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REVIEW ARTICLE

Recursion across domains. Ed. by LUIZ AMARAL, MARCUS MAIA, ANDREW NEVINS, and TOM ROEPER. Cambridge: Cambridge University Press, 2018. Pp. 404. ISBN 9781108418065. \$125 (Hb).¹

Reviewed by DANIEL L. EVERETT, *Bentley University*, and EDWARD GIBSON, *Massachusetts Institute of Technology*

1. INTRODUCTION. The purpose of this review article is to evaluate the research reported in *Recursion across domains* (henceforth *RAD*) in the context of wider issues that impinge upon it, especially the nature of grammar and its functions in human languages. *RAD* resulted from a conference organized by the editors and authors on the topic of recursion in cognition and language at the Federal University of Rio de Janeiro in August 2013. *RAD* assumes one particular approach to recursion in language, in which recursion is purported to be a genetically supplied feature of the syntax of human languages (Hauser, Chomsky, & Fitch 2002; henceforth HC&F).

The book consists of a foreword and an introductory chapter, followed by eighteen chapters organized in four sections. Four of the chapters across the sections discuss fieldwork or experiments investigating the Pirahã language, ten of the chapters discuss particular constructions involving embedding of various kinds in South American languages, and the remaining four chapters discuss the acquisition of recursive structures in other languages.

In what follows, we first review three perspectives on the nature and locus of recursion: the syntactic one that the authors of *RAD* assume (due to HC&F), and two precursors, which are not specifically syntactic: Peirce's (1865) semantic proposal, and a special case of Simon's (1962) proposal that hierarchy is the most economic way to organize information. Next, we examine the basic findings of the non-Pirahã chapters of *RAD* taken as a group, looking at the empirical lessons they contribute within the larger theoretical context. Section 4—the bulk of our review—discusses the four chapters about Pirahã. We focus on Pirahã because this is the language of most theoretical interest: it is unique among the languages that are investigated here in that it has been claimed to lack syntactic recursion.

2. DIFFERENT CONCEPTIONS OF RECURSION. *RAD* addresses theoretical and empirical aspects of recursion for the understanding of human languages. The book assumes Hauser, Chomsky, and Fitch's (2002) approach to recursion in language, where recursion is assumed to be a genetically supplied feature of the syntax of human languages. This view contrasts with two prominent precursors in linguistics and psychology, neither of which assumes that recursion is specific to the syntax of human language.

¹ [Editors' note] This issue of *Language* contains two review articles focusing on the volume *Recursion across domains*, ed. by Luiz Amaral, Marcus Maia, Andrew Nevins, and Tom Roeper. Since the topic of this volume (recursion) is one of central interest (and some controversy) in current linguistic theory, we thought it important to publish reviews from scholars who will bring differing perspectives to the topic. The authors of the two review articles worked independently; the reviews are each a response to the book and not to each other. We hope that these companion review articles will throw into sharp relief the most notable features of the volume. We recommend that readers approach these two review articles as a package, and we hope that publishing them together will contribute to a fruitful conversation about the issues raised in the volume and in the review articles. [Lauren Squires, Review Editor, and Andries W. Coetzee, Editor.]

In 1865, borrowing a term from the thirteenth-century Modistae, Charles Peirce reintroduced the phrase ‘universal grammar’ into linguistics and semiotics, arguing that the grammar of meaning required recursion for reasons of logic (Peirce 1982 [1865]). Peirce considered grammar to be a device for supporting the accurate interpretation of signs (icons, indexes, and symbols, as manifested in words, propositions, phrases, phonemes, photographs, semaphores, etc.). In Peirce’s version of universal grammar, recursion was a logical requirement on INTERPRETATION, not on grammatical structures. For example, a sign like *bachelor* is interpreted via other signs (e.g. *unmarried* and *man*), and this interpretative procedure produces a chain of interpretation of one sign in terms of another, of arbitrary depth. There can be no language without recursion in Peircean semiotics. But recursion in this Peircean sense is not the syntactic phenomenon intended by HC&F. Peirce does not predict that all languages will manifest evidence of SYNTACTIC recursion (e.g. coordination, morphosyntactic embedding, factive predicates, etc.; see Everett 2012 for a more complete list). For Peirce, neither nature nor nurture is the source of interpretative recursion. Peirce’s recursion is the sole consequence of logical constraint on semiotic interpretation (see also Everett 2019).

In a second influential work on recursion, Simon (1962) argued that hierarchy emerges from a constraint of efficiency of information processing across all domains, because hierarchical structures are inherently more efficient and stable than other ways of organizing a complex system. Hierarchy is found in atomic structure, in the organization of societies, in the way that we process information, in the organization of galaxies, in management, and in business production processes, among others. Moreover, this hierarchy is assumed to be a recursive process. Simon’s proposal applies to human languages, so that they are also predicted to be organized hierarchically and usually recursively. For both Peirce and Simon, recursion is a language-independent requirement on information and signs.

Despite the title of the book—*Recursion across domains*—*RAD* does not consider or even cite these influential approaches to recursion across domains. *RAD* considers only morphosyntactic recursion that is proposed to be rooted in biology. We raise the alternative notions of recursion not to advocate for them, but simply to point out that there are alternative perspectives on these important empirical matters. The omission of these other major proposals is arguably a weakness of *RAD*.

3. EXAMPLES OF RECURSION FROM AMAZONIAN LANGUAGES. The chapters in *RAD* on languages other than Pirahã offer potential contributions to the understanding of recursion that hold whatever theoretical framework one assumes. Field research is intellectually, psychologically, and physically demanding. It is fundamental to linguistics at many levels, providing the bulk of the data on which most of the field’s theoretical advances are based. Both authors of this review have conducted fieldwork in the Amazon region and appreciate and admire the efforts and determination of the authors of this book who have gone to remote places to gather data in an attempt to explore theoretical questions in often isolated and physically uncomfortable contexts.

A serious weakness with the chapters in this volume, however, is scholarship with respect to Amazonian languages. The editors fail to provide an overview of the grammars of Amazonian languages more generally (including relevant claims on recursion or lack thereof), leaving it to the reader to contextualize the claims of the book. Most surprising is the omission of any reference to the most famous of all Amazonian grammars, Derbyshire’s (1979) grammar of Hixkaryana (see also Derbyshire 1985), or to any of the languages studied in the four-volume *Handbook of Amazonian languages* (Derbyshire & Pullum 2010), a set of books of foundational importance for the study of

Amazonian languages. This handbook contains rich examples of syntax from a variety of Amazonian languages, with more detailed syntactic descriptions than in any of *RAD*'s chapters, in most cases based on more field research than the research underlying the chapters of *RAD*.

In spite of the lack of context, the current studies are welcome. Since Derbyshire's 1979 claim that Hixkaryána subordinate clauses are not tensed, it has been recognized that the syntaxes of Amazonian languages occasionally display typologically rare characteristics. Thus additional studies of Amazonian languages are always welcome, from empirical, typological, and theoretical perspectives. However, to review the descriptive contents of each chapter would require a significant detour from our more general theoretical concerns, as these emerge from the chapters on Pirahã. Therefore we only summarize some of the contents.

Chs. 4, 5, 7, 8, 9, 11, 12, 13, 17, and 18 focus on one or another type of embedding in languages other than Pirahã. Ch. 4 gives a flavor of the other chapters, to take one example. In this chapter (pp. 68–85), KRISTINE STENZEL looks at the embedding of evidentials in Kotiria, an Eastern Tukanoan language on the Brazil-Colombia border. Like other chapters, Stenzel's study is useful because it extends our knowledge of how embedding may impinge on grammatical and morphosemantic categories in a particular language. For Kotiria, Stenzel argues that evidentiality can require embedding and that the data thus expand the typological database of evidentiality crosslinguistically. Most interestingly, Stenzel shows how embedding is more closely associated with some types of evidentiality than others.

Other descriptive chapters include discussions of embedded imperatives in Mbyá, switch-reference in Kĩsêdjê, recursion in Tenetehára, recursion in Tupi-Guarani languages, and possessive recursion in Kawaiwete, among others. BRUNA FRANCHETTO's chapter on the interaction of recursion and prosody in Kuikuro stands out in particular for its coverage of a little-studied area of the intersection of prosody and syntax in marking embedded structures.

The chapters on language acquisition and embedded clauses in some industrialized cultures (Chs. 2, 3, 10, and 16) do not quite fit with the largely descriptive and Amazonian majority of the book, though these chapters are also useful for their data and thought-provoking discussions. A concern with these chapters is that—like the others—they fail to consider the possibility that linguistic recursion might derive not from biology, as is assumed here, but possibly from extralinguistic constraints, as the proposals by Peirce and Simon suggest (as discussed above).

4. RECURSION AND THE PIRAHÃ LANGUAGE. IAN ROBERTS's foreword (pp. xv–xx) suggests that one motive behind the conference was a desire to respond to Everett's (2005) controversial hypothesis that the Pirahã language has no recursive syntactic structures. For example:

The obvious inference to make from Hauser, Chomsky and Fitch's conclusions is that recursion is a property of all, and only, humans. Therefore, evidence of recursive structures of one kind or another should be available in all human languages; in fact, recursion, as part of FLN [narrow faculty of language], forms part of the definition of a possible human language. This view was directly challenged by Everett (2005), who argued that Pirahã, an indigenous language isolate spoken in Amazonas, Brazil, lacks evidence for what is often seen as the clearest form of syntactic recursion, namely sentential embedding. (xvi)

Roberts then underscores the importance of these issues:

On the simplest interpretation of what is at stake here, one could think that if such evidence [of recursion in all human languages] is not directly forthcoming, then it is right to conclude, as Everett and others ...

have, that the Chomskyan programme for linguistic theory is so fundamentally flawed that it must be abandoned. (xvii)

Several of the papers in this volume attempt to show that—contrary to Everett’s claim—Pirahã DOES have recursive syntactic structures.

The attention on Pirahã is due in large part to HC&F, who argued that the unique and defining component of human language that makes it more productive than animal communication systems is recursion. Unfortunately, HC&F did not define the term RECURSION; rather, they provided an example of SYNTACTIC/SENTENTIAL embedding, of arbitrary depth: ‘There is no longest sentence (any candidate sentence can be trumped by, for example, embedding it in “Mary thinks that ... ”), and there is no nonarbitrary upper bound to sentence length’ (HC&F, p. 1571; for discussion, see Langendoen 2010, Pullum & Scholz 2010, Futrell et al. 2016). HC&F also drew a parallel between language and the infinity of counting (p. 1577). Thus it seems that what HC&F meant by recursion was the possibility of SYNTACTIC embedding of arbitrary depth in a language (as opposed to semantic or discourse embeddings, for example).²

Everett (2005) argued that the Pirahã language provides a counterexample to the claim that all languages have arbitrary recursive syntactic structures. Formally, Everett hypothesized that Pirahã grammar contains no structures in which some constituent of category α has a proper subconstituent of category α . According to Everett’s observations and analysis, Pirahã appears to have no syntactic embedding (see Futrell et al. 2016 for a corpus-based evaluation of this idea; see Givón 1979 and Pullum & Scholz 2010 for some historical context showing that many languages have been claimed to have syntactic structure similar to that of Pirahã, without coordination or complex embedding, such as Proto-Uralic (Collinder 1960), Dyirbal (Dixon 1972), and Hixkaryana (Derbyshire 1979)). It is important to clarify here that Everett’s claim and HC&F’s original claim are about SYNTACTIC structures, not meanings. No one has ever claimed that Pirahã (or any language) lacks recursive MEANING structures. The Pirahã people are like all humans in constantly entertaining recursive meanings, such as believing, thinking, or talking about other mind states (as Peirce would claim). The relevant linguistic question here is whether Pirahã SYNTAX captures any of this structure directly.

Four chapters in *RAD* attempt to evaluate Everett’s claim that Pirahã lacks recursive syntactic structures. Before discussing the evaluations in these chapters, we first observe that while one of the authors of this review (Everett) may have a prior expectation that his hypothesis turns out to be correct, the other author (Gibson) has a prior expectation that Everett’s hypothesis is incorrect. In our recent paper (Futrell et al. 2016) we came to a mixed conclusion about whether Pirahã corpus evidence supports or does not support Everett’s no-syntactic-embedding hypothesis. We would each welcome rigorous evaluations of this hypothesis since we believe, like HC&F did, that there is much at stake in correctly characterizing universal features of human language.

Unfortunately, the chapters investigating Pirahã do not meet high scientific standards. Many of the problems we discuss below have common causes at their root. First,

² Nevins, Pesetsky, and Rodrigues (2009:366, n. 11) interpreted HC&F as having intended recursion to mean ‘Merge’ in Chomsky’s more recent syntactic framework (Chomsky 1995). This meaning of recursion is essentially compositionality outside of Chomsky’s framework (e.g. Frege 1892). All human languages are obviously compositional—with a lexicon, and ways to combine the words—so such a definition makes the claim about the nature of human language much weaker. Furthermore, the parallel with counting is much less clear under this interpretation of HC&F. In any case, there is in the current volume no mention of the earlier assumption by Nevins et al. of the Merge definition of recursion. Other responses to Everett’s (2005) work, such as Chomsky 2014, adopt the Merge-based view of the basis of universal grammar and seem to accept that some languages might not have arbitrarily embedded syntactic structures. But it is the unbounded-depth-of-embedding view that seems to be assumed in this volume.

no author of any of the papers on recursive structures in Pirahã is fluent in Pirahã. Second, the primary Pirahã consultant that these authors worked with is Jose Augusto Pirahã-Diarroi (known locally by his nickname ‘Verão’, drawn from his family’s working relationship with the Instituto Linguístico de Verão, Summer Institute of Linguistics). Although his father was Pirahã, Verão is not a native Pirahã speaker and is not fluent in the language. Verão was raised in an Apurinã village along the Maici River where he spoke only Portuguese. When he was approximately ten years old, his family moved from the Maici area. He returned to the Maici area after more than fifteen years as an employee of a Brazilian Indian agency, and he then began to learn the language. But he never achieved fluency, and his free translations are often inaccurate, unless they involve very simple events.³

Lack of knowledge of the language likely is what led the authors in this book to represent Pirahã with a mixed set of symbols that seems to be drawn partially from Portuguese, partially from English, and partially from Everett’s (1979, 1983) phonemic representation of the language. And remarkably, although Pirahã is a tone language—in fact, so much so that it can be whistled—the authors often do not represent tone phonemes. The transcriptions in this volume are also inconsistent regarding vowel qualities and omit many glottal stops (which are fully functioning consonants of the language).

In Ch. 1 (pp. 21–34), ULI SAUERLAND discusses an experiment he conducted on false speech reports in Pirahã, by which he attempts to provide experimental evidence regarding whether one aspect of Pirahã grammar is recursive. To do so, Sauerland recorded linguistic materials spoken by two Pirahã speakers. These materials were designed so that one person spoke about another person’s implausible statements. Speaker 1, who was named ‘Toe’, made some implausible statements, such as in 1. Speaker 2 then talked about speaker 1, in materials of the format of 2 (p. 26, ex. 12).⁴

³ For example, in a YouTube video made by Nevins and others (<https://www.youtube.com/watch?v=xEEAufXg8fc>), Nevins is interviewing Verão and a Pirahã man claimed to have the name Yapohen (his actual name is Hiahoái—there is no name ‘Yapohen’ in the language, because the Pirahã language lacks ‘y’, ‘e’, and syllable-final consonants). At 3:48 Nevins asks in Brazilian Portuguese (translations provided from the video): ‘And what did he (Everett) say would happen if you didn’t believe in God—in Tiso?’. Verão replies: ‘If we didn’t believe in God, God would ... [long pause] ... kill all the Pirahas’. Nevins then says to Verão ... ‘Ask Yapohen if this was frightening at the time’. Verão asks Hiahoái: ‘Tem medo?’, which is Portuguese for ‘Are you afraid?’. Hiahoái just smiles and utters ‘Eh’ (probably because he doesn’t speak Portuguese). So then Verão asks in Pirahã: ‘maiaagá?’ (the Pirahã word for ‘fear’), and Hiahoai repeats ‘maiaagá’. The interviewer then asks whether the Pirahãs think God is angry, and Verão asks in Pirahã: ‘Is your spouse angry?’ (kagí ʔaaópi?). (Here Verão shows his lack of knowledge of Pirahã by his wrong word choice.) Hiahoái simply repeats after him the Pirahã word for ‘angry’. Then Verão says, ‘He said that God was really fierce ... that if you are not a true believer, God would be very angry with you. And if God doesn’t like you, you could die. He could kill you.’ This is not a translation of what Hiahoái said. Verão simply does not speak Pirahã well enough to ask questions of this detail in the language. Although the authors of these chapters also interacted with a native Pirahã speaker, their access to this speaker was through Verão’s interpretations, instructions, and translations. See, for example, Sandalo et al.’s n. 1, p. 279.

We should add that much of what Verão says in this video is either incorrect because of his lack of fluency in the Pirahã language or incorrect because he was not present in the village for events he claims to know about. For example, Verão comments negatively on Everett’s missionary activity, though he was never at any time of his life present in a village where Everett lived. Moreover, Everett stopped missionary activity in 1988, when he accepted a position at the University of Pittsburgh. Verão left the Maici River area with his family as a young boy, about 1980, and did not return until about 2000. He simply never observed the events he claims to have seen and he has never spoken the language well enough to understand Pirahã discussions, so what he is saying is unlikely even based on hearsay.

⁴ We thank Sauerland for including his materials and raw data directly in the book, which make our evaluation possible.

- (1) Spoken by speaker 1 (Toe):
 ce kahápe ogéhiái igeuo
 I have.been stars there
 (This should be: Ti kahápií ?ogihíai ?igí-o)
 I go star alongside-LOC
 ‘I have been to the stars.’
- (2) Spoken by speaker 2:
 Toi he gáí-sai ce kahápe ogéhiái igeuo
 Toe 3SG say 1SG have.been stars there
 (Should be: Tooí hi gáí-sai. Ti kahápií ?ogihíai ?igí-o)
 name he spoke I go star alongside-LOC
 a. coordinate interpretation: ‘Toe talked and I have been to the stars.’
 b. subordinate interpretation: ‘Toe said “I have been to the stars.”’

Sauerland hypothesized that there are two interpretations of the sequence of words in 2: the coordinate interpretation in 2a and the subordinate interpretation in 2b. Sauerland further hypothesized that the subordinate interpretation requires syntactic recursion in order to be interpretable as such, whereas the coordinate interpretation does not require syntactic recursion.

Sauerland constructed ten items like 1 and 2, and a further ten control items like 3 and 4, where speaker 2 misreports what speaker 1 says (p. 27, ex. 13).

- (3) Spoken by speaker 1 (Toe):
 ce kahápe kahe’ái igeuo
 I have.been moon there
 (Should be: Ti kahápií kahai?áií ?igí-o)
 I go moon alongside-LOC
 ‘I have been to the moon.’
- (4) Spoken by speaker 2:
 Toi hi gáí-sai ce kahápehai heesé igeuo
 Toe 2SG say 1SG have.been sun there
 (Should be: Tooí hi gáí-sai. Ti kahápiháí hisí ?igí-o)
 Tooí he spoke I will.go sun alongside-LOC
 a. coordinate interpretation: ‘Toe talked and I have been to the sun.’
 b. subordinate interpretation: ‘Toe said “I have been to the sun.”’

Critically, both interpretations of 4 are false. Sauerland then had sixteen Pirahã speakers take part in his survey. In this survey, participants were asked to decide whether each of the twenty items was correctly understood by speaker 2. This was accomplished by asking them, ‘Did speaker B hear well?’. Participants were trained on both versions of one practice item: they were told that they should say ‘no’ to the control item (like 4), and they should say ‘yes’ to the target item (like 2). They were then tested on the remaining eighteen items (nine targets, nine controls). Sauerland reports above-chance behavior on the target items and concludes that Pirahã contains true syntactic embedding.

There are several problems with the research reported in this chapter. Most importantly, Sauerland confuses a potential embedded INTERPRETATION with a need for SYNTACTIC EMBEDDING to obtain that interpretation. In particular, there is no reason to assume that interpreting 2 as ‘Toe said “I have been to the stars”’ requires any syntactic recursion. As many others have noted in the discussion of recursion (including many authors in this very volume), sets of nonembedded syntactic materials can easily give rise to an embedded semantic interpretation, especially if such an interpretation is con-

textually supported. For example, in Ch. 2, BART HOLLEBRANDSE makes exactly this point about English examples like 5 (ex. 7a, p. 37).

(5) Malcolm is guilty. The jury thinks that. The judge knows that.

An available interpretation of 5 is that the judge knows that the jury knows that Malcolm is guilty, in spite of the fact that there is no syntactic embedding in this example. Similarly for 2, given a context in which someone has just said ‘I have been to the stars’, if a second speaker says ‘Speaker 1 said something. I have been to the stars’, most listeners will agree that the meaning of this in the context is that speaker 1 said that he has been to the stars, even though there was no syntactic embedding in the original statement.

Indeed, this alternative possibility to Sauerland’s assumed reading is testable, so we tested it. We ran the relevant control experiment in English, with twenty participants from Amazon’s Mechanical Turk. In creating our experimental items (given in the appendix to this review), we started with the written versions of all ten of Sauerland’s items (as presented in the appendix in his paper), and we used the instructions that Sauerland provided (‘Did speaker B hear well?’). Example target and control items are given in 6 and 7.

(6) Example target item

John: ‘I have been to the stars.’

Bill: John said something. I have been to the stars.

(7) Example control item

John: ‘I have been to the moon.’

Bill: John said something. I have been to the sun.

Note that there is no syntactic embedding in the written form of what Bill says in each discourse: there is no quotation or embedded sentence. The embedded meaning would have to be inferred, because it is not present in the syntax. Our English participants agreed with the target sentence on 99% of the trials, demonstrating that they obtained the embedded interpretation in spite of the lack of embedded syntax. Furthermore, they disagreed with the control (as desired) on 98% of the trials. All materials and results are available at <https://osf.io/z86k2/>.

Sauerland should have first done this experiment in a control language (such as English or German) that has syntactic constructions which mark embedding of meaning. He would need to compare the interpretation of two constructions: one that syntactically marks embedding, and one that does not. If there was a difference between how these constructions are interpreted—such that people make more embedded inferences in the case of syntactic embedding—then he could have compared Pirahã to these two. If the Pirahã case ended up being interpreted like the syntactically embedded control construction, then it might be possible to infer that the Pirahã construction is also syntactically embedded. But it turns out that the control English materials—which are NOT syntactically embedded—are always interpreted with the embedded meaning. Consequently these materials are not viable for use in a search for syntactic embedding in Pirahã.

Beyond the logic of the design, there are other problems with the research reported in Sauerland’s paper. First, many participants were at chance or worse on the control materials, suggesting problems understanding the task (a feature that is common to fieldwork and difficult to avoid without superb translators and cultural experts). Only eight of the eighteen participants got seven or more of the nine control trials correct (the others averaged 24% of the control items correct). For those eight participants, the mean correct response rate was only 51% (37/72 trials). These data do not support Sauerland’s claim.

In fact, the statistics that Sauerland reports are erroneous. He reports that ninety-three of the 144 experimental trials were answered correctly, which he states is greater than chance. But this analysis includes four participants who got ZERO OR ONE of the nine control examples correct. These participants clearly misunderstood the task. When these participants' data are removed, then only fifty-nine of the remaining 108 experimental trials were answered correctly (54.6%), which is not reliably different from chance.

These methodological, logical, and statistical flaws prevent Sauerland's paper from establishing what it claims to.

In Ch. 6 (pp. 111–26), CILENE RODRIGUES, RAIANE SALLES, and FILOMENA SANDALO attempt to show from the phenomenon of heavy-NP shift that Pirahã has recursive syntax. They argue that their observations about heavy-NP shift require an embedding analysis, not merely juxtaposition as Everett (2005, 2012) suggested. But Rodrigues et al. have missed some crucial issues with the materials that they use, which undermine their interpretation. As discussed below, the examples they present are compatible with a nonrecursive analysis, as suggested by Everett (2005).

For example, on p. 117, Rodrigues et al. claim that Pirahã has obligatory control between two clauses. But a crucial question that must be answered before concluding that their examples show clausal embedding is whether Pirahã zero-anaphora involves intrasentential control including syntactic embedding (which Rodrigues et al. want to show) or, more simply, a form of discourse topic-tracking, along the lines of Everett 1983 and Givón 1983, which would be between two separate sentences. Consider their example 13 (p. 117), presented as our 8. We represent it here with more morphological and phonological detail (adding appropriate glottal stops, tone, and vowel length).

- (8) ti ʔóog-abagaí kapiiga kaga kaí.
 1.ABS want-frustrated.initiation paper mark do
 'I want to study.' (their translation)
 'I want to do paper marks.' (free translation)
 'I almost begin to desire (something). (I) mark paper.'

It is crucial for their argument that the subject of 'mark paper' be covert. If this subject were overt, then there would be no control. But examples like 9 and 10, with overt subjects in the second clause (Everett 1983, 2016) (and which demonstrate the repetitive style favored by the Pirahãs), are also perfectly acceptable in Pirahã.

- (9) ti ʔóog-abagaí tíi kapiiga kaga kaí.
 1.ABS want-frustrated.initiation 1.ERG paper mark do
 'I want (something). I mark paper.'
- (10) Kóʔoí kapiiga ʔóog-abagaí Kóʔoí kapiiga kaga kaí.
 name paper want-frustrated.initiation name paper mark do
 'Kóʔoí wants (something). Kóʔoí marks paper.'

Thus, these materials are not evidence relevant to control. These are also not embedded sentences, because if they were, then the second (purportedly embedded) subject would be coreferent with the first, producing a binding violation (for the same reason that it is odd to say *John thinks that John is nice* in English, where the two instances of *John* refer to the same person). Thus, it seems that the clauses in each of these examples are juxtaposed sentences rather than embedded (see Everett 2012 for additional arguments against embedding and recursion in Pirahã).

Rodrigues et al. also investigate examples purported to demonstrate 'movement' in Pirahã. On p. 117 they claim that '[c]rucially for the present discussion, the SVO order in (13) [our 8] can alternate with an SOV order'. They provide the following example (we supply additional morphological and phonological information, as above).

- (11) *tii kapiiga kaga kai. (ti) ?ooog-abagai.*
 1.ERG paper mark do (1.ABS) want-frustrated.initiation
 ‘I want to study.’ (their translation)
 ‘I mark paper. (I) almost begin to want (that, i.e. to mark paper).’

However, what the authors claim to be a word-order alternation in a single sentence is in fact two sentences, which can be seen when the discourse context is shifted and instances of zero-anaphora are replaced by overt NPs or pronouns, as shown in several examples above. There is no obligatory control here. As Givón (1983) argues with respect to intersentential reference, pronouns are either overt or not dependent on discourse topic-tracking. If these are single sentences with obligatory control, the possible presence of pronouns or full NPs in the same positions as null subjects is difficult to account for.

The flaws in these examples are characteristic of Rodrigues et al.’s materials elsewhere. None of the materials unambiguously show syntactic embedding when properly examined. To make their points, the authors would need to demonstrate a biclausal, single-sentence relationship between the two predicates in examples like 8 and 10, such as NEG-raising between the clauses, reflexive pronominal binding, or some other known intrasentential relationship. The authors try to demonstrate this via control phenomena, but since the coreferential subjects of the two predicates can both be overt, control is not applicable.

In Ch. 14 (pp. 267–78), TOM ROEPER and YOHEI OSEKI attempt to work out a complexity hierarchy of different kinds of syntactic embedding/recursion: direct unstructured recursion, direct structured recursion, and indirect recursion. They hypothesize that syntactically embedded structures that are more complex are acquired later. Though this is an interesting general idea and the authors do provide some illustrative examples of what they have in mind, the specifics of how formal complexity is defined are missing, and there are no quantitative acquisition data to support the claimed hierarchy.

In the latter part of their chapter, Roeper and Oseki discuss Pirahã. It is crucial to their analysis that the sequence of prepositional phrases they discuss in this section be embedded. But it turns out that there is no strong evidence that these prepositional phrases are embedded, so these examples are probably not instances of syntactic recursion in Pirahã. For example, on p. 276 (ex. 30), they provide the following example and gloss (adapted from Sandalo et al. in this volume; see below for more about this example and errors in the transcription and translation).

- (12) *tabo apo tiapapati apo kapiiga apo gigohoi*
 board on chair on paper on coin
 ‘the coin on the paper on the chair’

This example is probably not a single phrase. It is a typical Pirahã construction discussed in Everett 1983 involving clarifying or parenthetical remarks, along the lines of McCawley 1982 for English and other languages. Even in English, where one can get syntactically embedded prepositional phrases (PPs), many examples of PPs need not be syntactically embedded, as in the following.

- (13) Speaker A: Where’d you put my money?
 Speaker B: In the house. In the kitchen. On the chair.

As Everett (1983) has argued, analogous Pirahã examples are plausibly multiple-clause utterances: clarifications. Imputing recursion to these Pirahã examples would be similar to imputing recursion to the English example in 13.

If the Pirahã postpositional phrases (PostPs) are in fact syntactically dependent on one another within the same sentence, then it should be possible to construct a grammatical sentence with the PostP phrases between a syntactic head and dependent, as in

the English example *It is in the house in the kitchen on the chair that Dan found the keys*. Here, the prepositional phrases *in the house in the kitchen on the chair* are between the verb *is* and the complementizer *that*, demonstrating that these PPs can be part of one sentence. In order to show that the Pirahã PostPs are also part of one sentence, some construction like this should also be possible in Pirahã, but none exists, to our knowledge. And for such examples (if they exist), the authors would also have to provide independent evidence that the PostPs are not clarifying parentheticals, following McCawley (1982).

Rather than showing recursion, these examples are consistent with the hypothesis that, in the course of the elicitation, the Pirahã subject was simply giving a separate phrase to describe each action he witnessed the linguists perform, in the order in which they did it or as close as he could recall.

Another chapter dedicated to an attempt to demonstrate that Pirahã has recursive syntax is Ch. 15 (pp. 279–95), by Sandalo, Rodrigues, Roeper, LUIZ AMARAL, MARCUS MAIA, and GLAUBER ROMLING DA SILVA. In this chapter, the authors attempt to show that Pirahã has syntactically embedded PostPs. But, like Roeper and Oseki, they simply assume that a series of appositional PostPs form a single embedded PostP, with no independent evidence that this is the case. Therefore, their analysis fails for the same reason as the Roeper and Oseki analysis discussed above. For example, their first Pirahã example (p. 286, ex. 16) is in 14.⁵

- (14) gata hio apo hoai
 can inward match box
 ‘The match box is in the can.’

This is an incomplete transcription and translation of this Pirahã example utterance. The correct transcription and translation of this example are in 15.

- (15) gáta hi -ó. ?apo -ó. Hoái -ii.
 can it -LOC head -LOC fire -thing
 ‘In the can. On the top. The fire-thing.’

This example can indeed be used to express the semantic idea ‘The match (box) is in the can’. But that is not literally what it says. It is structured as three distinct phrases, each one clarifying the one that precedes it. As discussed for similar examples above, in order to make a case that this is PostP embedding, the authors would have to show that the PostP can intervene between the subject and the object of a clause, so that the PostP is not part of a preceding or following clause. But no such examples are reported here. And again, even if they found such examples, the authors would also have to demonstrate that the PostPs are not clarifying parentheticals (Everett 1983, following McCawley 1982).

Similar problems are found in the other examples in this chapter. For example, consider again the following example, discussed above with reference to Roeper and Oseki’s chapter (Sandalo et al.’s ex. 30, p. 294).

- (16) tabo apo tiapapati apo kapiiga apo gigohoi
 board on chair on paper on coin
 ‘the coin on the paper on the chair on the board’

⁵ Sandalo et al. used a method of elicitation of ‘acting out’ what they were after to the Pirahã consultant. They describe this on p. 293: ‘we started with lexical elicitations ... Then we executed actions of putting coins in/on different objects present in the scene. This procedure allowed us to elicit target sentences’.

There is something wrong with either the transcription or the translation of this utterance. The word *tiapapati* is translated as a noun, but this is the verbal (imperative) form. So perhaps the researchers mistranscribed what was said—maybe the nominal form *tiapa-p* ‘butt thing = chair’ was spoken without the imperative suffix, *-áti*, and the researchers added this suffix in error in the transcription, but not the translation. Or maybe the imperative form was spoken, and it was mistakenly omitted from the translation. Assuming that the imperative suffix was spoken by the Pirahã speaker, a more accurate transcription and translation of this example is as follows.

- (17) tábo ʔapo -ó tiapa -p -aáti ʔap -ó. (Portuguese: *tabua*)
 board head -LOC butt -inalienable.possession -IMP head-LOC
 kapiiga ʔapo -ó giigo -hoi. (Portuguese: *dinheiro*)
 paper head -LOC money -foreign.item
 ‘Put your butt on the board. At the top. On the paper. The money.’

These phrases together mean: ‘On the board. On the butt-thing. On the paper. The money’. It appears that the speaker is supplying a series of clarifying statements. But there is no evidence of syntactic embedding here.

5. CONCLUSIONS. This book starts with an ambitious premise: to examine concepts of recursion across languages and in different cognitive domains. But in spite of the title, the editors and authors have not actually considered broader views of how recursion may apply across domains. And although this book has a lot of potentially useful information about a variety of understudied languages—for example, Kotiria, Guarani, Kuikuro, Kawaiwete, Karitiana, and others—the editors and authors do not situate their work within the broader realm of research on Amazonian languages (e.g. Derbyshire & Pullum 2010). Finally, the Pirahã chapters of the book fail in their goal of providing evidence that this language has recursive syntactic structures. A potential source for the lack of convincing methods and evidence with respect to Pirahã is that at least some of the editors may have already viewed the existence of recursion in Pirahã as a foregone conclusion. One editor, for instance, has previously received an NSF grant that includes teaching the public that ‘[a]ll languages have the basic form of recursion’,⁶ dismissing even the possibility that a language might lack syntactic recursion as an open scientific question. Perhaps as a result, it is hard to find hallmarks of scientific impartiality in both the selection of and the quality of the work on Pirahã. Whatever the cause, it is clear that the editors and authors have not taken a sufficiently critical eye to the Pirahã chapters in this book.

APPENDIX: EXPERIMENTAL INSTRUCTIONS AND MATERIALS FOR ENGLISH VERSION OF SAUERLAND’S EXPERIMENT

INSTRUCTIONS: You are provided with twenty scenarios in which John says something, and Bill says something after listening to what John said.
 Please answer whether Bill heard well.

SAMPLE DIALOGUE AND QUESTION:

John: ‘I have been to the stars.’

Bill: John said something. I have been to the stars.

Did Bill hear well?

Yes o No o

⁶ National Science Foundation, BCS-1523459, ‘Science Live!’ Workshop on the Acquisition of Recursion across Languages, Holland – July 2015; https://www.nsf.gov/awardsearch/showAward?AWD_ID=1523459.

MATERIALS

1. target
John: 'I have been to the stars.'
Bill: John said something. I have been to the stars.
1. control
John: 'I have been to the moon.'
Bill: John said something. I have been to the sun.
2. target
John: 'I have an airplane.'
Bill: John said something. I have an airplane.
2. control
John: 'I have a car.'
Bill: John said something. I have a bike.
3. target
John: 'I live in New York.'
Bill: John said something. I live in New York.
3. control
John: 'I live in Los Angeles.'
Bill: John said something. I live in Chicago.
4. target
John: 'I planted coffee.'
Bill: John said something. I planted coffee.
4. control
John: 'I planted rice.'
Bill: John said something. I planted corn.
5. target
John: 'I brought a refrigerator.'
Bill: John said something. I brought a refrigerator.
5. control
John: 'I brought a computer.'
Bill: John said something. I brought a generator.
6. target
John: 'I will kill a monkey now.'
Bill: John said something. I will kill a monkey now.
6. control
John: 'I will kill a jaguar now.'
Bill: John said something. I will kill a paca now.
7. target
John: 'I eat stone.'
Bill: John said something. I eat stone.
7. control
John: 'I eat soil.'
Bill: John said something. I eat wood.
8. target
John: 'I have many mouths.'
Bill: John said something. I have many mouths.
8. control
John: 'I have many heads.'
Bill: John said something. I have many noses.
9. target
John: 'I have a white tongue.'
Bill: John said something. I have a white tongue.
9. control
John: 'I have white hair.'
Bill: John said something. I have white skin.
10. target
John: 'I sleep in a pot.'
Bill: John said something. I sleep in a pot.

10. control
 John: 'I sleep in a boat.'
 Bill: John said something. I sleep in a tree.

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