [objectual] to occur essentially, (2) does not contain any variable and is thus not logically analytic on Bolzano's account. If we consider [[something]] and [objectual] to be variable, (2) does not contain any component that can be varied arbitrarily without violating the equiveridicality constraint. Nonetheless on Bolzano's account (2) is knowable by virtue of logical cognition alone. So analytic knowledge and logical knowledge in Bolzano do not coincide and we'll see why in the last section.

In retrospect it would be odd if a philosophical mind of Bolzano's stature had wholly overlooked the epistemic insight that come along with propositions such

as 'No bachelor is married'. Bolzano did not fail to notice the import of such sentences. Take:

[Caius who is a bachelor is unmarried]

What *we* mean when we say that 'Caius who is a bachelor is unmarried' is "analytic" is that it is true by virtue of the meaning of the words it involves or, if we follow Quine, that it can be turned into a logical truth if we put synonyms for synonyms. Of course, this proposition fulfills Bolzano's broader definition of analyticity: all its objectual variants (with respect to the component [Caius]) are equiveridical. But according to the story I've told above, what this means is that the proposition expressed is (merely) general - that all its objectual substitution instances are true. However the story I've told above is as yet incomplete. If we follow what Bolzano says in the first note to (1837 §148, 84), sentences may express logically analytic propositions "in a covert manner". As Bolzano sees it, logical analysis "requires more than a cursory reading" since a proposition "may be analytic or even logically analytic without its verbal expression immediately showing it" (cf. 1837, §148, 84, 85). Let us call sentences that display this feature "quasi-logically analytic". Bolzano explains that we must consider 'Every effect has a cause', for instance, to be quasi-logically analytic. The reason for this is, on the one hand, that 'effect' means 'what is caused by something else' and, on the other, that 'to have a cause' has the same "sense" (*Sinn*) as 'to be caused by something'. In Bolzano, the notion of "sense" is a technical notion: the sense of a word is the objective idea it designates. (Bolzano 1837 §285, 67) Though Bolzano does not make the move explicitly, his position is consistent with the idea that if two expressions have the same sense they can be substituted for one another without affecting the truth-value of the sentence in question. If we generalize Bolzano's comment, this means that to say of a sentence that it is quasi-logically analytic is to say that while it is not a logical truth, it can be turned into one if we substitute some of the terms it contains by other terms that have the same meaning. Given Bolzano's overall views, any sentence that is analytic

in Quine's broader sense (any sentence that can be turned into a logical truth by putting synonyms for synonyms, for instance: 'All bachelors are unmarried') corresponds to a sentence quasi-logically analytic in Bolzano's sense ('Unmarried adult men are unmarried') namely a sentence of the form 'A, which has B, has A' (Cf. Bolzano 1837 §148, 84). So ultimately, Bolzano did not avoid Quine's problem of synonymy, he merely anticipated it.

The question that arises at this point is whether Bolzano's theory presents us with a criterion for sameness of meaning that can do the job where Quine's fails. There is no short answer to this question. I will make two comments. On the one hand, Bolzano's view on meaning analysis, interpretation and definition are subtle and sophisticated and several passages suggest that, on his view, an adequate analysis does not require that analysans and analysandum be synonymous.¹⁷ This interpretive option - the one according to which Bolzano thinks that analysis does not preserve meaning - raises a series of problems, one of which is: how can Bolzano make good on talk of truth by virtue of meaning if he does not have a fully fledged account of sameness of meaning? But, on the other hand, Bolzano arguably does have some views on synonymy. If we follow what he says about some of the examples he uses, two expressions 'x' and 'y' are synonymous if I think and must think with the expression 'x' precisely what I think with the expression 'y' (Cf. 1837 §56, 243). This accounts raises important exegetical questions. For one thing, Bolzano's resorting to epistemic processes ("thinking") as a basis for an explanation of a semantic notion could be seen as atypical, both interesting and puzzling. For this reason perhaps, the temptation is great in commentators to overlook Bolzano's own explanation of synonymy to revert to the orthodox Platonist view that two expressions are synonymous if they express the same objective idea. The latter interpretation is not strictly speaking incorrect. Since 'to designate an idea' and 'to have a sense' mean the same in Bolzano, if two words designate the same idea they, by definition, have the same

¹⁷ I devote the third chapter of (Lapointe 2011, 29-42) to this question. See (Lapointe 2011, 36f) for a comparison of Bolzano's views on meaning analysis with Carnap's.

sense. But in the absence of a substantial account of what it is for a word to designate and idea (or for a thought to grasp on) such an interpretation is philosophically less interesting than the one according to which synonymy consists in the mapping of an expression 'x' onto another expression 'y' on the basis of some feature of intentional states.

As we've seen above, (ii) claims that we have privileged recognitional access to logically analytic propositions to the extent that we can know that logically analytic propositions are logically analytic by virtue of "purely logical cognitions". "purely logical cognitions" are contrasted with "other cognitions", cognitions such as those that are involved in propositions analytic in the broader sense: [A man, who is morally bad, does not deserve respect], for instance (which is analytic with respect to the component [man]). The difference between propositions analytic in the broader sense and logically analytic propositions is that in the latter only logical terms need to be interpreted since only logical terms are invariable or fixed. Bolzano's assumption seems to be that in order to interpret logical terms we only need "logical cognitions" which, I will assume, are cognition we derive from logic, where 'logic' is to be understood as the systematic collection of all truths that pertain to propositions and ideas. And one thing we know about logic is that, on Bolzano's account, it is (i) a collection of "purely conceptual" propositions and that, like all conceptual disciplines it is therefore (ii) a priori. Two points need to be stressed. First, for Bolzano, logically analytic propositions deliver a rather uninteresting form of *logical* cognition. Bolzano writes:

In my opinion not even one principle in logic, or in any other science, should be a merely analytic truth. For I look upon merely analytic propositions as much too unimportant to be laid down in any science as proper theorems of it. Who would want to fill up geometry, for example, with propositions like: an equilateral triangle is a triangle, or is an equilateral figure, etc.? (1837, §12, 51, 52)

The kind of cognition logicians will be chiefly interested in are neither broadly analytic nor logically analytic. They are synthetic a priori - where Bolzano's notion

of the synthetic a priori is to be understood in stark contradistinction to Kant's (whose doctrine of pure intuition Bolzano could not have criticized more harshly). For Bolzano a synthetic a priori proposition is a purely conceptual proposition - a proposition that does not contain an intuition - and which does not fulfill the conditions to be analytic in his sense. The propositions $[5 + 7 = 12]$ and $[\text{Every judgment has a copula}]$ are synthetic a priori truths on Bolzano's account.

Second, and by way of consequence, Bolzano's views on conceptual knowledge - which form the gist of his views on axiomatisation and the theory of deductive disciplines - are not systematically connected with his views on analyticity. If one wants to know what Bolzano has to say about a priori knowledge and truth by virtue of meaning, one has to revert to Bolzano's views on deductive knowledge, that is, to his views on systems of propositions in which synthetic a priori propositions are involved as principles, implicit definitions and theorems:

[...] we find judgments of this sort not only in mathematics, in the pure natural sciences and in metaphysics, as Kant proves it incontestably, but they are also to be found in logic, namely not merely among the theorems that belong to this discipline if we understand it, with Bolzano, according to a wider concept, but in the very part of it which one calls analytic and which has been worked on since Aristotle. (Příhonský 1850, 42, 43)¹⁸

That Bolzano has views on truth by virtue of meaning that make it possible for him to fulfill the epistemic requirement has been stubbornly overlooked in the literature. Indeed, Bolzano could not be more explicit:

If a given proposition consists of mere concepts, such as, for instance, the proposition that virtue deserves respect [...].; then the truth or falsity of the latter depends only on the properties of these concepts; and, at least in many cases, nothing else will be required in order to convince yourself of its truth that you examine attentively the concepts themselves of which it is composed. Thus, it will be possible for you to

¹⁸ The *Neuer Anti-Kant*, while it was signed and published by Příhonský was written in collaboration with Bolzano, in light of Bolzano's theory. It is often attributed to Bolzano himself.

recognise the truth that virtue deserves respect from the mere fact that you have the concepts virtue, to deserve and respect. (Bolzano 1837, §42, 180, 181)

For Bolzano, in order to know the truth of a purely conceptual proposition (i.e. a synthetic a priori proposition) it is sufficient to "have" or "cognize" the concepts that are involved in this proposition. This claim, I would like to suggest, is intimately linked to Bolzano's views on axiomatization. What it is to "have" or "cognize" a concept in Bolzano is to be in a position to infer the properties of the corresponding object as it is defined by an axiom system. That we can "infer" from a concept the properties of the corresponding object is a claim Bolzano makes at a number of places and it is a claim that can be sustained systematically in his theory - as long as we keep in mind that for Bolzano conceptual disciplines are ordered axiomatically.¹⁹ For Bolzano, the essence of an object is the set of properties that can be inferred from its concepts (Bolzano 1837, §111, 521). As Bolzano defines them, the conditions under which a property can be inferred from a concept are as follows: the property b can be inferred from [A] iff:

- (i) [A has b] is true
- (ii) [A] is a pure concept (i.e. does not contain an intuition)

In a conceptual order, if [A has b] is a proposition, then both (i) and (ii) are systematically fulfilled and b can be inferred from [A]. Since [A has b] will be either an axiom or deducible from an axiom then in order to know a concept [A], i.e. in order to know which properties I can infer from [A] I need to know the relevant part of the deductive order in which [A] is embedded and be in a position to draw the relevant consequences.

¹⁹ According to Bolzano, we can "infer" from concepts the "essential properties" of the objects to which they refer: a property can be "inferred" (*gefolgert*; e.g., Bolzano 1837, §65, 287), it may "follow" (*folgen*) or "ensue" (*sich ergeben*) from a concept (e.g., Bolzano 1837, §114, 531).

Notwithstanding the fact that his approach raises a number of questions - e.g. it's easy to see how we justify the truth of theorems, but how do we justify the truth of primitive propositions? - Bolzano's approach presents non-negligible virtues.²⁰ For one thing, since Bolzano assumes that the essence of an object is determined by its concept and given that, for him, a concept is what makes up the meaning of a sign, then a set of axioms necessarily determines any sign it contains as much as possible (for that axiom system) and hence must be in the relevant sense a "definition" of the sign. Besides, if the condition for knowing that an *a priori* proposition is true is that one grasp (part of) the axiomatic structure in which it is embedded, then the truth of *a priori* cognitions cannot be a mere function of evidence or intuition. In this respect, one finds in Bolzano an intuition that will prove to be fruitful in a number of his successors: *a priori* knowledge is always deductive and cannot be explained without the support of a theory of logical consequence.

Bolzano's conception of truth by virtue of meaning - to be true by virtue of the meaning of the terms is to be demonstrable in an axiomatic system - was, at the time, exceptionally novel and interesting. What's more, contrary to what has been assumed by some, Bolzano's views on conceptual knowledge present some similarity with Quine's later views on logical truth. (See Künne 2006, 230) On Quine's later account, logical truth is defined for regimented languages in which all logically demonstrable sentences are true. For Quine, in such languages, to be logically demonstrable *is* to be logically true. (Quine 1975, 324) It's not the case then that no comparison is possible, though this deserves at least one important qualification. When Quine redefines his notion of logical truth in his "Reply to Stawson", he stresses the fact that he does not seek to fulfill the epistemic requirement, that his venture is "epistemologically neutral" (Quine 1975, 324). By contrast, Bolzano was explicitly engaging with the core Kantian epistemological problem: the possibility of a priori knowledge. To this extent one

²⁰ I discuss some of these problems in (Lapointe 2011, 102-115).

can say that Bolzano was, in the crucial parts of the *Theory of Science*, first and foremost concerned with fulfilling the epistemic requirement on logical truth. What is distinctive and somewhat unusual about Bolzano's approach is that he did not think that a theory of analyticity would be equipped to do so.

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