Biolinguistic Platonism remains an Oxymoron

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1. Introduction

More than thirty years ago Jerold J. Katz published a major ontological criticism of Noam Chomsky's linguistics (Katz, 1981), and since then, numerous publications have restated, developed, and clarified the criticism (e.g. Katz & Postal, 1991; Katz, 1996; Postal, 2003, 2004, 2009; Behme, 2013, 2014a; Neef, 2014). These authors argue that any variant of biolinguistics representing the same ontology as Chomsky's is internally incoherent. Despite the serious nature of these criticisms, they have been largely ignored by Chomsky and occasional attempts by others to address them (e.g., Smith, 1999; Collins, 2009[1]) have been unconvincing. Recently Chomsky has admitted: "if we want a productive theory-constructive [effort], we're going to have to relax our stringent criteria and accept things that we know don't make any sense, and hope that some day somebody will make some sense out of them – like sets" (Chomsky, 2012: 91). This admission prompted further critical publications (Postal, 2012; Behme, 2012, 2014a) and the matter has finally generated public debates (e.g., Hornstein, 2013a) and publications explicitly acknowledging the existence of such criticism (e.g., Ulfsbjorninn, 2012, Krivochen, 2013[2]; Watumull, 2013). One author stated that: "a fallacy free and dispassionate—if

[1] The reference to Collins (2009) is not meant to imply that the entire paper was unconvincing. However, the essence of Katz & Postal's criticism has not been addressed (for details see Behme, 2013).

[2] Krivochen acknowledges but does not attempt to resolve the incoherence in Chomsky's biolinguistics. Instead he offers an alternative account, which will not concern us here.

disputatious—rebuttal is necessary and proper[3]" (Watumull, 2013: 301). Showing that the charge of internal incoherence is unfounded and clarifying things which, according to Chomsky, do not make any sense would indeed be important for anyone defending biolinguistics. Given that Watumull's article has been judged as "vigorous rebuttal of Postal's argument ... [that] argues (convincingly in my view) that Platonism and the biolinguistic program are perfectly compatible" (Hornstein, 2013b), it will be the focus of this paper. Watumull presents the problem and its putative solution as follows:

> Prima facie, the ontologies of these levels are incommensurable: set-formation, phrases, and so on in linguistics; action potentials, neurons, and so forth in neuroscience. ... The concept that unifies the research is computation — essential to which is information — and the concept that unifies computation is the Turing machine. Indeed, the beauty of the Turing machine is that in its abstractness it subsumes and thereby relates all computational primitives; *in principle* therefore it renders commensurable the computational ontologies of linguistics and neuroscience — or so I would endeavor to prove in the TPLT. (Watumull, 2012: 227, my emphasis)

At issue of course is whether it *is* possible, in principle, to unify the ontologies of abstract linguistic objects and concrete biological brains. Below I argue that Watumull's rebuttal fails because its author [1] appears to misunderstand several points of the Katz & Postal criticism, [2] misrepresents Postal's position, [3] conflates the ontological issues, [4]

[3] The attempted rebuttal is neither fallacy free nor dispassionate. The tone is condescending throughout (e.g., "Alas, it is Postal who is confused" (307), "Postal's first confusion is particular to the idealization of indefinite computation" (308)."[Postal's] objection is a *non sequitur*" (311). Further, Watumull criticizes Postal for finding it odd that Chomsky has never replied to his criticism: "Biolinguistics has no single author: It is a research program pursued by numerous individually-thinking scientists subordinate to no individual..." (302). This appears irrelevant (Postal has never denied that fact) and inconsistent because Watumull also holds that "modern linguistics — generative linguistics (subsuming biolinguistics) — [was] established and expounded by Noam Chomsky" (Watumull, 2012: 224), suggesting that Postal's term 'Chomsky's biolinguistics' *is* correct.

defends a view that has been rejected by Chomsky, and [5] pays no attention to neurophysiological properties of actual brains. Instead of presenting novel research or innovative theorizing that could provide a coherent ontology for biolinguistics, Watumull relies on "simplistic prototypes of theories" (Watumull, 2012: 232) based on dubious entities like "as yet undiscovered neurobiological primitives" (Ibid.: 227), genetically encoded "semantic primitives that recognize syntactic categories" (Ibid.: 239), and a "genetically installed linguistic oracle" (Ibid.: 239) that could supposedly render a biolinguistics in which language is both abstract and biological coherent.

2. Preliminaries

Part of Watumull's alleged refutation seems based on a serious misunderstanding of the grounding for (Katz and) Postal's criticism. He writes: "For Postal, language is a Platonic object, and *therefore* he concludes that the biolinguistic assumption of a physical basis for language is "absurd" (Postal 2009: 104)" (Watumull, 2013: 301, my emphasis). Watumull assumes here that Postal takes the biolinguistic ontology to be incoherent because he holds that language is a Platonic object. But Postal has, rather, argued that the biolinguistic ontology is incoherent *regardless* of whether or not Platonism is true:

> While Postal is offering Platonism as an alternative to Chomsky's incoherent biolinguistic view, he states explicitly that the incoherence critique remains valid even if Platonism or other alternatives are rejected: "But, logically, efforts to show the superiority of a platonist view of NL to NC's biolinguistic one were unnecessary because on purely internal grounds, NC's

> foundational position is untenable regardless of the superiority of any other position. That holds since it is incoherent and so fails to qualify even as a rational candidate for the proper view of NL ontology" (Postal, 2012, 5) - (Behme, 2012: 2)

That is, Postal holds Chomsky's ontology to be incoherent because Chomsky assumes language to be both: (i) part of the human brain, and (ii) based on set-theoretic objects currently taken to be generated by the operation Merge (e.g. "a generative grammar as being based on an operation of Merge that forms sets" (Chomsky, 2012: 91)). Clearly (i) and (ii) cannot apply simultaneously to the same object (e.g. an I-language). Brains are finite, physical objects. They exist in time and space, are destructible, and enter into causal relations. Sets are abstract objects. They do not exist in time and space, cannot be destroyed and do not enter into causal relations. Therefore, Chomsky's ontology, which attributes these contradictory properties to the same object (I-language), is internally incoherent. This incoherence arises entirely independently of whether one defends linguistic Platonism or linguistic naturalism. To overcome the incoherence one has only two choices. First, one could give up one of the contradictory claims (i) and (ii). This would entail giving up Chomskyan biolinguistics. Second one could attempt to show that some previously unknown miraculous objects can have both: biological and abstract properties[4]. I argue below that even though Watumull claims he defends biolinguistics he never attempts the second option.

[4] One finds in the biolinguistic literature occasional references to postulated objects with mysterious ontological properties. Consider: "[Language] Quarks cannot be absolutely located or materialized in space and hence they cannot stand in any simple one-to-one correlations with 'concrete material'" (Sigurðsson, 2009: 179) and "Certain semantic objects arise at phase boundaries and have an ephemeral existence at these very moments. No external demands are imposed on this dynamics" (Hinzen, 2009: 130). But to my knowledge no biolinguist has provided a coherent ontological account of genuine biolinguistic objects that have concrete and abstract properties.

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A second confusion arises when Watumull attributes to Postal the following view: "Postal must assume that our finite brains can access an infinite set of Platonic sentences" (Watumull, 2013: 311). But Postal neither must nor does assume that brains can access an infinite set of Platonic sentences. He assumes that human brains can only access finite tokens. On his view, no set can be accessed directly by any brain because sets do not exist in time and space.

The Platonist position does not deny that complex mental activities are *associated with* language use and with mathematical calculation. But, for example, when one solves an equation, one does not literally manipulate, or access abstract objects like numbers, or variables, or differential operators. Rather, the plausible hypothesis is that one undergoes a series of cognitive state changes, which in complex and poorly understood ways faithfully *mimic* the relationships holding between the relevant abstract objects. Assuming that languages are abstract objects, the Platonist rejects the view that languages are aspects of human biology (e.g., complex mental activities) and denies that knowledge of languages and languages are identical.

Finally, Watumull misrepresents Postal's position. He provides the following partial quotation: "'[A]n interpretation of physical things as representing particular abstractions [is] something Chomsky's explicit brain ontology has no place for' (Postal 2009: 110)" (Watumull, 2013: 305), and later, again, alleges that "Postal believes that an "explicit brain ontology" as assumed in biolinguistics "has no place for" the encoding of an abstract object such as a Turing machine in a physical system such as the brain" (Watumull, 2013: 312). The implication seems to be that Postal believes it is impossible to encode an abstract object like a computer program in any physical system such as a

computer. Postal holds no such view. In the passage from which Watumull quotes he writes:

> … nothing physical is a rule or recursive. Physical things are destructible, recursive functions not. At best a physical structure can encode rules. But that involves an interpretation of physical things as representing particular abstractions, something Chomsky's explicit brain ontology has no place for. And, as discussed in Postal (2003), Chomsky's view here amounts to a pun on the word generate. Standard formal theory use of this item refers to a relation between two sets, sets being nonphysical objects; see e.g. Partee, ter Meulen & Wall (1993: 435) and below. Such things do not exist in space or time, thus are not subject to the laws of nature. That is why assumptions that some are infinite raise no problems of coherence. However, in [Chomsky's quote], *generate* is used in the sense of a relation between a physical object and some physical outputs, roughly as a synonym of *produce*. But every physical production takes time, energy, etc., and an infinite number of them requires that the physical universe be infinite and, internal to Chomsky's assumptions, that the human brain be. (Postal, 2009: 110-111, original emphasis)

Watumull cites Postal out of context and obscures the fact that Postal of course recognizes the triviality that computer programs can be implemented in physical systems. He merely denies that a physical system such as a human brain can generate an infinite output if "*generate* is used in the sense of a relation between a physical object and some physical outputs, roughly as a synonym of *produce*". To refute Postal's position, Watumull would have to demonstrate that brains are capable of producing infinite physical outputs. I argue below that no such refutation is offered.

3. Substance and Property Dualism

Watumull claims his arguments establish "that the ontologies of Platonism and biolinguistics—properly defined—are not mutually exclusive and contradictory, but in fact mutually reinforcing and consilient in a coherent and compelling philosophy of language" (Watumull, 2013: 301). He stipulates that I-language is "internal to an individual" (e.g. a biological object) and "a system of d-infinity (discrete / denumerable / digital)" (e.g., a platonic object)" (Watumull, 2012: 224). He then concedes that "prima facie, the ontologies of these levels are incommensurable... [and require] a novel and nontrivial unification" (Watumull, 2012: 227).

Given that Platonic and biological objects are of a fundamentally different nature, any coherent ontology containing both must assume either substance dualism or property dualism. One could classify Postal's view as substance dualism. He holds that Platonic objects are real, but that their essential properties are not shared by any physical object (for details see Postal, 2004, 2009, 2012). On Postal's view, natural languages are entirely disjoint from human brains. But brains can acquire knowledge of a natural language, presumably based on specific properties of human (and as far as we know only human) brains. What these properties are need not concern us here, except that they are physical properties of concrete neurobiological objects. So in Postal's ontology, two fundamentally different kinds of objects exist: abstract or formal objects (e.g., natural languages, taken as collections of sentences) and concrete or physical objects (e.g., brains which can acquire knowledge of natural languages). One can call this view explicit Platonism.

Watumull assumes property dualism and claims to defend a view that can be called implicit Platonism. He proposes that an object (like the human brain) can have both: physical and abstract properties: "I-language has mathematical and biological aspects" (Watumull, 2013: 306), and he holds that "Language is a complex phenomenon: we can investigate its computational (mathematical) properties independent of its biological aspects" (Watumull, 2013: 308). Elsewhere he envisions a theory that provides formalized "definitions of linguistic primitives in order that 'linking hypotheses' (not mere correlations) to as yet undiscovered neurobiological primitives can be formed" (Watumull, 2012: 227). These alleged linguistic and neurobiological primitives have distinct ontological natures, yet both are to be found in human brains. This form of property dualism is also known as computationism and stipulates that the "mind is a collection of programs (or algorithms) that can be embodied ("instantiated") in either brains or machines" (Bunge, 2003: 181-182).

However, the putative embodiment is problematic for two reasons. First, it could be understood to imply that abstract objects (computer programs) are literally located in physical objects (brains or machines). This is clearly not the case. Second, it could create the impression that the physical structure in which programs are instantiated is irrelevant. But even though computational algorithms are device-independent, the actual procedure that is instantiated in a particular device and the way that algorithm is physically realized in available hardware can differ from device to device.

Watumull (and Chomsky as well) face an important limitation here. Their explicit goal is to provide an account of *human* language instantiated in *human* brains, to model "a specific form of human intelligence, ... that of language" (Watumull, 2012: 223).

Chomsky has focused on the study of human language for decades claiming that by "studying *the properties of natural languages*, their structure, organization, and use, we may hope to gain some understanding of the specific characteristics of *human* intelligence" (Chomsky, 1975: 4, my emphasis).

This expressed goal of biolinguistics raises a problem for the purely mathematical/computational approach Watumull is taking. One of the supposed benefits of his computational approach is that one can ignore biological structures and properties because those represent just one of a potentially very large number of computational platforms. But an account for how human language is implemented in the human brain cannot ignore the platform. Hence it is not only important for biolinguistics to establish that 'the linguistic computational program' can be instantiated in *some* hardware but that it can be embodied in a human brain.

4. Interlude: Watumull's misrepresentation of Chomsky's position

Watumull asserts that he is "convinced of the existence of "a Platonic heaven [of] arithmetic and [...] set theory," inter alia, that "the truths of arithmetic are what they are, independent of any facts of individual psychology, and we seem to discover these truths somewhat in the way that we discover facts about the physical world" (Chomsky 1986: 33)" (Watumull, 2013: 306). He claims to be committed to mathematical Platonism "[m]ore strongly than Chomsky, who does grant mathematical Platonism" (Ibid.). This is

misleading, as the context in which Chomsky made the remark reveals:

> ...it has been suggested that knowledge of language should be understood as the analogy of knowledge of arithmetic, arithmetic being taken to be an abstract 'Platonic' entity that exists apart from mental structures...The analogy [is] quite unpersuasive. In the case of arithmetic, there is *at least a certain initial plausibility* to a Platonistic view insofar as the truths of arithmetic are what they are, independent of any facts of individual psychology and we seem to discover these truths somewhat in the way that we discover facts about the physical world. *In the case of language however, ... there is no plausibility* to the idea that apart from the truth of grammar concerning the I-language and the truth of UG concerning S_0 there is an additional domain of fact about P-languages, independent of any psychological states of individuals (Chomsky, 1986: 33, emphasis added).

Here Chomsky grants no more than "a certain initial plausibility" to mathematical Platonism. He contrasts this with linguistic Platonism, which lacks even such "initial plausibility", because in his view there can be no natural languages that are independent of any psychological states of individuals[5]. For this reason, Chomsky claims, there can be no analogy between knowledge of language and knowledge of arithmetic. This view is expressed in other publications: "…it is a mistake to think of computer models of the mind that are divorced from biology… or Platonistic or other non-biological conceptions of language" (Chomsky, 2002: 72), and he repeatedly denies the usefulness of a Platonist approach to the natural sciences: "[scientific] studies do not postulate weird entities apart from planets, comets, neurons, cats, and the like. No 'Platonism' is introduced, and no 'E-linguistic' notions: only biological entities and their properties" (Chomsky, 2001: 42),

[5] It is irrelevant here whether Chomsky's claim (that there is no analogy between mathematics and linguistics) is correct. However, it is odd that Watumull claims to rebut Postal by defending a view that is incompatible with Chomsky's commitments.

and "… there are images of [natural objects] in some Platonic universe that we could study, if we wanted[6]. Unless they have some other properties that are not determined by the internal events that they are reflections of, then they're dispensable" (Chomsky, 2012: 130).

Prominent defenders of Chomsky have also emphasized that "language for [Chomsky] is I-language, a state of the mind–brain, and not a set of sentences" (Smith, 1999: 148) and claimed that taking languages "to be Platonic objects existing independently of the humans who speak them, and possessing mathematical properties … [is implausible]" (Smith, 1999: 146). They reject Platonism because even though "we take grammars themselves to be abstracta, it does not follow that linguistics is the study of abstracta … we are not interested in the abstracta simpliciter; … [but] in the grammar determined by the psychogrammar realized by the agent[7]" (Ludlow, 2011: 56).

The forgoing has shown that Chomsky's ontological commitments are very different from those Watumull attributes to him. This difference has important implications. Watumull claims he has "chosen to defend something [i.e., biolinguistics] its own author [i.e., Chomsky] is unwilling to" (Watumull, 2013: 301). But Postal's arguments were directed specifically at the ontological incoherence of Chomsky's biolinguistics. Hence,

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[6] No Platonist holds that there are images, or copies of things in the perceptible world, in the Platonic Universe. On the contrary, classical Platonism holds that the perceptible world contains images (or shadows) of the world of forms.

[7] Ludlow's use of the term 'abstract object' is ambiguous. He claims that grammars and the languages generated by them are abstract objects. This seems to refer to the same kind of abstract objects Platonists like Katz and Postal propose. Yet Ludlow also argues that the fact that grammars and languages are abstract objects "is not to reject the idea that UG is a feature of our cognitive psychology … UG is a natural system that can be investigated at several levels of explanation, including both the biophysical level and the psychological level. … When we begin to explore minimalist mechanisms we are doing speculative theorizing about the physiogrammar. This isn't to say we are speculating about what neurons are up to; that is yet another level of abstraction down" (Ludlow, 2011: 55). Here the term abstract object seems to refer to a generic biophysiological object from which properties of particular objects have been abstracted away.

even if Watumull's defense of his own biolinguistics succeeded, it could not address Postal's criticism of Chomsky. Having established that Watumull's proposals provide no defense of Chomskyan biolinguistics I will show next that they also fail to support biolinguistics more broadly construed because they lack any biological content.

5. The slippery slope from implicit to explicit Platonism

Unlike Chomsky, Watumull attempts to establish that linguistic objects exist separately from and independently of brains. He states that linguistic objects are "reducible to or properly characterized as mathematical objects... [that in his] theory of natural language, the quiddities that define a system as linguistic are ultimately mathematical in nature" (Watumull, 2013: 306.). Elsewhere he postulates that his research program "give[s] the highest degree of reality to the mathematical form of I-language" (Watumull, 2012: 226) and that "the theory needs to be mathematical because the phenomenon (I-language, CB) is mathematical" (Ibid.,: 229). Yet he makes no specific proposal how one might achieve a "novel and nontrivial unification" of these mathematical properties with the biological properties of the putative I-language.

If the essential properties of language are mathematical in nature, it seems to follow that only non-essential or accidental properties of language could be biological. This suspicion is confirmed by the statement "biology is the ladder we climb to the "Platonic heaven" of linguistic Forms" (Watumull, 2013: 311). Watumull never attempts to provide

an explanation of what *specifically biological* properties language has[8]. It turns out that there could be none. This follows from his discussion of multiple realizability[9]: "The rules of arithmetic for instance are multiply realizable, from the analog abacus[10] to the digital computer to the brain; mutatis mutandis for other functions, sets, etc." (Watumull, 2013: 306). Multiple realizability requires that the substrate in which the computational program is 'embodied' is neutral. Were the embodiment of the program to require specific biological properties, then it would no longer be multiply realizable. This suggests that whatever might have been biological about Watumull's ontology can be eliminated. He has moved all the way from implicit to explicit Platonism.

5. In search of biological properties

Given that for Watumull the biological properties of language are at best accidental properties, one might wonder what the basis for calling his view *bio*linguistics is. He offers the following definition

> Let the ontology of some research program be defined as

[8] At one point Watumull claims he has conducted "a rigorous mathematical and biological analysis *of the hypothesis* that a "computational mechanism of recursion", such as Merge, is unique to language" (Watumull, 2012: 236). But no biological analysis of an abstract computational mechanism can be conducted.

[9] In the philosophy of mind multiple realizability is the thesis that any physical platform (physical kind) can encode or embody the abstract Universal Turing Machine (program). This thesis is not uncontroversial but a discussion of objections to it would lead to far afield.

[10] This example is incorrect. An abacus is more accurately described as a "calculating aid" and needs to be distinguished from computers/calculators that can or do encode e.g. the rules of arithmetic (e.g. a slide rule is an analog mechanical calculator and Babbage's Analytical Engine is a digital mechanical computer). In any serious discussion of multiple realizability it is important to be precise about where the rules for doing calculations actually reside.

> 'biolinguistic' if it assumes, investigates, and is informed by the biological basis of language … At issue here is the particular definition of biolinguistics that identifies language as *I-language* — i.e., a computational system (a function in *intension*) *internal* to the cognitive-neurobiological architecture of an *individual* of the species *Homo sapiens sapiens* — the properties of which are determined by the three factors that enter into the design of any biological system: genetics, external stimuli, and laws of nature. (Watumull, 2013: 302-303)

And elsewhere he admits that his theory depends crucially on "as yet undiscovered neurobiological primitives" (Watumull, 2012: 227) and on genetically specified "oracular information" (Ibid.: 239). Naturally, one would expect genetic research to play an important role in Watumull's research agenda. However, it turns out that Watumull's mathematical biolinguistics shares the shortcomings of Chomsky's biolinguistics and other varieties of biolinguistics. None of these programs pay any attention to the putative *biological* properties of language. Watumull obscures this fact when he writes:

> ... the theoretical and empirical contributions of the diverse subprograms in which these scientists work *are* so numerous and important that none can be "dominant" (Postal 2009: 104): for example, in the intersection of cognitive science, linguistics, and the formal sciences, the formal properties and functional architecture of linguistic cognition *are* being specified; evolutionary biology *is* investigating possible homologues /analogues of language in nonhuman animals; genetics *is* discovering some of the genes active in the development and operation of the language faculty; neuroscience *is* mapping the physical substrate of linguistic processing; and this is but a sampling of the biolinguistics program. (Watumull, 2013: 302, my emphasis)

Here he creating the impression that biolinguists work currently on specific genetic and

neurophysiological research programs. However, despite using the terms biology and biological more than 50 times in his article, he provides not a single specific example of the putative biolinguistic structures. His readers learn nothing about the "genes entering into the development and operation of the language faculty". This is unsurprising because no such genes have been discovered by biolinguists. He also fails to provide any example of the "physical substrate of linguistic processing" that is allegedly being mapped by neuroscience. Watumull then leaves unimpeded the inference that Postal was correct to point out that "in total contrast to actual biological science, in four decades [Chomsky] has not specified a single physical property of any linguistic object" (Postal, 2009: 113). But if language is a biological object, as anyone holding a biolinguistics view must assume, then language must have at least some biological, that is physical, properties. Furthermore, specifically biological linguistic properties must be at least in some aspect different from biological non-linguistic properties. Yet, the biolinguistics enterprise has not specified a single *biological* property that is uniquely linguistic.

Watumull claims throughout his article that language has biological properties but, like Chomsky, he never specifies any. Several passages illustrate the emptiness of the 'biological' commitment. First one finds "evolution has encoded within the neurobiology of *Homo sapiens sapiens* a formal system (computable functions) generative of an infinite set of linguistic expressions" (Watumull, 2013: 302). No attempt is made to specify which part of our neurobiology could have the extraordinary property allowing the brain (a physical organ) to "generate" an infinite set of linguistic expressions (an abstract object). Next, Watumull tries to establish a similarity between mathematical and linguistic encoding:

> My brain (and presumably Postal's) and my computer encode a program (call it ADD) that determines functions of the form fADD (X + Y) = Z (but not W) over an infinite range. Analogously, my brain (and Postal's) but not (yet) my computer encodes a program (call it MERGE) that determines functions of the form fMERGE(α, β) = {α, β} — with the syntactic structure {α, β} assigned determinate conceptual-intentional and sensory-motor representations — over an infinite range.[11] These programs are of course limited in performance by spatiotemporal and operational resources, but the programs themselves — the functions in intension — retain their deterministic form even as physical constraints vary (Watumull, 2013, 308)

Again, there is a significant tension in treating language as both biological and computational. If one treats language as an abstract 'computational program', then the biology in which the program is implemented is irrelevant (mere implementation details or platform-neutral realizers). If one treats language as biological organ, then the output of this organ can only be finite. A successful biolinguistics would have to combine the putative physical and abstract properties of language in a single biological organ.

Furthermore, it has never been established that human language *is* implementable in platforms other than human brains[12]. Watumull gestures at a difference between computers and brains that allows the former to encode program ADD but only the latter

[11] This assertion begs the question of whether NL grammars are proof-theoretic or model-theoretic, an issue discussed in Langendoen & Postal (1984), Pullum & Scholz (2001), Postal (2004), Pullum (2007), Pullum (2013).

[12] Watumull assumes here without argument that everything required for language is computable; that we are merely an instantiation of a Turing machine. But so far no computer has passed the Turing Test. Whether it will be possible in the future to implement language in a non-biological platform remains to be seen. Until we know what the neurophysiological language-structures are it is premature to abstract away from them: "[Connectionists are] abstracting radically from the physical reality, and who knows if the abstractions are going in the right direction?" (Chomsky, 2012, p. 67).

also to encode MERGE[13]. But again he fails to specify a single neurobiological property that could account for this difference between brains, which are complex self-organizing systems that learn from the environment and have no clear distinction between program and device, and computers, which have fixed-architectures and are programmable with algorithmically predictable effects. Instead, he continues: "I-language is a cognitive-neurobiological token of an abstract type; it "generates" sets in the way axioms "generate" theorems" (Ibid.). But this claim ignores Postal's criticism that axioms generate theorems in a precise technical sense of 'generate', involving relations between abstracta. Neither the axioms nor the theorems nor the principles (e.g. rules of inference), which determine the latter, have any physical existence. But the core claims of Chomakyan biolinguistics are that I-language is physical and that E-languages "are not entities with some ontological status; they are introduced to simplify talk about properties of FL and L [faculty of language and language, CB] and can be eliminated in favor of internalist notions" (Chomsky, 1999: 33). Thus, for Chomsky to 'generate' is a physical operation of a human brain, while the axiom/theorem relation is abstract. To say that a set of axioms "generates" a set of theorems misrepresents Chomsky's ontological commitments. Further, Watumull conflates what a brain can do in time and space with what an abstract system of logical/mathematical relations with no temporal/spatial/causal connections to the world does. In other words, he assumes that what the brain does is the same as what the abstract Turing machine 'does'. But this just assumes what is at issue in the question of whether language is concrete or abstract.

[13] This example seems to contradict the multiple realizability claim because, apparently, only brains but not computers can encode MERGE. Charitably one can assume that the failure of computers to encode MERGE is merely contingent and that, at least in principle, computers can encode MERGE.

This question begging is not eliminated by asserting that, "we are endowed physically with a competence that *does* generate a set that *could* be produced by indefinite computation" (Watumull, 2013: 308, original emphasis) without explaining how a physical object (brain-state) possibly could yield an abstract object (set).

Watumull claims competence is "the ability to handle arbitrary new cases when they arise" such that "infinite knowledge" defines an "open-ended response capability" (Ibid.). Nothing in these assertions gives any hint of any neurobiological properties that are implicated in our putative linguistic competence. Seemingly unaware of the complete lack of *biological* content of his biolinguistic speculations, Watumull continues, "I-language is a way of representing an infinite set by a finite table (a function)... I-language "would arrive at every [sentence] in some finite time, having used only a finite quantity of tape. And everything about the process could be defined by a finite table." This gives a rigorous sense to the linguistic notion "infinite use of finite means." (Ibid.). Watumull attempts to turn an idealized purely abstract notion of computability into something biologically real ignoring that:

> There remains the fact that for all but a finite number of values of n, it will be infeasible in practice for any human being, or any mechanical device, actually to carry out the computation: in principle it could be completed in a finite amount of time if we stayed in good health so long, or the machine stayed in working order so long; but in practice we will die, or the machine will collapse, long before the process is complete. (There is also a worry about finding enough space to store the intermediate results of the computation, and even a worry about finding enough matter to use in writing down those results: there's only a finite amount of paper in the world, so you'd have to writer smaller and smaller without limit; to get an infinite number of symbols down on paper, eventually you'd be trying to write on molecules, on atoms, on electrons.) But our present study will ignore these practical limitations, and work with an idealized notion of

> computability that goes beyond what actual people or actual machines can be sure of doing (Boolos et al., 2002: 23-24).

But of course the purpose of Chomskyan biolinguistics is to account for a supposedly entirely biological (hence physical) innate language system. A peak of uninformative verbosity is reached when Watumull attempts to explain what makes an object a linguistic object: "In order for an object to be classified as linguistic, it must be generated by I-language; in other words, to be a linguistic object is to be generated by I-language. And thus I-language *explains* why a given natural language contains as members the expressions it does" (Watumull, 2013: 310, original emphasis). This passage is uninformative and question begging. Langendoen and Postal (1984) and Postal (2003) argue that there are unlearnable natural languages, hence natural languages no actual I-language can correspond to.

Finally, Watumull seems unaware that extensive biochemical research would be required to link his mathematical speculations to the neurobiology of human brains. He proposes:

> ... the structures Merge generates in parsing (i.e. the reverse derivations the child performs in recognizing and analyzing linguistic data) necessitate querying to be interpretable (i.e. mappable into the initial (genetically determined) state of I-language). Some answers are given in the structure (e.g., those defining arrangements of phrases, etc.), obviating oracle queries; *residual answers need to be given in the genetic endowment as oracular information* (e.g., the semantic and syntactic primitives of Pinker 1984) and/or derived from mathematical law. So designed, acquisition is the process of running a bootstrapping PAC algorithm on a hierarchy of queries, the answers to which specify the setting of language-particular parameters. (Watumull, 2012: 240, my emphasis)

Turing (1939) called an oracle machine (o-machine) a Turing machine, which could interrogate an "oracle" during the computation:

> Let us suppose we are supplied with some unspecified means of solving number-theoretic problems; a kind of oracle as it were. ...this oracle ...cannot be a machine. With the help of the oracle we could form a new kind of machine (call them o-machines), having as one of its fundamental processes that of solving a given number-theoretic problem[14] (Turing, 1939: #4)

Broadly speaking adding an oracle to a Turing machine is similar to giving a computer access to an external database or other resource during the computation process. In order to evaluate Watumull's proposal one would need to know what kind of information the oracle provides and how this information could be "given in the genetic endowment". His vague reference to "the semantic and syntactic primitives of Pinker" could generate the impression that a biological account of these primitives is available. Yet, even though the primitives have played a crucial role in nativist theories of language acquisition, it was never specified how they might be linked to the innate endowment:

> The total explanatory theory of language acquisition must eventually include a developmental theory of the origin of whatever innate primitives are postulated. Thus, if syntactic categories are innate, then a developmental account must be constructed that will provide a causal theory which bridges the gap between the genes and these innate categories. Despite the fact that the syntactic approach is over a quarter of a century old, there have been no proposals-not even any serious discussion - on how this formidable task might be accomplished. (Obviously, one

[14] For discussion, modern definitions of Oracle Machines, description of the Oracle Graph Theorem, and use of Oracle Machines as computational models see Soare (2009). Soare discusses that Oracle Machines are "used in theoretical research and also in real world computing where a laptop computer may communicate with a database like the World Wide Web" (Soare, 2009: 374) but he makes no suggestions how oracular information could be encoded in the genome. It would have been the task of Watumull to provide at least the broad outline of a hypothesis for bridging the gap between abstract computational device and concrete biological instantiation.

> cannot leave this problem entirely to the biologist - most biologists hardly know what syntax is.) While it is certainly not now reasonable to demand anything like a complete theory, it is reasonable to expect a promissory note, and at least a sketch of an argument as to how it might eventually be redeemed. (Braine, 1992: 79)

Instead of providing any explanation for how the gap between genes and postulated innate syntactic primitives might be bridged, Watumull assumes that the primitives could provide the crucial oracular information for a computational linguistic device. Like other biolinguists before him, he fails to anchor his speculations in human biology. This leaves him with a purely abstract proposal. This kind of "theorizing" exemplifies what Chomsky has ridiculed decades ago: "People may study whatever abstract object they construct, as a form of mathematics. The matter has no empirical relevance, no relevance to the real world" (Chomsky, 1987: 35).

Despite having failed to specify any biological properties of I-language, Watumull surprisingly asserts: "for mathematical biolinguistics to have defined I-language as a Turing machine is not to have confused the physical with the abstract, but rather to have abstracted away from the contingencies of the physical" (Watumull, 2013: 310). But before one can abstract away from contingencies, one needs know what the physical (e.g., neurobiological) properties are, and then specify which of those can be eliminated for the model one constructs. Unjustified radical abstractions are highly problematic:

> … if you take a look at the core things [connectionists are] looking at, like connections between neurons, they're far more complex. They're abstracting radically from the physical reality, and who knows if the abstractions are going in the right direction? (Chomsky, 2012: 67)

Yet for Watumull dealing with actual biological properties is seemingly a waste of time. He is interested in the "making of abstract mathematical models of the universe to which at least the physicists give a higher degree of reality than they accord the ordinary world of sensation" (Weinberg, 1976: 28, cited by Watumull, 2012: 226). At this point nothing seems to be separating Watumull's proposal from full-blown Platonism.

Watumull is not entirely unaware that biology cannot account for formal linguistic properties: "neurobiology cannot answer the question whether some pattern is linguistic" (Watumull, 2013: 312). Yet, he seems unable to grasp that this is not a contingent problem that could be solved by a more advanced neurobiology of the future. The logical chasm between a physical object (brain) and an abstract one (set) remains unaddressed by Watumull's speculations. Apparently he mistook a model (the abstract Turing machine) for the object that is being modeled (a human brain): "...the beauty of the Turing machine is that in its abstractness it subsumes and thereby relates all computational primitives; in principle therefore it renders commensurable the computational ontologies of linguistics and neuroscience" (Watumull, 2012: 227). It is legitimate to abstract away from the most basic physical properties of brains (e.g. that brains exist in time and space, metabolize nutrients and oxygen, have a limited storage capacity, etc. etc.) when one constructs a computational theory of some brain activity. But these physical properties do not disappear. Similarly, one can abstract away from basic ontological properties of sets (e.g. that sets do not exist in time and space, are causally inert, etc.) when one constructs a computational theory of natural language. But again, these properties do not vanish. And when one wishes to construct a theory that combines physical and abstract properties in a

single object (I-language), then these properties need to be accounted for. Watumull has never achieved the attempted unification because his proposal eliminated the biophysiological properties of actual brains. Instead of "unifying mathematical Platonism and biolinguistics" (Watumull, 2013: 313), he has unintentionally revealed that only the formal properties of language are properly called 'linguistic properties'. Hence, Watumull's thesis provides not a refutation but a vindication of (Katz and) Postal's ontological view of language.

Finally, it is no challenge to claim that Postal "must assume that our finite brains can access an infinite set of Platonic sentences" (Ibid.). Postal would claim that such an idea is obscure because it is not clear what 'accessing an abstract object' means. What is clear is that people gain knowledge of (some) sentences. Postal does not claim that he knows how knowledge of language is acquired and, judging by Watumull's article, biolinguists seem to be in no position to answer this 'how' question either. Given that the putative neurobiological properties of I-language play no explanatory role in Watumull's biolinguistics ontology, they probably can be eliminated. What is left then is a full-blown Platonist ontology for language: linguistic objects have formal, mathematical properties and human brains have physical, neurobiological properties. I-language remains an internally incoherent construct of Chomsky's and other biolinguists' "theories/programs".

6. Implications

I have argued that Watumull fails to establish that biolinguistic ontology is coherent. His metaphor that "biology is the ladder we climb to the "Platonic heaven" of linguistic Forms, though it would be scientific suicide to throw the ladder away once up it" (Watumull, 2013: 311) is doubly misleading. First, it gives the wrong impression that a physical object could extend into the realm of abstract forms. Second, it suggests that biology has played a role in Watumull's theorizing. It has not and the claim that I-language is "a concretization (an "embodiment" in the technical sense) of a mathematical abstraction (a Turing machine)" (Watumull, 2013: 313) remains vacuous because Watumull did not specify any neurobiological properties of the human brain that could be implicated in the alleged embodiment. At best, it appears that his talk of unifying mathematical Platonism and biolinguistics is mere metaphor because it depends on the notion of a bodiless embodiment.

Anyone interested in the biology of language can only be disappointed by Watumull's paper. He never reveals any biological properties of language that could provide an internally coherent foundation for Chomsky's or his own biolinguistics. Instead, he merely pays lip service to biology before eliminating it entirely from his account: "I am assuming that fundamentally a system is linguistic in virtue of mathematical (non-biological) aspects" (Watumull, 2013: 311). According to one of the leading proponents of biolinguisitics, since "the early fifties ... the topic we were interested in was, how could you work [the formal science of linguistics, CB] into biology?" (Chomsky, 2012, p. 21). Given the complexity of language it would of course be unreasonable to expect that *all* biological properties of language are known by now. But it is reason for concern that

in 60 years biolinguists have seemingly not discovered *any* specifically linguistic biological properties of the hypothesized language organ[15].

No doubt a certain progress has been made by researchers working under the biolinguistics umbrella, in identifying and describing many non-biological properties of language that were unknown 60 years ago. Given that this progress was possible in the absence of any knowledge about the neurobiological properties of human brains, it cannot be ruled out that actual work in biolinguistics depends no more on biology than the work of Platonists like Katz and Postal does. Presumably, it was for this reason Postal stated that when doing actual work on syntactic structure Chomsky is "advancing set-theoretical accounts of NL structure, [and] abandons his own putative ontology and proceeds, but only incoherently, as if he had a realist one which permitted him to sensibly view sentences in set-theoretical terms" (Postal, 2009, p. 114). Watumull has provided no motivation for working linguists to become interested in neurobiology.

Watumull claims that his thesis "is or would be accepted by the majority of researchers in biolinguistics" (Watumull, 2013: 313). This *argumentum ad populum* (appeal to popularity) implies that a view is likely correct because most experts accept it. It is a frequently committed fallacy of reasoning. One need not go far back in the history of linguistics to find counter examples: "In the 1950s, all of the fields of social science and

[15] Watumull's inability to specify neurobiological properties of language is quite representative for biolinguistics in general. For example one leading biolinguist recently replied to a request to explain how the UG is encoded in the genome with: "...Does anyone really know how things like learning biases get coded in the genome? Does anyone know how the bee dance or the dead reckoning behavior of ants gets coded in the genome? But, seriously, *I don't know, or, right now, care.* That question is way above my pay grade" (Hornstein, 2012, emphasis added). Another prominent biolinguist admitted: "I don't know much about mutations" (Pietroski, 2013). The fact that one can practice BIOlinguistics without even caring how the putative language faculty is genetically encoded or knowing much about mutations speaks volumes.

psychology were behavioral science" (Chomsky, 2012: 66). That is the vast majority of psychologists were behaviourists. Yet, Chomsky's revolutionary proposals (combined with other insights from psycholinguistcs) showed that the majority view was false. For the subject under discussion it is not relevant what the majority of biolinguists believes but whether or not a Chomskyan biolinguistics rests on a coherent ontological foundation. Watumull has failed to show that it does.

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