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REMARKS ON THE FOUNDATIONS OF LINGUISTICS

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FOUNDATIONAL ALTERNATIVES

As with any intellectual domain, there exist foundational issues about the nature of linguistics, the kinds of objects it studies and, therefore, the kind of field it is. While all surely accept the banality that linguistics is about (natural) language (NL), most linguists currently seem to believe, under the influence of the voluminous writings of Noam Chomsky on the topic, that the proper interpretation of this means that linguistics is about human linguistic knowledge and its development, and is therefore about something mental, possibly then about something biological.[1] Linguistics would then be an empirical science concerned with the development of NL in normal humans and the innate, biologically given mechanisms which determine/permit this development.

I am indebted to David Pitt for many useful comments on earlier versions of this paper. Any deficiencies though are exclusively attributable to the author.

[1] For (only) some of the true multitude of expressions of this foundational view, see Noam Chomsky *Language and Mind*. New York: Harcourt Brace Jovanovich, 1972; *Reflections on Language*. New York: Pantheon, 1975; *Rules and Representations*. New York: Columbia University Press, 1980; *The Generative Enterprise*. Dordrecht: Foris, 1982; "Some Conceptual Shifts in the Study of Language," *How Many Questions? Essays in Honor of Sidney Morgenbesser*, ed. Leigh S. Cauman, Issac Levi, Charles D. Parsons, Robert Schwatz. Indianapolis: Hackett, 1983; pp. 154–69; *Modular Approaches to the Study of the Mind*. San Diego: San Diego State UP, 1984; *Knowledge of Language*. New York: Praeger Scientific, 1986; *Language and Problems of Knowledge*. Cambridge, MA: MIT Press, 1988; *The Minimalist Program*. Cambridge, MA: MIT Press, 1995; "Derivation by Phase," *MIT Occasional Papers in Linguistics 18* (1999); *New Horizons in the Study of Language and Mind*. Cambridge, UK: Cambridge UP, 2000; *The Architecture of Language*. New Delhi: Oxford UP, 2000; "Beyond Explanatory Adequacy," *MIT Occasional Papers in Linguistics 20* (2001); *On Nature and Language*. Cambridge, UK: Cambridge UP, 2002.

More than two decades ago, Jerry Katz (JJK) came to the conclusion that the view just alluded to, hereafter the *received view*, was deeply in error and involved, inter alia, a fundamental confusion between NL and knowledge of NL. Under the contrasting conception that he developed, the core of linguistics is a formal science, one of the same type as logic, mathematics, and theoretical computer science.[2] This pursuit is a study of NL, and not an empirical science that studies knowledge of NL. This does not deny the feasibility of an empirical science of the latter sort, nor does it quarrel with the idea that understanding the development of knowledge of NL is an important scientific problem.[3]

IMPLICATIONS OF THE EXISTENCE OF LINGUISTIC KNOWLEDGE

One might approach the foundational issue in a simple, possibly simplistic way as follows. Grant with the received view, which JJK *rejected*, that there *is* knowledge of NL.[4] One can then argue two conclusions:

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[2] For the foundational development in question, see Jerrold J. Katz, *Language and Other Abstract Objects*. Totowa, NJ: Rowman and Littlefield, 1981; "An Outline of Platonist Grammar," *Talking Minds: The Study of Language in Cognitive Science*, ed. Thomas G. Bever, John M. Carroll, and Lance A. Miller. Cambridge, MA: MIT Press, 1984; "The Unfinished Chomskyan Revolution," *Mind and Language* 11 (1996): 270–94; *Realistic Realism*. Cambridge, MA: MIT Press, 1998; Jerrold J. Katz and Paul M. Postal, "Realism vs. Conceptualism in Linguistics," *Linguistics and Philosophy* 14 (1991): 515–54; Terence D. Langendoen and Paul M. Postal, *The Vastness of Natural Languages*. Oxford, UK: Basil Blackwell, 1984, ch. 6.

[3] It could be argued, correctly I believe, that study of knowledge of NL is not well-defined in the absence of a deep understanding of NL, that is, of a deep understanding of the results of the formal science. For if knowledge of NL involves knowledge of properties of NL sentences, the task cannot be described independently of valid conclusions about those properties.

[4] In fact, "knowledge of NL" can only be interpreted seriously in terms of knowledge of the properties of individual NL sentences and of the principles determining proper collections of them. This follows in the terms sketched below because NLs are interpreted as collections of sentences, yielding, a direct analogy with, for example, knowledge of natural numbers.

Moreover, the conclusion is made explicit by the major advocate of the received view:

(i) Chomsky (*Modular Approaches* 31)

> That is, the new sentence "Everyone believes him to be intelligent" can no longer mean "For every X, X believes X to be intelligent." It has to mean, "for every X, X believes somebody else to be intelligent." That's just a fact—that's a datum. We all know that. All right, that's just a fact about our knowledge.

No conclusion drawn here can be avoided by appeals to odd or unsuspected uses of the verb "know" in the tradition JJK rejected. For inherent in that view is that "know" has the standard implications. So:

(ii) Chomsky (*Reflections* 13)

1a. There is NL.
b. For any NL_x, knowledge of NL_x is distinct from NL_x.

These would both be consequences of general features of the knowledge relation, regardless of how ultimately analyzed. The basis for conclusion (1a) from the assumption that there is knowledge of NL is that independently, for any domain X, knowledge of X systematically depends on the existence of X. For some real rabbit, R, one can determine in principle R's average blood pressure. There can be knowledge of that average blood pressure. But a question about the average blood pressure of the Easter Bunny has no answer. No one can know it, because there is nothing to know. Just so, one can ask about the height of the 38th president of the United States at the age of 40; but the parallel question about the first *female* president of the United States elected before 1950 has no answer. No one can have knowledge of the putative height in question. There can be none, since there is no such person whose height could be measured.

One justifiably concludes generally then that for any X, knowledge of X can only exist if X has existed or does exist. Consequently, the assumption shared by both foundational positions about linguistics under discussion that there is knowledge of NL entails that there is NL.[5]

The language faculty, given appropriate stimulation, will construct a grammar; the person knows the language generated by the constructed grammar. This knowledge can then be used to understand what is heard.

And:

(iii) Chomsky ("Some Conceptual Shifts" 161)

Knowledge of grammar, or of the rules and principles of grammar, entails ordinary propositional knowledge of fact, e.g., John's knowledge that the sentence . . . means such and such rather than something else.

[5] This was though seemingly denied when Chomsky, *Language and Mind* 169, stated (i) and then appended a footnote which claimed (ii):

(i) "To study it (grammar: PMP), we must abstract away from other factors that are involved in the use and understanding of language, and concentrate on the knowledge of language that has been internalized in some manner by the language user."
(ii) "Since the language has no objective existence apart from its mental representation, we need not distinguish between 'system of beliefs' and 'knowledge' in this case."

Several comments are in order. First, since no argument was given or referenced for the claim of the *since* clause, there is no reason to view it as other than dogma. Second, since mental representation, whatever it is, is finite, (ii) contradicts the author's position, consistently maintained over decades, that NL is infinite; see the text below.

Third, (ii) here contradicts other claims by the author, e.g. (i) and (iii) of note 4. For (iii) of note 4 invokes "ordinary prepositional knowledge of fact," which cannot be contradictory. But systems

Turn to (1b). There exist both rabbits and knowledge of rabbits. The two are distinct. Rabbits have fur, knowledge of rabbits does not. Cats will kill rabbits and eat them. They can neither kill nor eat knowledge of rabbits. There are oceans and knowledge of oceans. The two are distinct. Oceans are formed of water, knowledge of oceans is not. Hence many people have literally drowned in oceans but no one can literally drown in knowledge of oceans. There are natural numbers and knowledge of natural numbers. The two are distinct. There are even natural numbers; one of them is a prime. It would make no sense to claim that (part of) knowledge of natural numbers is even, or that one of its components is a prime.

One justifiably concludes generally then that for any X, if there is knowledge of X, it is distinct from X. Therefore, the premise that there is knowledge of NL not only determines that there is NL, but that the latter is distinct from any knowledge of it. Point (1b) is in effect put very nicely in Carr[6] in characterizing JJK's position: "Knowledge of something is distinct from that which we have knowledge of. That is, the 'knowledge of' relation is a two-place predicate. If we accept that this is so, it is clear that our knowledge of the structure of a sentence is distinct from the structure of the sentence per se. It follows from this that sentences themselves, as the objects of our inquiry, are not competence units, are not units of knowledge."

Given these rather straightforward conclusions, the received view about the foundations of linguistics is at best unacceptably odd. For its own foundationally defining assumption that there is knowledge of NL to be accepted, it must grant that there is NL. But in spite of that, it claims that linguistics is not about NL but about knowledge of it. This leaves no known field to be concerned with NL itself. Strict analogs with logic, mathematics, and other formal sciences are immediate.

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of belief can be. For instance, it is not hard to initially believe in the viability of the story underlying a paradox noted by Russell in 1918, namely, that some town has a resident barber who shaves all and only those men who do not shave themselves. But reflection shows the description is contradictory and incapable thereby of being modeled by an actual individual; see Willard van Orman Quine, *The Ways of Paradox*. Cambridge, MA: Harvard UP, 1976; p. 2, and Richard M. Sainsbury, *Paradoxes*. Cambridge, UK: Cambridge UP, 1988; p. 2.

Taking (ii) seriously would thus open the way to viewing a grammar of an NL as making inconsistent assertions about the same putative NL sentence K in the way the barber story makes inconsistent assertions about a putative barber. For Chomsky has claimed, as in (i) and (iii) of note 4, that a grammar provides speakers with knowledge of the properties of sentences like K. But since such knowledge of K is, according to (ii), not distinct from beliefs about K, the position is consistent with a grammar making inconsistent claims about K, as the barber story makes inconsistent claims about a barber.

There is, in short, nothing in (i) or (ii) of this note that offers any ground either for a view that NL has no existence distinct from something mentally represented or for a view that knowledge of NL is not to be distinguished from beliefs.

[6] Philip Carr, *Linguistic Realities*. Cambridge, UK: Cambridge UP, 1990; pp. 116–17.

The received view is analogous to a position that logic is about knowledge of logic, leaving no field to be concerned with propositions, quantifiers, contradiction, entailment, truth conditions, models, completeness, and so on.

The foundational issue JJK raised can be approached from a different vantage point. In general, for any field, one can identify the essence of what it is about by isolating those things whose nonexistence would determine the nonexistence of the field. In some cases, the answer is simple. Ornithology could not exist if there were no birds and number theory could not exist if there were no numbers. From what was concluded above, one might argue that linguistics could not exist if there were no NL. While undoubtedly true, that conclusion remains vague because the notion NL is.

AN ABSTRACT ONTOLOGY FOR LINGUISTICS

So it is evidently necessary to ask in general ontological terms what an NL is. The answer, I believe, is that an NL is a set-theoretical object, a collection, in fact, a bit more precisely, a collection of sets, where each set is a complex object composed of syntactic, semantic, and expression objects. The traditional term for these sets is "sentence," so that it is appropriate to say that an NL is a collection of sentences. And it is then correct to say that if sentences did not exist (given that they are sets, and mostly hereditary sets of [sets of . . .] abstract objects, this is arguably not possible, but no matter here[7]), NLs would not exist, and hence linguistics could not. Put differently, linguistics can exist for partly the same reason that knowledge of NL can, namely, because NLs exist, and NLs exist because they are collections of sentences, and the latter exist because they are hereditarily abstract objects.

The conclusions reached so far suggest that the core of linguistics is a field that asks questions such as what universal conditions must sets meet to qualify as NL sentences and what principles determine the collections of such that are individual NLs.[8] These are substantive questions internal to linguistics.

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[7] Hedging is required if, as argued in Paul M. Postal, *Skeptical Linguistic Essays*. New York: Oxford UP, in press, ch. 6, certain classes of sentences, in particular those embodying so-called "direct discourse," involve sets whose hereditary elements include actual physical tokens of linguistic objects. Such sets are not fully abstract objects; since their tokens will not exist in many possible worlds, such sentences will also not exist in those worlds; see Katz, *Realistic Realism*, ch. 5.

[8] The claim that NLs involve conditions on collections of sentences as well as conditions defining sentencehood is not redundant because there are, arguably, conditions on such collections that do not reduce to conditions on proper sentences. For instance, the single English sentence "No gorilla is an abstract object" must satisfy both all the universal laws governing NL sentencehood and the particular sentence conditions of English. And yet one hardly wants to consider the singleton set

Here attention is briefly focused on a different, foundational question, namely, what kind of ontological thing sentences are. I have already in large part answered this by saying that NL sentences are sets, since sets are *abstract objects*; but see note 7. They have no locus in time and space, cannot cause or be caused. Moreover, they are abstract objects of the sort *at least one component of which can have tokens*. In fact, one can say that the precise function of the expression aspect of an NL sentence S is to provide a structure that can be interpreted by some physical mechanism as instructions for producing tokens of (that aspect of) S. Since speaking of tokens of parts of sentences is clumsy, I will hereafter speak loosely of "tokens of sentences," which is perfectly consistent with past practice.

In the common case, these tokens consist of sound waves. For those NLs, such as the variety of distinct nonphonetic systems used by the deaf, the tokens consist of physical gestures of the hands, arms, face, and so on; see Perlmutter and Neidle, Kegl, Maclaughlin, Bahan and Lee[9] for discussion of such signed NLs. Writing systems provide a distinct ancillary method for determining tokens of sentences as marks on surfaces. No doubt logically there could exist three-dimensional analogs and nothing in principle would preclude tokens which were odors, light waves, electric disturbances, and so on. That is, there is, I suggest, no inherent connection between the nature of NL sentences and the physical objects that serve as their tokens. This connection must involve conventions. This fact was

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containing that sentence to be in itself an NL. The implication is that there are conditions on the collections that form NLs independent of conditions on individual sentences.

An intriguing idea about one such condition which could, if developed precisely, rule out situations like a singleton collection NL was proposed by JJK in Katz (*Semantic Theory*, "Effability and Translation," *Language and Other Abstract Objects*). This proposal was that NLs are *effable*, meaning that they express every proposition, as described in:

(i) Katz (*Language and Other Abstract Objects* 226)

Each proposition (thought) is expressible by some sentence in every natural language.

No matter how one sensibly reconstructs the notion "proposition," there will be infinitely many of them, so that a single sentence could express all of them only under conditions of infinite ambiguity. It seems possible to approach the question of barring that feature via formal conditions. That is, perhaps one could impose a condition like:

(ii) For every NL, if P_1 and P_2 are distinct propositions, then there are sentences S_1 and S_2 in NL such that S_1 expresses P_1 but not P_2 and S_2 expresses P_2 but not P_1.

If so, it may be possible to rule out inter alia seemingly anomalous NLs like the singleton collection case by a precise development of JJK's insight about NL effability.

[9] David M. Perlmutter, "No Nearer to the Soul," *Natural Language and Linguistic Theory* 4 (1986): 515–23; Carol Neidle, Judy Kegl, Dawn Maclaughlin, Benjamin Bahan, and Robert G. Lee, *The Syntax of American Sign Languages*. Cambridge, MA: MIT Press, 2000.

in essence traditionally recognized in linguistics via the doctrine that the relation between NL form and meaning was arbitrary. It might even be argued that the specification of the physical aspect of tokens is external to linguistics. In any event, if included in NL, specification of the physical aspect is surely a circumscribed subpart, with the traditional name "phonology," which, however, wrongly builds in an excessively restrictive assumption that NL sentence tokens are inherently noises produced by the human speech apparatus.

There should, of course, be no confusion of an arbitrary NL sentence S with specific tokens of S. These objects could hardly be more ontologically different. An individual sentence S has no locus in time or space, is objective not subjective, can cause no reactions and was not itself caused by anything. But a specific (e.g., phonetic) token of S occurs at a particular time and in a particular place, it is caused by the movement of a vocal tract, and can cause things, like the shattering of crystal. Tokens like other physical manifestations can be physically *recorded* but sentences are no more recordable than numbers or lattices. Moreover, there is a one-many mapping of sentences to tokens, and no knowable principle that governs the number of tokens of any specific sentence, which is indeterminate. Further, arguably, most sentences of even those NLs that have been learned by someone have never been instantiated by an actual token and never will be. For truly complex sentences, say those of successively greater word length than $(10)^3$, $(10 \times 10)^3$, $(10 \times 10 \times 10)^3$, and so on, production of actual tokens by humans is out of the question and even becomes incompatible with the physical limitations of the universe.

None of this is paradoxical because NL sentences are abstract objects whereas their tokens, if any, are physical objects. The latter are governed by a variety of physical and practical limitations; the former are not. The foundational conclusion is then of the following order. The core of linguistics that studies sentences and proper collections of such, that is, NLs, is a formal science not an empirical one. The objects it studies are sets and collections of sets, not physical ones, hence, objects not subject to sensory perception, just as mathematics is a formal science because the objects it studies are abstract objects. Sentence tokens, which relate to aspects of sentences only by conventions, are essentially of interest to the core of linguistics only as a pathway to knowledge about the sentences of which they are tokens.

CONTRADICTIONS EMBRACED AND AVOIDED

Virtues

An overwhelming virtue of the foundational view that JJK developed is that it avoids crude contradictions inherent in the received view that he rejected. I consider two.

NLs for Which No Knowledge Exists or Can Exist

The received view's identification of the topic of linguistics with the domain of linguistic knowledge overlooks the fact that most NLs have not been learned by anyone and, more importantly, arguably never could be. Hence, for most NLs there is simply no associated linguistic knowledge. This perhaps radical-sounding conclusion (observed and justified, though, in Langendoen and Postal[10]) is easily supported. To be an NL is to obey all the laws defining such, whatever they turn out to be. Therefore, to show the existence of an unlearnable (hence unlearned) NL, it suffices to specify a logical exhibition of an object that both obeys all such laws and yet is unlearnable. Given that NLs are collections, required then is specification of a collection that obeys all the laws of NL and yet whose membership principles are even in part unlearnable by humans. This might seem currently impossible because of the minimal available understanding of what the laws of NL consist in.[11] But this conclusion is too pessimistic.

For the undeniable limits on current understanding of the defining features of NLs can be gotten around. Necessary is to take an *already learned* NL, NL_x (assume NL_x = say some variety of English), which by definition then satisfies all

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[10] Langendoen and Postal, *The Vastness of Natural Languages*, ch. 6.

[11] The view that there are unlearnable NLs clashes with claims in the literature, for example, that of (i)

(i) Norbert Hornstein and David Lightfoot, eds., *Explanation in Linguistics*. London: Longman, 1981; p. 14:

> Position (2) is vitiated by the fact that a child can master any natural language if exposed to it in the normal way.

But there is not clearly an inconsistency since in at least many cases, it would be impossible for a child to be exposed to the NL in the normal way. That is, as is, (i) really assumes without basis that a child could be exposed to any NL in the normal way and thus in effect begs the question of whether the notion of "exposability" involved is coextensive with the notion of NL.

The reasoning in the text suggests otherwise. The view in the text also clashes even more sharply with that of (ii):

(ii) Scott Soames and David M. Perlmutter (1979) *Syntactic Argumentation and the Structure of English*. Berkeley: U of CAP, 1979, 151:

> It is reasonable to expect that new languages will come into being. Dead languages and languages not yet born are part of the phenomenon of human language. To say that such languages are possible human languages is to say, among other things, that they could be learned by children in the same way that attested languages are learned. Any language that could not be learned by children as a native language is not a possible human language.

Here there is genuine inconsistency with the position in the text, but also no argument. If the last sentence is not question-begging, it is simply a decision to use "possible human language" in a certain way.

NL defining laws, and to map it via formal conventions into some distinct object, NL_y, with two properties: (a) NL_y obeys all NL defining laws and is hence an NL; (b) NL_y is unlearnable. Though such a mapping is fairly trivially obtained. One need only associate each of NL_x's fixed, distinct *lexical items* with a new lexical item via some disjointedness preserving mapping such that the new collection of lexical items is unlearnable. There are innumerable functions that would meet these conditions. One, for instance, would map an arbitrary lexical item as in (2):

2. Assume some linear ordering $O = [p_1 \ldots p_k]$ of the finite set of phonological representations of the actual lexicon of NL_x. Assume further a function F that maps each member i $(1 < i \leq k)$ of O into a new phonological representation $NL_y(i)$, where $F(NL_x(i)) = NL_y(i) = <p_i + [p_1 \ldots . p_k]^{10,000} + p_i>$.

What (2) says then is that F maps each phonological representation p_x of a lexical item in NL_x into a new one p_y consisting of p_x followed by ten thousand repetitions of the entire sequence of phonological representations of every lexical item of NL_x in the assumed ordering followed by the representation of p_x. Via this lexical mapping, each sentence S of NL_x, which, by definition, satisfies all NL laws, has as a correspondent a sentence of NL_y, which equally does, by a substitution for every phonological representation in S the image of that phonological representation under the function F. Hence, F yields from the collection of sentences NL_x a distinct collection NL_y based on a distinct but algorithmically specified lexicon of phonological representations.

That such a lexicon is actually unlearnable by humans needs no stress. So the only way the claim that there are unlearnable NLs could fail is if the lexicon provided by the described mapping violated some laws of NL. But there is no hint in linguistic studies that this is the case. The collection of sentences defined by the relevant mapping is in one-to-one correspondence with the original collection. And each member of the "new" collection has structural properties identical to those of its "original" correspondent. Each "new" sentence is nothing but an alternative "spelling" of the original sentence of which it is an image. So the only apparently potentially relevant law would be one limiting the length of the phonological representations of lexical items. But I believe it is true both that phonological theories contain no such bounds and that there is no justified way they could. The reasoning that precludes such bounds as part of a justifiable theory of NL is identical to that described below as showing that NLs are infinite, because the length (complexity) of their constituative sentences is unbounded.

But once it is seen that there are unlearnable NLs, hence NLs for which there not only is no actual human knowledge of the relevant sort but not even any

possible human knowledge of that sort, the conceptualist claim embedded in the received view which holds that linguistics is about knowledge of NL is seen to be incoherent. For in many, in fact arguably most cases, not only are particular NLs distinct from contingent knowledge of them, they cannot in principle even have any corresponding contingent knowledge associated with them. Evidently, the choice of the parameter 10,000 in (2) is arbitrary and there is no principle that bounds such a parameter. Consequently, not only are there unlearnable NLs, there are infinitely many of them even limiting attention just to trivial variation on a schema like (2); the weaker point that there are infinitely many NLs has already been argued in detail Pullum.[12] Moreover, the choice of schema (2) was entirely arbitrary and there are endless other ways to algorithmically construct unlearnable lexicons in accord with the laws of NL from actually learned ones.

NL as an Organ State and Yet Infinite

Turn to the second sort of incoherence that the formalist view developed by JJK permits one to avoid. The received view claims that an NL is something psychological/biological, in the baldest terms, a state of an organ, that aspect of the brain which permits NL knowledge to arise; see (4) and (10) below. And yet it has been unvaryingly claimed in the same tradition at issue that NL is somehow infinite. These two views are not consistent.

The incoherence of joint assertions of the biological character of NL plus its putatively *nonfinite* characteristic are seen, for example, in Chomsky.[13] Page 164 states:

3. "But they arise as soon as we face seriously the task of accounting explicitly for the unbounded range of sentence structures in a particular language."

But page 156 had insisted as follows, where "UG" represents universal grammar, identified with an innate faculty responsible for NL learning.

4. "In contrast, a mentally represented grammar and UG are real objects, part of the physical world, where we understand mental states and representations to be physically encoded in some manner. Statements about particular grammars or about UG are true or false statements about steady states attained or the initial state (assumed fixed for the

[12] Geoffrey K. Pullum, "How Many Possible Natural Languages Are There?" *Linguistic Inquiry* 14 (1983): 447–67.

[13] Chomsky, "Some Conceptual Shifts."

species), each of which is a definite real-world object, situated in space-time and entering into causal relations."

The putative physical character of NL advanced in (4) is then contrasted on page 157 with the following dismissal of "externalized language," that is, collections of sentences.

5. "Statements about the externalized language, however it is characterized, have a status that is much less clear, since there is no corresponding real-world object."

So (3) claims that there are infinitely many sentences in individual NLs, while (5) and its continuation, in effect, dismiss the reality of "external" NL, that distinct from some aspect of human biology. There are then two incoherent choices. Either the task cited in (3) (as needing to be faced seriously) of accounting for infinitude is, absurdly, a task of accounting for a property of things which are not real, or the real infinite collection of things has to be part of what the author takes to be real, something physically (biologically) encoded in some manner. Under the former disjunct, the nonfinite character of NL, that is, that some aspect of it can be placed in one to one correspondence with the full sequence of natural numbers, holds only when the latter sequence is placed in one to one correspondence with a nonexistent collection of nonexistent objects. By that (evidently ludicrous) logic, any physical object, for example, someone's desk, would be infinite. To prove that, one would simply state that each desk is associated with an unbounded collection C of objects called, for example, *deskons*, say {deskon$_1$, deskon$_2$, . . .}, evidently in one to one correspondence with the natural numbers. Then one asserts, reasonably, that neither deskons nor collections of them are real, accounting inter alia for the failure of scientists to discern them.

Just in case one might doubt, despite (5), that someone could, outside of a parody, deny the reality of NL sentences, the claim is reiterated and made perhaps even more explicit in Chomsky:[14]

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[14] Chomsky, "Derivation by Phase" 34. The issue of the consistency of claims that NL is an organ state and yet infinite was raised by a questioner after the lecture represented by Chomsky, *The Architecture of Language*. The full question and answer were:

(i) Chomsky (*The Architecture of Language* 62–63)

QUESTION: Infinite use of finite means; doesn't it entail an inconsistency? Isn't the model of an infinite potential in, a finite organ inherently inconsistent?

CHOMSKY: That was the problem until about a century ago. It did look like an inconsistency. One of the important discoveries of modern mathematics is that it isn't an inconsistency. There is a perfectly

6. "We also speak freely of derivations of expressions EXP generated by L, and of the set of such EXPs—the set that is called 'the structure of L' in Chomsky (1986), where the I-/E terminology is introduced. Evidently, these entities are not 'internal' That has led to the belief that some externalist concepts of 'E-linguistics' are being introduced. But that is a misconception. These are not entities with some ontological status; they are introduced to simplify talk about properties of FL and L, and can be eliminated in favor of internalist notions."[15]

Here "FL" denotes the presumed faculty of language, a putative biological entity, while "L" denotes a state of FL, supposedly an individual NL and "EXP" refers to sentences.

Under the second interpretation of the incoherence in (3)–(5), the infinite aspect of NL is not a property of (unreal) collections of unreal things but is a property of the real physical object, the organ state L in quote (6). This yields the equally incoherent idea of an infinite organ state, incoherent because organs, and their states, are bounded in both space and time. That is, no aspect of anything in a finite organism can be placed in one to one correspondence with infinitely many things.

On the second branch of interpretation, the contradiction at issue is isomorphic to the incoherence of a view of the foundations of mathematics (happily undefended, as far as I know) that would say, for example, that mathematics is an empirical study of the structure of physical computers, that numbers are elements of the functioning of computers, but that there are infinitely many of them.

Joint assertion of such ideas, unknown in mathematics but arguably dominant in linguistics, appears to be rendered *psychologically* possible only by a strange, unjustified and unjustifiable sort of implicit dualist *methodological* incoherence; this includes, inter alia, *punning* on otherwise technical terms like "generate."

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coherent sense to notion of infinite use of finite means. That is what ended up being the theory of computability, recursive function theory and so on. It is a big discovery of modern mathematics which clarified traditional ideas. There have been sort of intuitive ideas like this around but they really became clarified quite recently-not really until almost mid-century. So, yes, it looks like an inconsistency but it simply isn't. There's a very simple account of it that is not inconsistent. I can't go into it any further here.

This answer was unacceptably unresponsive. It at best addressed what was in 1996 the essentially trivial side issue of how a finite abstract procedure can specify an infinite set. But the issue the questioner rightly raised was not merely that (or perhaps even that) but rather what sense can be made of the elements of an infinite set in biological, organ state terms. Not addressed was the nature of objects that are putatively infinite in number but also somehow both capable of having a physical nature and of being aspects of a human brain.

[15] This passage is analyzed in detail in chapter 11 of Postal, *Skeptical Linguistic Essays.*

When arguing for foundational issues, one stresses the empirical side . . . an NL as an organ state, as something biological. When turning to linguistic matters proper, one argues from principles that are only appropriate in the realm of abstractions. For instance, in arguing for the infinitude of the collection of sentences of, for example, some variety of English, one can point to constructions like that of (7):

7a. Babar proved that he proved that he is an elephant.
b. Babar proved that he proved that he proved that he is an elephant.
c. Babar proved that he proved that he proved that he proved that he is an elephant.
d. Babar. . . .

Evidently, the examples of (7a–c) exemplify pattern (8):

8. Babar proved (that he proved)$^{n\geq 1}$ that he is an elephant.

Now *if* there is no bound on the pattern, then the number of sentences in it, hence in the containing NL *if* they all are members, is nonfinite.

How can one argue though that the pattern *is* unbounded? A standard way, I believe, would run something like this.[16] If one assumes to the contrary that the pattern is bounded, and that the bound is given precisely by the value of $n = m$, then two challenges must be faced:

[16] So, a primitive and undeveloped form of this reasoning is seen in the remark in (i):

(i) Chomsky (2000: 51)

> For example, the most elementary property of the language faculty is the property of discrete infinity; you have six-word sentences, seven-word sentences but you don't have six-and-a-half word sentences. Furthermore, there is no limit; you can have ten-word sentences, twenty-word sentences and so on indefinitely.

Note that given quote (6) in the text, this putatively elementary property of the language faculty incoherently depends at best on counting things that do not exist. Moreover, even if they are taken as existing, there is no way they could be part of the language faculty or anything it yields, since the latter is putatively a physical thing whose outputs would be physical things.

One should comment too on the talk of the nonexistence of six and-a-half word sentences. This is entirely irrelevant to any issue of nonfiniteness. If one takes the *finite* collection of all sentences of any NL having less than eight words, there will be none with the characterization in the quote. This follows simply from the fact that the notion *six-and-a half word sentence* is undefined, necessarily, since the notion *half a word* is. Thinking in set theoretical terms, moreover, there is no mystery here, as *half of a set* is undefined (not to be confused with half of the members of a set with an even number of members).

9a. Challenge 1: What argues that the bound is m and not $m + 1$?
b. Challenge 2: What argues the bound is m and not $m - 1$?

Evidently though, regardless of what m (at least as big as the number of attested sentences) is chosen, neither challenge can in general be met. There is no nonarbitrary way to pick m that justifies it against either a smaller bound or a bigger one.[17] The argument is obviously exactly parallel to that for natural numbers. No claim that some natural number m is the largest can survive the challenge to justify why m is the greatest number with no successor rather than $m + 1$ or $m - 1$.

The link between the linguistic argument for the infinitude of the class of sentences and the parallel argument for the infinitude of the class of natural numbers is seen to be even tighter if one considers the set-theoretical interpretation of natural numbers under which each is the set of all its predecessors.[18] Because the claim of a finite bound on natural numbers then reduces to a more general need for a bound on set existence. It must be granted that there are finite sequences of sets A, B, C . . . all of whose members consist of the total collection of their predecessor sets, but it must be accepted that *some* finite sequence of sets cannot be the exhaustive members of a set. Yet no principle of set-theoretic existence picks out any such sequence of sets. The same logic applies to sentence patterns like (7) under the assumption that sentences are sets.

The parallelism between the infinite characteristic of NLs and that of the sequence of natural numbers is also brought out by the well-known fact that via the device of Gödel numbering,[19] any denumerable set of elements can be mapped into an isomorphic set of natural numbers. Given that, a denial that a pattern like (8) is unbounded is equivalent to a denial that the corresponding natural number sequence is unbounded.

Nothing in the reasoning just cited is changed if, instead of fixed single bounds on the relevant sets, one considers some notion of an approximation. That is, one might grant that one cannot fix a *unique* finite bound on, for example, the number of natural numbers or the number of NL sentences but claim that there is nonethe-

[17] Nonarbitrary bounds on sentence length and complexity can no doubt ultimately be inferred from limitations of performance, physical structure, life span, and so on. However, such bounds are arguably external to NL and part of the inherent limitations of physical organisms. One can assume that clearly nonlinguistic domains like the ability to calculate the values of mathematical functions, to determine logical inferences, and so on, are likewise subject to in all likelihood very similar bounds. To the extent that this is true, building such bounds, even when discovered, into linguistics would have no explanatory value and merely amount to a redundant complication.

[18] For a simple account of this view, see Paul R. Halmos, *Naive Set Theory*. Princeton, NJ: D. Van Nostrand, 1960; pp. 43–44.

[19] George S. Boolos and Richard C. Jeffrey, *Computability and Logic*. Cambridge, UK: Cambridge UP, 1974; p. 170.

less some imprecise interval beyond which there are no objects. One would say that the bound lies somewhere between e.g. m and q ($q > m$). This helps not at all to defend the finiteness view because the indeterminate range variant is subject to twin challenges exactly parallel to (4). That is, nothing can justify that the proper range is $[m. \ldots q]$ and not $[m. \ldots q + 1]$ or not $[m - 1. \ldots q]$.

Arguments like that just gone over then seem to support the claim that NLs as collections of sentences are nonfinite collections. But the reasoning is, obviously, entirely *nonempirical* and "Platonic." It could have no application to an empirical domain, such as human faculty states. One cannot, for example, use such reasoning to show that the number of objects that can be calculated via an instantiation of algorithm G in some computer is unbounded. Even granted that the abstract algorithm G *in principle* calculates an infinite number of values for some function, the computer is subject to constraints of time, memory, and so forth, which make its lifetime calculations quite trivially (compared to an infinite set) finite. To actually know something about the size of the number of actual calculations a fixed computer can perform, each such calculation having to correspond to a fixed physical aspect of its structure, requires empirical knowledge of the physical structure of the computer, of the length of its existence, and so on.

Just so, if NL sentences are, as in the foundational position rejected by JJK, some kind of psychological or biological objects, that is, objects that can be directly empirically studied, then their number is going to be given by real-world aspects of human nature, and will be (very) finite. Moreover, there has never been, and still is not, any actual empirical information about this matter. So any past idea about NL size interpreted as an empirical claim is necessarily unfounded and a view that the size is nonfinite is exactly as incoherent as a claim that some physical computer can perform infinitely many actual calculations.

Punning on Technical Terms Like "Generate"

Advocates of the joint views that NL is both exclusively a physical-world phenomenon and yet infinite may fail to recognize the incoherence of such a conjunction of assumptions because they confuse the issue with equivocal uses of terms like "generate." A clear and representative example is seen in remarks like the following in:

10. Chomsky:[20]
    a. "We can take a language to be nothing other than a state of the language faculty."

[20] Chomsky, *The Architecture of Language* 8.

b. "So lets take a language to be (say, Hindi or English or Swahili) a particular state attained by the language faculty. And to say that somebody knows a language, or has a language, is simply to say their language faculty is in that state."
c. "The language, in that sense, provides instructions to the performance systems."
d. "The next question is: how does it do it? There is another assumption that comes along: it does it in the form of what are called 'linguistic expressions' (read 'sentences': PMP). Each linguistic expression is some collection of properties."
e. "The technical terminology for that is that the language generates an infinite set of expressions; that is why the theory of a language is called a 'generative grammar.'"

The incoherence is visible in a few lines of a single page; (10a) says that the NL (viewed as a psychological grammar) is a state of an organ or faculty. This organ state is related to knowledge of NL in (10b), and in (10c) is said to provide instructions to performance systems. And (10d, e) claim that this is accomplished because the organ state generates an infinite set of expressions. The confusion arises fundamentally because the grammar generating an infinite set of sentences, the collection of sentences, and the sentences themselves are all being conceptualized in two contradictory ways.

On one branch of the contradiction, where the language faculty/organ is said to provide instructions to performance systems, the objects involved are taken to be physical-world features existing in space and time. The operation of the organ state is taken to be analogous to the functioning of a physical computer and "generating" is in effect then taken to be no different than a kind of organism-internal (mental) printing or signal sending. The organ state = grammar could at best produce *tokens* of NL sentences, things existing in a particular space at a particular time, totally distinct from the *types* that are sentences. Inter alia, such talk combined with the accompanying claim that linguistic expressions are sets and that the organ generates a set reveals a profound equivocation between a view of sentences and collections of them as physical objects and a view of them as abstract objects. Necessarily then, there is a correlated equivocation about "generate" as involving physical (mental) production (of tokens) and also as being the technical term relating the finite set of abstract elements of a proof theoretic system to the equally abstract, though typically nonfinite, set of types (theorem analogs).[21] On the second term of the contradiction, the collection of proved

[21] That the technical sense of "generate" involves a relation between sets, hence between abstract objects was perfectly well-known to the author of the work criticized before he wrote it. So:

structures can be infinite because both it and its members are abstract objects and unconstrained by the limitations of the physical universe and its laws. But on the former term, the objects would have to be some physical features of the biological mechanism, bounded in space and time, hence, in number.

THE NATURE OF SENTENCES

As stated at the outset, JJK's key realization was that the received ontological position which takes NL to be something psychological/biological confuses knowledge of NL with NL itself. The focal point of this confusion is that the received view cannot offer a coherent ontological notion of what an NL sentence is. This task is though unproblematic under the abstract view that JJK developed. In those terms, NL sentences are (quite complex) sets, and NLs are collections or families of sets, both core notions of other formal sciences like logic and mathematics.

The failure of the received view to offer a coherent account of the notion sentence is reflected in the notable fact that although the literature on that view is voluminous, it is extraordinarily difficult to find any explicit statement specifying the ontological status of sentences. In Postal[22] I was able to find only two, which, though essentially contemporaneous, were contradictory. One was that in (6) above from Chomsky,[23] which claims sentences do not exist. The other was a claim in Chomsky[24] that they are analogous to mental images.[25] Significant about the latter view is that it fails to recognize the fact that mental images and their

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(i) Chomsky (*Language and Mind* 126 n12)

> In general, a set of rules that recursively define an infinite set of objects may be said to *generate* this set. Thus a set of axioms and rules of inference for arithmetic may be said to generate a set of proofs and a set of theorems of arithmetic (last lines of proofs). Similarly, a (generative) grammar may be said to generate a set of structural descriptions.

See also Katz and Postal, "Realism vs. Conceptualism in Linguistics."

[22] Postal, *Skeptical Linguistic Essays.*

[23] Chomsky "Derivation by Phase."

[24] Chomsky, *New Horizons* 160.

[25] A similar view is found in

(i) Chomsky (*On Nature and Language* 48), which claims:

> Each internal language has the means to construct the mental objects that we use to express our thoughts and to interpret the limitless array of overt expressions that we encounter. Each of these mental objects relates sound and meaning in a particular structural form. A clear understanding of how a finite mechanism can construct an infinity of objects of this kind was reached only in the twentieth century, in work in the formal sciences.

This passage thus clearly also embodies the contradiction of talk of an infinite number of mental objects (therefore, brain objects in the author's framework).

analogs remain entirely in a realm which could at best represent sentence tokens. This follows because such things would have precisely the time and space properties of external sentence tokens as well as the many to one relation with sentences. They thus fail to reconstruct a useful notion of sentence for linguistics, or even one consistent with the actual discussions of sentences in the literature based on the received view. The latter of course treats individual sentences as unique, objective, timeless objects, not as subjective mental events, as in (11):

11. Chomsky:[26]
"Take any sentence you like, take an old example which is still not very well understood: 'John had a book stolen.' Take that sentence in English. It has lots of empirical properties, including certain very curious multiple ambiguities."

In this entirely typical remark, one is given no real-world temporal or spatial coordinates for the definite sentence at issue, implicitly revealing its abstract character.

The beginning of the generative grammar movement (in which the received ontological view JJK rejected is located) involved a repudiation of earlier so-called *structuralist* views of NL in which sentences were, in effect, identified with external tokens, that is, with utterances. Curiously, while it was claimed the newer view was a great step forward, on an ontological level all that was done at best was to replace an inadequate identification of sentence with (mind/organ)-*external* tokens with an equally inadequate identification of sentence with (mind/organ) *internal* ones. Neither view captures the type characteristic of sentences. Moreover, unlike the pregenerative view, which was at least consistent, the psychological view is forced by, inter alia, its adoption of the claim that NL is infinite into some form of incoherence. For its ontology drives it to take sentences to be inner tokens, but talk of infinity minimally requires them to be locationless types.

CONCLUSION

JJK assumed, I believe, that once the issue of the abstract versus nonabstract view of the foundations of linguistics was raised, the problems discussed and the advantages and disadvantages of the alternatives were made explicit there would be some fundamental debate in linguistics which would, on rational grounds, lead toward the view of linguistics as a formal science, which he had come to

[26] Chomsky, *The Architecture of Language* 18.

advocate. The latter has not happened because the former has not. JJK's critique of the received position and advocacy of the formal alternative have, sadly, for the most part simply been ignored. And as the twentieth century has given way to the twenty first, one finds, despite his insights, that linguistics remains dominated by an incoherent foundational view that confuses NL and knowledge of NL, sentences and collections of sentences as abstract objects with concrete mental and biological things, grammars with mental printers, "generate" in the technical sense with organism-internal production or printing, and which fails to coherently distinguish sentence and sentence token.

This sorry situation tells us something admirable about JJK and correspondingly something less than admirable about current linguistics. With his training and background in another field where high standards of argument and justification are taken for granted, JJK was evidently too optimistic about the degree to which linguists were open to serious reasoning about the foundations of their field. Much of the membership of this field is seemingly content either to have no foundational view whatever or to accept one which apparently cannot be, and in any event is not, defended against an alternative long existing, well explicated, publicly available, and specifically constructed and defended as an alternative to the one in vogue. Even more ominously, the former does not have to be defended to continue to be accepted.

The sad thing, then, is that two decades ago JJK offered linguistics the gift of a rather simple and elegant basis for the foundations of linguistics that avoids the problems and incoherence inherent in the received position, (only) some of which has been gone over here, and, moreover, one that incurs no foundational burden not already inherent in parallel formal foundations based on the notion of abstract object needed for logic and mathematics.[27] But despite this, the major body of theoretically oriented linguists have continued at least implicitly to opt for the incoherent alternative. One cannot help but wonder whether (and hope that) this situation is unique in the history of modern inquiry.

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[27] A formal, abstract object-based view of linguistic ontology, of course, faces the classic epistemological problem often raised in connection with mathematics and logic of how knowledge of abstract objects can be obtained. This issue and its relevance to the choice of ontological foundations for linguistics are dealt with at length in Katz, *Realistic Realism*, in the framework of a general treatment of the question of knowledge of abstract objects. See Carr, *Linguistic Realities*, for some skeptical discussion of JJK's earlier position on this matter.