You drink. You drive. You go to jail. Where's recursion?[i]

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1. Introduction

1.1. What is recursion?

There are different formalizations of recursion around, but the two that seem most appropriate to considerations of its relevance to human language are (1) and (2):

(1)   Recursion A: *Recursion is an operation that applies to its own output.*

(2)   Recursion B: For any grammar recursion is the property that in principle a machine could determine in finite time, for any arbitrary finite string over the right alphabet, whether the string is in the language or not.

For this discussion, I assume definition (1).

With that important book-keeping matter out of the way, let's turn to some background issues for the discussion of recursion.

1.2. Background considerations

My conclusion is revealed in my title. The recursive interpretation of the first three clauses is imposed on them by the mind, not the grammar. Recursion is a property of general intelligence occasionally found in grammar.

Having provided this spoiler, let's move on to why recursion is worth talking about. Most importantly it has been an important topic in one form or another for most of the history of language studies. The reason for its long-lasting interest is simple: many structures in most human languages can be nested or embedded into other structures. People who study languages have to be able to analyze this and know what its implications are for understanding grammar.

With Chomsky's work over the decades, recursion moved closer towards the center of linguistics. In the 50s and 60s, Chomsky's publications, e.g. *Syntactic Structures* and *Aspects of the Theory of Syntax*, as well as his mathematical-linguistics findings later known as the 'Chomsky hierarchy of grammars' have been of fundamental importance in this 'centering' of recursion.

Kenneth Hale later made important empirical comments about recursion, unfortunately buried at times in obscure, hard to locate publications, on evidence that recursion manifested itself differently, and perhaps not at all, in the grammars of certain languages, especially Hale 1976 and Hale 1983. One of Hale's points was this: not all grammars manifest recursion as dominant theories predict. More research is needed to better understand how and whether recursion is manifested in grammars cross-linguistically.

In recent years recursion has come to the forefront of linguistic research as a result of the proposals and debates surrounding Hauser, Chomsky, and Fitch (2002; HC&F) and Everett (2005).

To me one of the most obvious lacunae in the discussions of recursion as presented in the HC&F paper, aside from its global lack of definitions and precision, is omission of any discussion of the *locus of recursion*. I think that every researcher is agreed that human cognition crucially relies on recursion in one

way or another. But there is little discussion on where it is found. There are at least three possibilities: (i) recursion is built into the grammars of human languages and from there exploited by other cognitive domains; (ii) recursion is located in general human intelligence and from there manifested in specific human activities, e.g. language and vision; (iii) recursion is found independently in distinct cognitive modules, e.g. a recursion in grammar, a recursion in vision, etc. In the absence of strong evidence to the contrary, I will assume that the third possibility, modular recursion, is unnecessarily complex and so I won't discuss it further.

Because of my and others' strong interest in the puzzle of recursion, I organized the first international conference on Recursion in Human Language at Illinois State University in April 2007 (see van der Hulst (2010) for papers presented at that conference) in order to learn more about what a different scholarly traditions - mathematics, computer science, linguistics, and psychology - thought of recursion.[ii] How did these disciplines define recursion? What importance did they attribute to it in human language relative to computer science, etc.? The responses were quite diverse, as expected from an eclectic conference. The conference at the University of Massachusetts that led to the current volume focused more (though not exclusively) on more uniform approaches to recursion.

Thus most papers in the current volume focus on the Minimalist-internal subtype of recursion known as Merge (see below for more discussion of the relationship between Merge and recursion), an operation central to the Minimalist Program. But this seems inadequate to me if we are after an understanding a role of recursion generally in human cognition and language. So to state my thesis: *recursion is a general property of human cognition which can be exploited in linguistic structures but need not be.*

For example, humans can think thoughts about people thinking certain thoughts, or about people believing that other people are thinking certain thoughts, etc. They must be able to do this to function socially, it seems to me. But although this is necessary for recursion in language, it is not sufficient for it - not all languages need it in their grammars. Another crucial point I will come back to several times in this paper is that recursion in language is likely universal, but not recursion in grammar. That is, there are recursive discourses in the absence of recursive sentences.

I will argue as well that, apart from the data on Pirahã that I discuss, the assumptions of minimalism that all languages have recursion via Merge leads to some nontrivial difficulties for that theory.

1.3. Where's recursion?

As just mentioned, there are three possible sources for recursion in the brain:
(3) Recursion originates in cognition and from there it may perhaps be manifested in grammar.
(4) Recursion originates in grammar and it is manifested in nonlinguistic cognitive activities only parasitically on the linguistic phenomenon.
(5) There are separate recursions for each cognitive module.

Possibility (4) predicts that all grammars have recursion. Possibility (3) would be supported if there were languages that lacked recursion in their syntax

but manifested it in discourse -- in the way speakers organize, present, and discuss information. It isn't clear to me that there is any evidence for (5), at least at this time. Various researchers have suggested, based on field research in several languages, that there may be grammars that lack recursion. If correct, this would count against (3) and (4) and in favor of (3).

I want to know about the where the source of recursion is because I am interested in knowing how specific the biological endowment for language is. I believe that biology is obviously relevant for studies of all human abilities, including language. But I agree with the formulation of the research question by Adele Goldberg:

"The question is not whether anything at all is specific to human beings and/or hard wired into the brain, but whether there exist rules that are specific to human language and not a result of our general conceptual/perceptual apparatus together with our experience of the world." (Goldberg 2009:117).

Recursion is found all around us in nature. Hold up one mirror in front of another at the right angle and the image of the one will reflect back and forth from one to the other in an infinite visual regress. Or pluck your electric guitar and lean it with its pickup towards the speaker against your amp and you will get a loud squeal as the guitar pickups amplify their own output from the amp and send it back to the amp in an infinite aural loop. Recursion is also seen in the growth patterns of minerals and plants (such as the horsetail and fern).

These are just a couple of examples in nature. Another can be found in a simple child's toy, as the image in Figure One:

Figure One: Nesting Recursion in a Matrushka Doll

      Nonhumans are also exposed to recursion and some even appear to exemplify it in their own behavior. For example, consider a deer going from the forest to a lake to drink (this example was originally suggested to me by Bob Futrelle). The deer starts towards the water, but takes a loop off of its path to lick some salt it senses along the way. After the salt, it takes yet another loop to eat some berries. Subsequently it takes up its original path to the river. One could describe the main path, its secondary loop and then its tertiary loop, as recursive path-following on the part of the deer, as one path is embedded in another.

      The property of recursion is also important to information processing. Herbert Simon, in his 1962 article, "The architecture of complexity", provides the following example from two hypothetical watchmakers:

      There once was [sic] *two watchmakers, named Hora and Tempus, who manufactured very fine watches. Both of them were highly regarded, and the phones in their workshops rang frequently. New customers were constantly calling them. However, Hora prospered while Tempus became poorer and poorer and finally lost his shop. What was the reason?*

      The watches the men made consisted of about 1000 parts each. Tempus had so constructed his that if he had one partially assembled and had to put it down-- to answer the phone, say--it immediately fell to pieces and had to be reassembled from the elements. The better the customers liked his watches the more they phoned him and the more difficult it became for him to find enough uninterrupted time to finish a watch,

The watches Hora handled were no less complex than those of Tempus, but he had designed them so that he could put together sub-assemblies of about ten elements each. Ten of these subassemblies, again, could be put together into a larger subassembly and a system of ten of the latter constituted the whole watch. Hence, when Hora had to put down a partly assembled watch in order to answer the phone, he lost only a small part of his work, and he assembled his watches in only a fraction of the man-hours it took Tempus.

This watchmaking example has nothing to do with syntax. Therefore it shows us that human reasoning is recursive independently of grammar (Hora's watches are built by completing one component and placing it inside another component - a recursive operation). In fact we know that many things in the world apart from humans are recursive (even atoms manifest recursive-like hierarchies in their construction from subatomic particles). So I don't think recursion is specific to grammar. The question that emerges as most interesting is the location of recursion in human minds. My paper proposes a locus for recursion in general human cognition and further argues that its significance in grammars has been overstated.

The paper is organized as follows. First, I discuss in more detail the relationship between recursion and Merge, pointing out different potential misconceptions of the relationship between Merge and recursion that seem to have sprung from a common (and perhaps correct) exegesis of HC&F. Second, I recapitulate evidence that Pirahã lacks recursion in the sense of (4). I show how evidence from English and Pirahã argues against some influential proposals on the connection between recursion in grammar and the recognition of false beliefs. This leads to the conclusion that Quine was correct in one sense about the incommensurability of translation. The paper concludes with a summary of the major issues and lessons raised regarding recursion, cognition, and grammar.

2. Recursion, Merge, and the Narrow Faculty of Language (FLN)

As I have stated, many of the papers in this volume equate recursion and Merge or at least pay relatively little attention to the distinction. That is a mistake. But it is an understandable one because of the widespread interpretation of HC&F expressed below in a quote from Nevins, Pesetsky, and Rodrigues (2009; NP&R), replying to earlier work of mine:

(6)   *"Hauser, Chomsky, and Fitch (2002, HC&F) presupposed, rightly or wrongly, an approach to syntactic structure in which all phrase structure—not just clausal embedding or possessor recursion—serves as a demonstration of recursion. We had this in mind when we noted in NP&R that if Pirahã really were a language whose fundamental rule is a nonrecursive variant of Merge, no sentence in Pirahã could contain more than two words."* Nevins, et. al. (2009: 679)

The first part of the quoted paragraph seems unsupported by an examination of HC&F, as we see below. The second sentence of the paragraph is non-empirical. Such an interpretation says only this: 'The theory we believe in cannot work unless three words in a row is recursion, so three words in a row must be recursion.' This is an untestable claim. Moreover, if it turned out to be true, then I don't believe that anyone would have thought that HC&F proposals were worth publishing or worth responding to. For example, if HC&F had said

merely that 'The narrow faculty of language consists in the fact that humans can put more than two words in a row', then any number of researchers on language abilities in non-humans could point out that under this version of recursion, humans are not the only ones with a 'narrow faculty of language'.

NP&R's interpretation also underscores a serious problem for Chomskyan theory. This problem was pointed out in Everett (2009,439ff), when I said that Universal Grammar (UG) has two versions, a nonempirical, tautological version that is little more than a *façon de parler* about the human brain - this version just says that humans have language because they have human biology (and under this view, UG is just whatever it is about human biology that makes language possible - as Goldberg puts it above, all linguists believe this. But this is unfalsifiable - unless we find talking crickets or some such). But there could be other, empirical versions that could in principle be falsified. One such hypothesis is the HC&F proposal of the Narrow Faculty of Language (FLN). Although I believe that the proposal of the FLN has been falsified by languages such as Pirahã, it is laudable in that it at least could be tested.

This is why I don't think it is an exaggeration to say that the trail leading from the general claim about recursion in HC&F to the content-bleached notion of Merge urged upon us by NP&R leads Minimalism to an intellectual cul de sac. If 'at least three words in a phrase' is all that HC&F intended, then they haven't made much of a claim at all.

Moreover, if phrase structure or Merge were what HC&F intended, then they were non-perspicuous. To see this, let's consider a few of the relevant quotes from HC&F, which I number for convenience (all emphasis, boldface, is mine). It is worth spending some time on HC&F's proposals since they have led to two international conferences and dozens of publications on the subject of recursion, while their actual proposals have undergone surprisingly little scrutiny.

(7)   *"We assume, putting aside the precise mechanisms, that a key component of FLN is a computational system (narrow syntax)* **that generates internal representations** *and maps them into the sensory-motor interface by the phonological system, and into the conceptual-intentional interface by the (formal) semantic system...* **All approaches** *agree that a core property of FLN is recursion, attributed to narrow syntax in the conception just outlined. FLN takes a finite set of elements and* **yields a potentially infinite array of discrete expressions.** *This capacity of FLN yields discrete infinity (a property that also characterizes the natural numbers). Each of these discrete expressions is then passed to the sensory-motor and conceptual-intentional systems, which process and elaborate this information in the use of language." (HC&F 2002:1571)*

There is nothing in this quote that mentions phrase structure. It may be that the 'internal representations' HC&F have in mind are phrase structures. But they do not say this explicitly, so they could be most anything, from neuron firings, to pictures that stand for meanings. Moreover, to take a random example, Richard Hudson's (2007) *Word Grammar*, shows us that it is false to say that 'all approaches agree' if by that we mean that all approaches posit phrase structure, since Word Grammar, a popular and cogent theory of grammar, does not. In fact, in Everett (2010a) I suggest that Pirahã might indeed lack phrase structure altogether, though nothing crucial hangs on this for now.

Let's turn to another quote on the topic of recursion in HC&F. In this quote, HC&F perpetuate a myth about the need to capture the discreteness of language in the grammar:

(8)   *"The core property of discrete infinity is intuitively familiar to every language user. Sentences are built up of discrete units: There are 6-word sentences and 7-word sentences, but **no 6.5-word sentences. 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. In these respects, language is directly analogous to the natural numbers..."* (HC&F 2002:1571)

But the 'discrete' part of 'discrete infinity' is a red herring. The fact that there are no half words just follows from what it means to be a word, phonologically and grammatically, in conjunction with what it means to express a concept. There are no half concepts, so there are no half words. Thus there is no need to make discreteness either an explanandum or explanans of the computational system.

As for infinity, on the other hand, this is indeed a relevant part of the nature of human languages that the computational system should tackle. But it is far from clear *where* infinity should be computed. Should we focus on sentences, as Chomskyan theory has done since its inception (using 'S' as the grammar's start symbol, for example) or should we focus on discourse - coherent and cohesive (Halliday and Hasan (1976); Wolf and Gibson (2006)) *combinations of sentences*? To put it another way, is the creativity and infinity of language located in discourse construction or phrase structure? And how could we answer this question? One thing is clear from the outset though - such questions are not answerable in the Minimalist Program (or indeed any version of generative theory) because they lie outside its 'solution space'. As examples like (17) below demonstrate, Pirahã sentences do appear to have a finite boundary beyond which no words can be added (though a finite sentence can still be a very long sentence!). This is not true of Pirahã discourse, however.

Before looking at Pirahã, though, let's continue with our discussion of recursion in HC&F. Consider the following:

(9)   *"This is made clear by the observation that, although many aspects of FLB are shared with other vertebrates, **the core recursive aspect of FLN currently appears to lack any analog in animal communication** and possibly other domains as well."* (HC&F 2002:1571)

Once again, this depends on one's definition of recursion.[iii] As I mention in Everett (2008), it is well-known that iteration is a form of recursion (tail recursion). Many animal communication systems involve iteration (just remember the last time you said "I wish that dog would shut up!" - you were referring to the iteration of its barking). If HC&F meant to refer to applications of recursion that produce long-distance dependencies or phrase structure, etc., then they might be correct. But, again, they were unclear. If that's what they meant they should have said so.

(10)   *"In fact, we propose in this hypothesis that **FLN comprises only the core computational mechanisms of recursion** as **they** appear in narrow syntax and the mappings to the interfaces. If FLN is indeed this restricted, this hypothesis has the interesting effect of nullifying the argument from design, and thus rendering the status of FLN as an adaptation open to question. Proponents of the idea that FLN is an adaptation would thus need to supply additional data or arguments to support this viewpoint."* (HC&F 2002:1573)

HC&F have just taken us from *recursion* a singular noun, to 'core computational mechanism**s** of recursion', a plurality. These 'mechanisms' are more than any single, general notion of recursion, apparently. So HC&F here admit that FLN is more than simply recursion. But they don't explain what this 'more' consists of. Perhaps they meant MP-type syntactic structures? Or the 'interfaces'? Who knows. Because they are unclear, there is nothing in this quote to support NP&R's claims that HC&F meant 'phrase structure' or Merge when they wrote 'recursion'. It is further important to emphasize that even the assumption that recursion refers to structures that are found in all human languages (in what the MP calls 'narrow syntax') is an empirical hypothesis, certainly not something that 'all approaches' agree to or an a priori truth. See Bybee (2006), Evans & Levinson (2009), Hudson (2007), Goldberg (2006), Croft (2001), and a number of others.
     What about HC&F's reference to the interfaces - semantics and phonetics? Do we know a priori that these involve recursion, in spite of HC&F's declaration? Of course not - unless we are back to the unenlightening notion that Merge establishes recursion by fiat. Perhaps this is OK within MP, but not to other linguistic or cognitive scientists. Even if a language has a complex semantics or phonology, there will only be recursion at the 'interfaces' if we can find empirical evidence for things like nested structures, hierarchical organization, and so on.[iv] I can only say that to this point in my research, there is no evidence for recursion in the syntax, semantics or phonology of Pirahã. Pirahã certainly has a semantics that builds what are in effect compositional sentence meanings. But it is by no means clear that we need recursion to yield such meanings (see especially Hobbs (2008) and Language Log - http://itre.cis.upenn.edu/~myl/languagelog/archives/005380.html for a paratactic account of semantics). The same considerations hold for the phonology. I return to this in Everett (2010a). The following quote is important because it seems to come closest to motivating NP&R's understanding of HC&F and HC&F's proposal of FLN:

(11)   *"... **long-distance, hierarchical relationships are found in all natural languages** for which, at a minimum, a "phrase-structure grammar" is necessary. It is a foundational observation of modern generative linguistics that, to capture a natural language, a grammar must include such capabilities."* HC&F (2002:1577)[v]

Whether humans choose a finite vs. phrase structure grammar is precisely the empirical point that I have addressed in Everett (2005; 2008; 2009a; 2009b; 2010a; and 2010b) as well as the current paper. The 'infinity' of the Pirahã language, for example, might lie *outside* the grammar in the Chomskyan sense -

in discourse - via the ability to fashion stories out of sentences rather than sentences out of phrases. There could, in other words, be a longest sentence in Pirahã, yet not a longest story. Example (12) is not expandable. Adding another word would render it ungrammatical, (13):

(12) **Xahoapioxió xigihí toioxaagá   hi   kabatií   xogií xi**
another:day man old   he   tapir   big   it
mahaháíhiigí   xiboítopí   piohoaó.   Hoíhío
slowly   cut:up   by:the:water.   Two.
'Yesterday (or before) an old man slowly cut up big tapir(s) by the water. Two (of them).'

(13) ***Xahoapioxió   xigihí toioxaagá   hi   kabatií   hoíhío***
another:day man old   he   tapir   *two*
xogií xi   mahaháíhiigí   xiboítopí   piohoaó.
big   it   slowly   cut:up   by:the:water.
'Yesterday (or before) an old man slowly cut up two or more big tapir(s) by the water.'

If the infinity of language turned out to reside in discourse, rather than the sentence grammar, then Minimalism would be unable to express this. That is because its only form-creating operation is Merge and Merge only form sentences and phrases from lexical items. Theories that do not have anything to say about facts external to sentences (e.g. all versions of Chomskyan theory) cannot appeal to discourse, thought, etc. for support for their theory of grammar, e.g. the role that recursion plays in the FLN. To beat this horse another way, recursion could be responsible for the infinitude of natural languages in a way that is unexpressable in Chomskyan theory, by allowing infinity to be a property of discourses, rather than sentences.

HC&F further reinforce this 'sentential bias' of Chomskyan theory when they say:

(14) *"At the lowest level of the hierarchy are rule systems that are limited to local dependencies, a subcategory of so-called "finite-state grammars." Despite their attractive simplicity, such rule systems are inadequate to capture any human language. Natural languages go beyond purely local structure by including **a capacity for recursive embedding of phrases within phrases** [emphasis mine, DLE], which can lead to statistical regularities that are separated by an arbitrary number of words or phrases..."* HC&F (2002:1577)

Yet there are no long-distance dependencies in Pirahã sentences, period. But there are in Pirahã discourse, as in (71) below. So that argument for the universality of recursion is wrong. It seems that HC&F, by this type of quote, have in mind more than mere phrase structure, but especially recursive embedding. Not once do HC&F discuss Merge in their article. They do discuss the importance of phrase structure occasionally in the quotes above, but only in the sense of the difference between finite state vs. phrase structure grammars, embedding of phrases within phrases, and long-distance dependencies. They say that the fact that no natural language can be described by a finite-state grammar

is 'foundational' to the generative research program. And yet they never once consider the possibility that there could be a finite grammar in a (nonetheless) nonfinite language, as I have claimed for Pirahã (and see section __ below).

But Pirahã falsifies these 'foundational observations' if Everett (2005) is correct (more facts are presented, along with these, in section two):

(15)   a. There are no "long-distance hierarchical relationships" in Pirahã sentences. See example (71), below, however, for an example of a long-distance relationship in Pirahã discourse.
b. Pirahã sentences *do* have upper bounds (i.e. there are sentences, which I define in Pirahã as potential modification on each word + lexical frame of the verb and the categories mentioned in the verb's lexical frame + absence of recursion to which no further words may be added, as in example (12).
c. Pirahã grammar (phonology, morphology, and syntax) lacks recursion of any kind, so far as I have been able to tell. Certainly, we do not find phrases within phrases in Pirahã, which was one of the assumptions of HC&F.
d. There is no strong evidence even for phrase structure in Pirahã.
Though I am not prepared to argue in detail for this hypothesis at present, I offer a non-phrase structure analysis for Pirahã that seems to account for Pirahã syntax in Everett (2010b).
So to return to the question "What did HC&F *really* mean by recursion, the answer at this point is 'Who cares?' It has ceased to be relevant, because of the lack of empirical focus. It is entirely possible that NP&R are correct and HC&F said 'recursion' but meant 'Merge'. Under either assumption, i.e. that they meant what computer scientists mean by recursion, as in (1) and (2) above, or Merge, recursion as a foundational component of human grammars is problematic. At the same time, if HC&F do mean Merge and if their interpretation of Merge matches NP&R's, in the quote above, then MP and the generative enterprise more generally have reached the end of their Hegelian dialectic.

But since this is a paper about the nature of recursion and not about the shortcomings of Minimalism per se, I'd like to look a bit more carefully at the relationship between recursion and Merge and ways to test for it. Merge takes one item from a set of items and joins it to another, either a phrase or a word. If it is lacking in a language how would we tell? Here are some suggestions:

(16) Phenomena that would falsify Merge:
    a. A language without recursion (Everett 2005).
    b. Ternary branching required in the grammar (see Culicover and Jackendoff 2005).
    c. Absence of phrase structure in a grammar (Hudson 2007).

(17) Complications in grammars that would render Merge less helpful or even useless:
    a. A language with one level of embedding only in complement clauses, another level in possessor phrases and yet another with modifiers.
    b. Finding that some languages limited complement clause embeddings to one level, others to two, till others to three.

c. And so on.

The items in (17) are problematic for the usefulness of Merge because they would require that we allow formulations of the type $Merge^{0...n}$ (see (16)). We could expand on this at will. For example, imagine a $Merge^0$ language. Such a language would allow no more than *one word* in a clause, because more than one would require Merge. I doubt that such examples will be found in natural languages, though, for any number of reasons (see Everett (2010b)).

Crucially, however, even if we showed that a language lacked Merge, we would still not have shown that it lacks recursion. Since recursion is more general and Merge is a specific form of recursion, the entailments are the following:

(18)   a.   Merge $\Rightarrow$ Recursion
        b. $\neg$(Recursion $\Rightarrow$ Merge)
        c. $\neg$Recursion $\Rightarrow$ $\neg$Merge
        d. $\neg$($\neg$Merge $\Rightarrow$ $\neg$Recursion)

By (18a), if the data suggest that there is Merge, then there will necessarily be recursion in a language, unless Merge is blocked in some arbitrary way, as NP&R would have it. (18b) shows though that even if we find recursion in a language, this does not mean that the language has Merge. (18c) means that If we show that a language lacks recursion, then it cannot have Merge. And (18d) means that even if a language lacks Merge, it can still have recursion. Again we see that if HC&F meant Merge rather than recursion, they were misleading. These entailments suggest the empirical issues nicely. And we must not lose sight of the fact that the empirical issues are at the forefront. What is at stake cannot be settled by simply defining Merge or saying that it *must* occur in all languages.

Moreover, if we discover possibilities like those suggested in (17), where Merge could be limited for any value from 0 to n iterations then it is difficult to see any contribution of Merge to grammatical theory. These are, as they must be, empirical issues. No empirical tests or arguments for Merge or recursion are ever adduced in NP&R's spirited defense of HC&F or in HC&F or the MP themselves.

To sum up, the proposal that the FLN consists of recursion must be testable to have any interest. It doesn't matter what theory we are assuming. But while there are in principle ways to test for the presence of the general notion of recursion in a language, there is no way to test Merge, as presented in NP&R. There it is a nonempirical, a priori commitment to a theory. It is not a hypothesis about the data of natural language.[vi]

To conclude this section, if Merge is what HC&F had in mind when they wrote 'recursion', then *John eats sausage* is recursive. I think a lot of creatures that HC&F hypothesize to lack the FLN could produce this sentence just fine in one way or another.

3. Pirahã: a finite grammar in a non-finite language[vii]
3.1. Introduction

Let's briefly review the facts I have adduced to support my claim that Pirahã lacks recursion in its grammar. If these are even partially correct

The following facts are all predicted by if Pirahã lacks recursion. However, they are nothing more than a set of mysterious coincidences if Pirahã has Merge/recursion. Let me emphasize this. If just one of these facts obtained in a particular language it would be a matter of curiosity and something in need of explanation. That they all occur in a single language is even more striking (I am not claiming that these have been proven. But their absence from texts and conversations is striking). My hypothesis, that recursion is lacking in Pirahã, predicts all of them. The NP&R account predicts none of them at all. Their cumulative effect argues strongly against the NP&R analysis. Interestingly, in none of their papers do NP&R ever address these facts as a set. They never say how their analysis would account for them nor what the implications are for my analysis since it does predict all of them.

I hasten to add that even if I am right about all of these things, this doesn't mean that Pirahã syntax lacks recursion. All linguists know that there are functional alternatives to these formal devices. On the other hand, my claim is intended to entail that there are *no functional alternatives* employed in Pirahã. Obviously, these assertions require experimental testing to check for the presence of such alternatives more thoroughly. On the other hand, the absence of all the formal devices is predicted by and consistent with my proposal that Pirahã lacks recursion. In what follows I provide a quick recap of some of the evidence against recursion in Pirahã syntax.

3.2. Possession

As I have pointed out before, Pirahã lacks recursive possession. I am not claiming merely that Pirahã lacks prenominal recursive possession, something that is lacking in better-known languages, such as some have claimed for German. Rather, my claim is that there is no recursion anywhere in the Pirahã NP/DP (German does allow postnominal possessor recursion, for example, which Pirahã does not).

(19)　　a. English recursive structure:
　　　　John's brother's house.

　　　　b. Pirahã non-recursive structure:
　　　　* Xaikáibaí xahaigí kaiíi xaisigíai.
　　　　Xahaigí kaiíi xáagahá. Xaikáibaí xahaigí xaoxaagá. Xahaigi xaisigíai.
　　　　'Brother's house. John has a brother. It is the same one.'

3.3. Modification

Also, there are no examples of recursive modification in Pirahã, contra Everett (1983/1986/1990 - all different versions of the same analysis). The data that these earlier works reports was collected under artificial circumstances of elicitation.

(20)　　a. English recursive structure
　　　　'Two big red barrels'

b. Pirahã non-recursive structure
*Kabogáohoí biísai xogií hoíhio.
Kabogáohoí biísai. Xogií píaii. Hoí hiaagá
'Two big red barrels.'

3.4. Restricted reference

Pirahã also handles what I will call 'restrictive reference', e.g. relative clauses, by non-recursive means:

(21)   a. English recursive structure
'I want a hammock *like the one that Chico sold.*'

b. Pirahã non-recursive structure
Ti baósaápisí xoogabagaí. Xigiábií xaoói. Chico hi goó baósaápisí bagáboí.
'I want a hammock. I am like a Brazilian. Chico sold a/the hammock (restriction of reference).'
Baósaápisí xaisigíai.
'It is the same hammock.'

3.5. Semantic complements without embedding:

Imperatives have also been shown to lack recursion in Everett (2009).

3.5.1. Imperatives

(22)   a. English recursive structure
'I am ordering to make an arrow.'
b. Pirahã non-recursive structure
Ti xibíibihiabiigá. Kahaí kaisai.
'I am not ordering you. (We are speaking of) (you) make an arrow.'
(23)   c. Pirahã alternative structure
Ti gí xibíibihiabiigá. Ti gí xoogibaaí. Gíxai kahaí kaí xígiaoaxáísai. Pixái xíga.
'I am not ordering you. I really want an arrow. OK? You make an arrow. Now.'

3.5.2. Quotatives
3.5.2.1. Function of quotatives

The function of quotatives is twofold in Pirahã. They can report speech or they can provide information about intentions or other internal states.[viii]

In this sense, Pirahã is like many languages of the Amazon and elsewhere in using 'to speak' and 'to hear' in place of 'to think' or 'to intend' or 'to understand'.

3.5.2.2. The absence of embedding in quotatives

(24)   (a)   **Hi gáisai. Tiobáhai kabiigá.**
'He spoke. There is no child here.'
(b)   **Hi gáxaiábísai. Tiobáhai kabísaiáagahá.**
'He says-sai there is no child here.'
(c)   **Hi gáxaiábísai. Tiobáhai kabísaiáagísai.**
'He says-sai there is no child here.'

Evidence that the content of what was said and the verb 'to speak' are separate sentences, is found in intonation, as in the figures below:

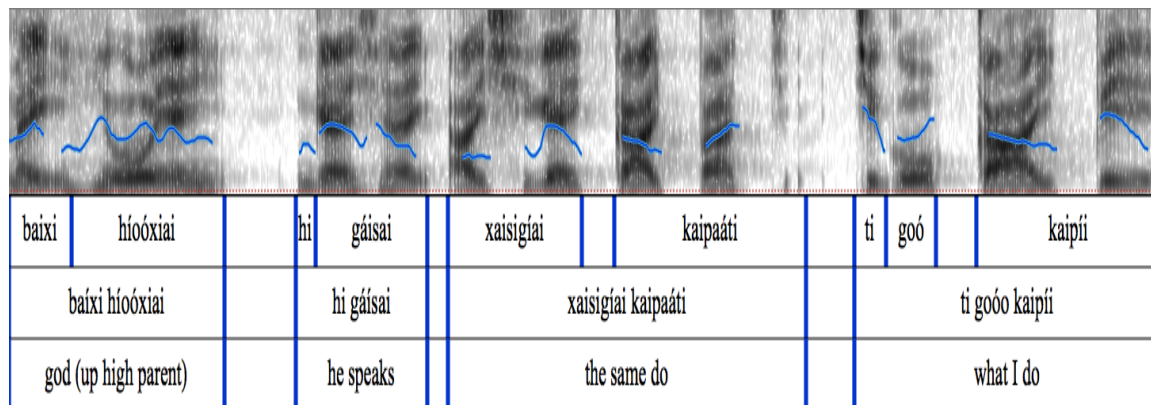| baixi	híoóxiai		hi	gáisai	xaisigíai		kaipaáti		ti	goó		kaipíi
baíxi híoóxiai			hi gáisai		xaisigíai kaipaáti				ti goóo kaipíi			
god (up high parent)			he speaks		the same do				what I do			

Figure 2

Notice the breaks after hiooxiai, gaisai, xaisigiai, kaipaati, and goo. Each break is preceded by slowing down of velocity and pitch declination. And each is followed by increased velocity and pitch reset, among other markers.

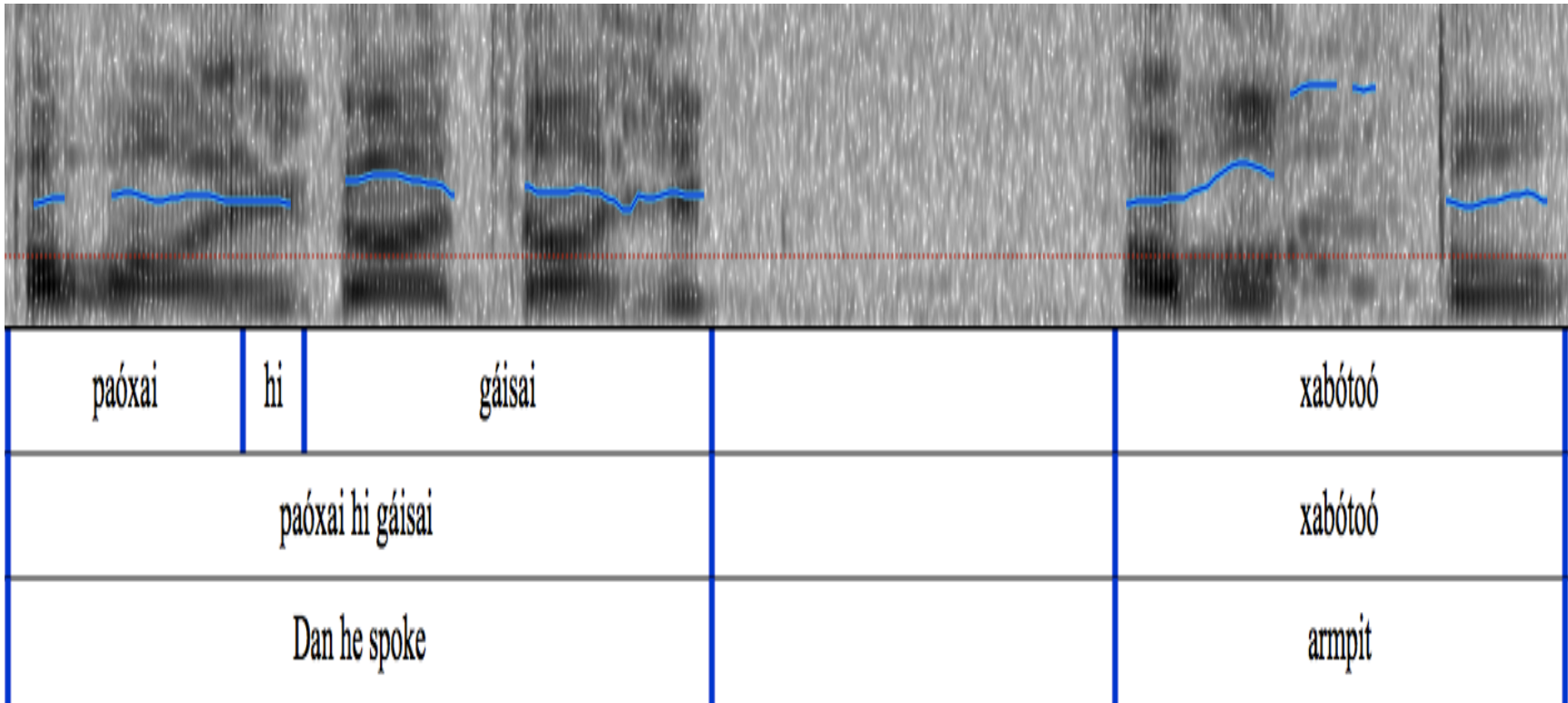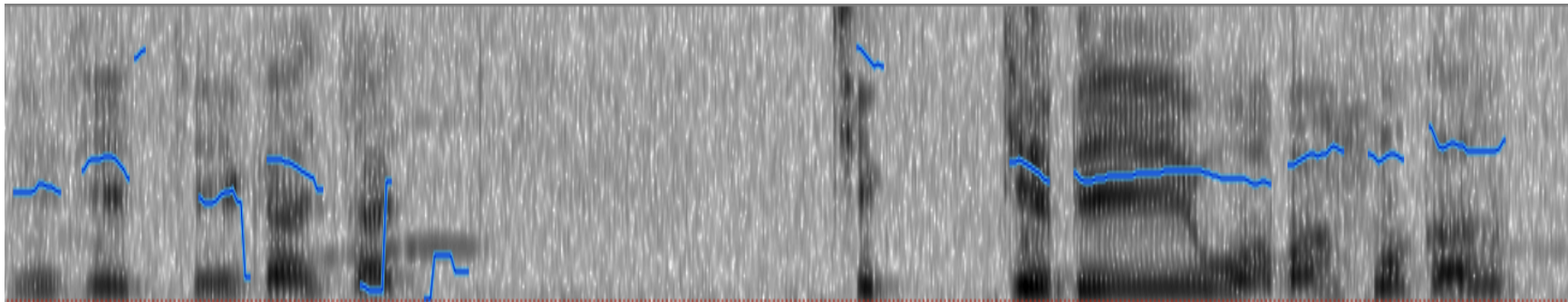| paóxai	hi	gáisai		xabótoó
paóxai hi gáisai				xabótoó
Dan he spoke				armpit

Figure 3

       The example of Figure 3 is freely translated as 'Dan says (that it is called an) 'armpit. 'Armpit' is the content of his speaking. It is, typically and clearly, separated from the verb 'to speak' in a separate intonational unit (see Everett and Oliveira (2010)).

nísɛ́či	hi	gáísai		ti	bííoabahoagáhá
nísɛ́či hi gáísai					ti bííoabahoagáhá
Vincente spoke					I am come to be tired

Figure 4

       This example more freely rendered is the direct speech, 'Vicente says, "I am tired."'. Notice the use of the first person pronoun (which rules out indirect speech when the I is coferential with Vicente, which it more commonly would be). On the rarer occasions when 'I' refers to the reporter of someone's speech, forcing an indirect speech translation, nothing is required to change.

3.5.3. Direct vs. Indirect discourse

       There is no formal marking to distinguish direct vs. indirect speech in Pirahã. In the examples below, recorded in July 2009, on a trip to the Pirahãs with GEO Reporter, Malte Henk, the speaker is saying that I/Dan Everet/Paóxaisi (my Pirahã name) spoke and that the content of what I spoke is that the person reporting my speech, not Dan, was prevented from returning to the jungle (the same example could be used also to report what 'Dan' says).

(25)   **Paóxai**   **hi**   **ig**   **-áí**   **-sai**.
      Dan   he   carry-sound - old information (Or 'Dan spoke')
      Tíi   **xaboópai**   **-ta**   **-soogabagaí**.
      I   return -again want
      Xi   **ti**   **bííbi** **-hiabikoí**   **xipói** **-hióxiai**.
      She me allow -not   woman   -that one
      'Dan spoke. I want to return again. That woman would not allow me.'
      Tíi   **xoí**   **kabáo.**   **Xabiigá.**
      I   jungle not.   (I) remain.
      Xapaí   **xáabaáti**.
      Head (first)   stay (command)
      (woman) foi mato.
      (she) went to the jungle
      Ai   **tíi** **gaaba xoí**   **kabáo.**   **Xabaá**.
      Then I   next   jungle not.   (I) remained.

       Some have claimed that direct and indirect speech can reveal aspects of grammatical relations and structures, e.g. recursion. The problem is that the relationship between types of speech reports and syntactic structure just isn't so straightforward in many languages. For example, Maier (2009) argues that '... the line between direct and indirect [speech] is blurred...' He argues also for a '... unified analysis of speech reporting in which a general mechanism of mixed quotation replaces the classical two-fold distinction.' Just as we see for false beliefs in section __, formal grammatical markings are useful for certain aspects of communication and learning about others but they are not required.
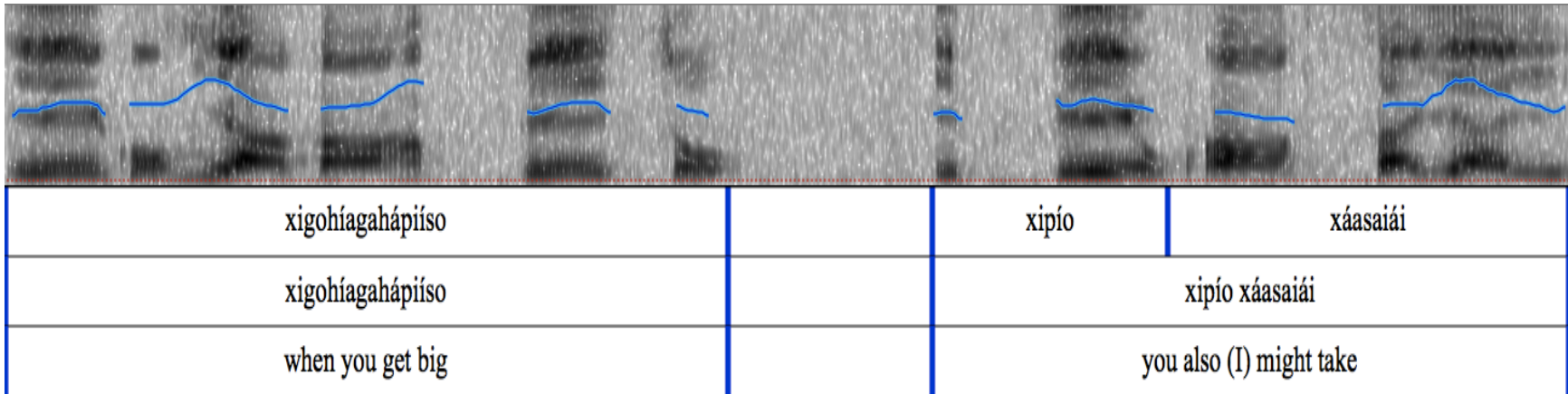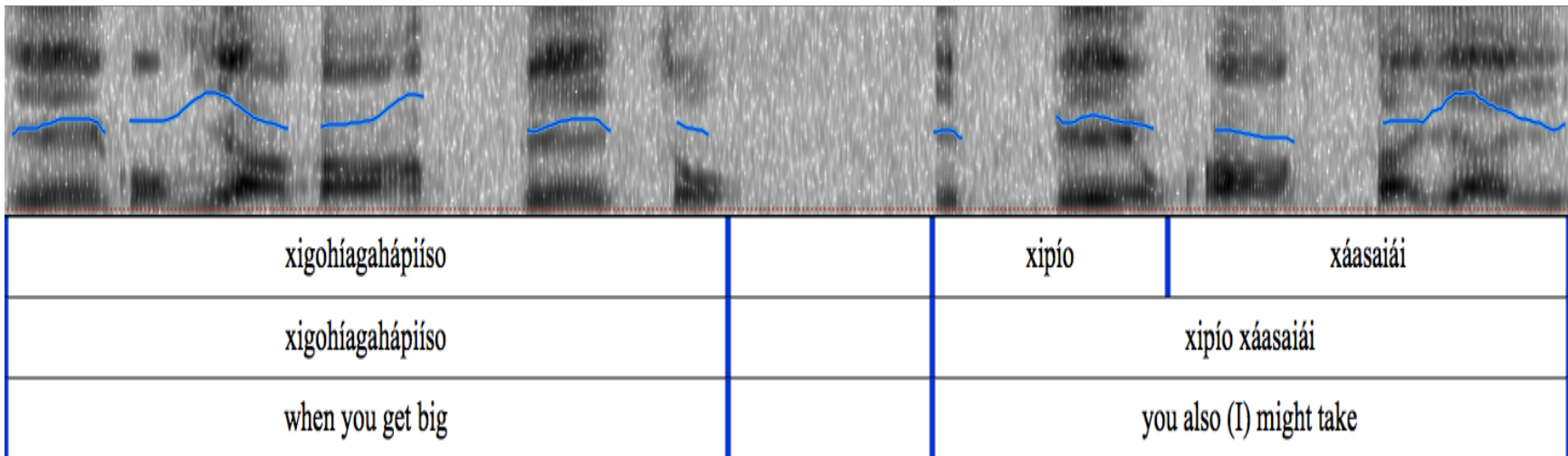
Figure 3
Temporals

3.6. Temporal clauses

Some linguists appear to believe that temporal clauses are necessarily subordinate syntactically. This is not true for Pirahã temporal clauses, as the below examples illustrate (see also the spectrograms in Figures - - -):

(26)   (a) **Kohoáikabáobáo. Ti gí xahoaisoogabagaí.**
    ' (When I) finish eating, I want to speak to you.'[ix]

(27)   (a) **Kaógiái xaaboópáitahaó.**
    (b) (**Kaógiái bííooabá.**
    'Kaógiái returned. Kaógiái was tired.' (free: 'When he returned, Kaogiai was tired.')
    (c) **Kaógiái bííooabá. Kaógiái xaaboópaitahaó.**
    'Kaógiái was tired. Kaógiái returned. (free: ' Kaógiái was tired when he returned.')

Like all the other cases we have seen to this point, temporal clauses in Pirahã show how hypotactic semantic relationships can be manifested without syntactic embedding or recursion.

3.7. Wh-questions
3.7.1. Introduction

Though this evidence has already been presented in Everett (2009) among other places, the dislocation of WH-words provides additional evidence for the absence of embedding in Pirahã. Consider, for example, the contrast in 44 and 45:

(28)   a.   <u>**Hi**</u>   **goó**   **kai**   **-baaí**   **-sai.**   **Hi**   **xo-báaxáí.**

        3   focus   make   really   -old:information   3   see-attractive

        'What [thing/kind of] making [does he] know well?' (literally 'He what associated making sees well?')

    b.   **Hi xobáaxáí. <u>Hi goó</u> kai baaí-sai.**

        'He knows well. What does he intensely make?'

(29)   *<u>**Hi goó**</u> **xobáaxáí. __ kai -sai**

    'What thing [does he] know well to make?' (literally 'What associated thing he knows well to make/making?')

The explanation for this constrast is that neither 28 nor 29 contains an embedded clause. Each pair is two separate sentences. In a question, the order of the clauses must be that in 28a or 28b, not 29. This follows if there is no embedding, because if we want to place the interrogative word initial in the phrase then we need to place its containing sentence to the left of its paratactic partner. Otherwise, the wh-word would be 'orphaned' from any sentence, as in

the English hypothetical example in (30):

(30)   *_Who_ You came to town yesterday. ___ did Bill see?

These data not only support the idea that there is no embedding/recursion in Pirahã, but they also present problems for standard embedding accounts in which WH-words should not have scope from adjuncts. Let's begin by pointing out that WH-questions most commonly take the form of copular clauses in Pirahã. The most common way to ask information questions (not merely echo questions) is as in (31):

(31)   a.   **Kaoí   xigí   -ai?**

who   associated   -be

'Who is/was it?'

b.   **Hi   goó   xigí   -ai?**

3   focus   associated   -be

'What was/is it?'

However, interrogatives can also appear with other arguments in sentences or paratactic constructions, as in 32-34:

Paratactic Wh-questions:

(32)   a.   **Kaoí xigí-ai? Kohoibiíhiai hi kobai -haí.**

'Who is it? Kohoibiihiai saw it.'

b.   **Hi goó xigí -ai? Kohoibiíhiai hi koabáipi.**

'What is it? Kohoibiíhiai killed it.'

Nonparatactic Wh-questions

(33)   a.   **Kohoibiíhiai kaoí   xob   -áo   -b   -á?**

name   who   see   -completive   -motion: -remote

downward

'Who did Kohoibiíhiai see?'

b.   **Kaoí Kohoibiíhiai xobáobá?**

(i) 'Who did Kohoibiíhiai see?'

(ii) 'Who saw Kohoibiíhiai?'

(34) a. **Paóxaisi hi goó koabáipí?**

Dan Everett 3 focus kill

'What will Dan kill?'

b. **Hi goó Paóxaisi koabóipí?**

(i) 'What will Dan kill?'

(ii) 'What will kill Dan?'

Now back to (32) above. The reasoning behind analyzing such examples as parataxis is the same as for relative clauses. The clauses need not be adjacent and Wh words are too far removed structurally (they are in separate sentences) from their potential matrix clause to be connected to it by movement. So in (35) kaoí 'who' is associated with an independent verb, xigíai 'to be with' and that in (35) if we propose that Hi goó xigíai 'what' has been extracted from the clause beginning with Koihoibiíhiai, this would require movement across the intervening independent sentence:

(35) **Kaoí xigí -ai? Kaxaxái hi xahoái -hiab -a.**

who associated -be name 3 speak -neg. -remote

Kohoibiíhiai hi kobai -haí.

name 3 see -relative certainty

'Who is it? Kaxaxai didn't speak (didn't say anything). Kohoibiíhiai saw it.

(36) **Hi goó xigí -ai? Ti baai -aagá.**

3 focus associated -be 1 fear -be/have

Ti xahoai -baaí -soog -abagaí.

1 speak intensive -want -frustrated initiation

Koihoibiíhiai hi ko ab -ái -p -í.

name 3 eye not -cause -motion:up intentive

'What is it? I am afraid. I want to speak intensely. Kohoibiíhiai killed it (literally caused its eye to stop suddenly).'

There is no syntactic theory I am aware of in which **Hi goó xigí-ai** could be extracted from the rightmost clause to the left periphery in 36. I conclude that these Wh-sentences provide evidence against embedding in Pirahã.[x]

Now, the fact that Pirahã does have overt wh-movement raises a problem for accounts that rely on embedding. For example, the scope properties of Wh elements in Pirahã fit the profile of a typical wh-in-situ language in which

adjunct wh-phrases may take scope out of their containing clause, contra the case with wh-movement languages. The data are found in examples like:

Wh-in-situ within adjunct clauses (Pirahã):

(37) a. **Xaoóí   hi   kaoí hiabaí   -so**.

foreigner 3   who pay -completive

Gixai   xoá -boí   -haí.

2   buy -come   -relative certainty

'The foreigner completes paying whom. You will buy (merchandise)?'

b. [**Kaoí   hi   gí   hiabaí   -so**.]

who 3   2   pay   completive

Gíxai   xoá -boí   -haí.

2   buy -come   -relative certainty

'[When who pays you] you will buy (merchandise)?

Overt wh-movement from adjunct clause (English):

(38) *Who, when the foreigner pays __, will you buy merchandise?

Scope out of 'adjunct' in Pirahã:

(39) [**Hi goó xígi   -ai**]. [(**Hi**) **Kai -sai**].   **Hi   xob -áaxáí**.

3   focus   associated do/be   make   -nominalizer 3   see
-well

'What does he know how to make well?'

(40) ***Hi xob -áa'áí   [hi goó xigi   -ai   kai -sai**]

3   see -well 3   focus   ASSOC -do/be   make   -nominalizer

The clause containing <u>kai-sai</u> must precede the clause containing <u>xobáaxái</u> only if the speaker wishes to place wh-like expression <u>hi goó</u> 'what' initial in the series.

If Pirahã wh-questions involved embedding, as they suggest, then the scope of the 'adjunct clause' would be a problem for a Wh-in-situ typology because wh-movement languages are not supposed to show this effect. But under the no-embedding analysis I am proposing, the scope properties are unsurprising - they are separate clauses interpreted by different rules.

3.8. Conditionals

Gibson, et. al (in progress) . conclude that whatever -sai is, it is not a nominalizer. The fact that –sai appears with conditionals thus supports the non-recursive analysis of Pirahã syntax. This is so because the conditional use of –sai is only found on events known to both speaker and hearer via the preceding discourse or immediate nonlinguistic context. The meaning of –sai 'old information', originally analyzed by Everett (1983) as a nominalizer, is the same in all cases. The association of conditional clauses with old information is not unusual. Haiman (1978) argued that conditionals are topical. And, again, contra my earlier nominalizing analysis, all verbs with -sai can be fully inflected, though this is rarer precisely because of -sai's marking of old or topical information (see Givon 1983).

As an example of the conditional use of -sai, consider the following. During a cloudy day when both speaker and hearer are aware of the possibility or presence of rainy conditions, one might use –sai to say 'If it rains tomorrow I will not go.' –sai might also be used as a conditional if speaker and hearer had been discussing rain. However, if rain is not part of the previous discourse or immediate circumstances, the conditional will appear without –sai:

(41) **Pii   -boi   -baaí   -hai.   Ti   kahápi   -hiaba**.

water   -move:downwards   -intensive -intentive 1   go away   -negative

'It is raining a lot. I will not go.'

The conditional sentence in (41) is not marked by -sai, but by context and (usually) rising intonation. Rising intonation is commonly used whether or not -sai is present. Additional examples are found in (42)-(44). See Everett (2009) for more details.

(42)   **Pii boibaaíhai. Ti kahápihiaba.**
       'It is raining a lot. I will not go.'

(43)   **Pii boibaaísai. Ti kahápihiaba.**
        '(We are talking about) it raining a lot (at a time also under discussion). I will not go.'

(44)   **Pii boibaaísai. Ti kahápihiabísai.**
        '(We are talking about) it raining a lot (at a time also under discussion). I will not go (as I had already mentioned).'

3.9. Morphology
Even if recursion is lacking in Piraha syntax, it is possible that it is present in Piraha morphology. Jan Zwart (personal communication) has even written to suggest that this is obviously the case, at least with Piraha names.[xi]
I have said this about Piraha names:

(45)   "All names for people are derived from verbal constructions, animal names,

nominal phrases, etc. In about 90% of these cases, -si occurs optionally in morpheme final position, as though marking a change in the basic reference or function." (Everett 1986: 279-280)

So let's begin this section by looking at Piraha names. One form of my main language teacher's name, for example, is **Kohoibiihiai**, which literally means 'blood-eat'. It is also the name of a species of fish in the Maici river. If this name, and the others like it, is produced by the synchronic grammar of Piraha, then placing such a name into a sentence could be argued to be a recursive process, as in the hypothetical example:

(46) **kohoibiihiai   kohoáipí kohoibiihiai**.
name   eat   sp. of fish
'Kohoibiihiai eats blood-eater fish'

However the class of words for names in Piraha seems closed. People do not invent new names. Rather, names are repeated frequently among the Pirahas, within and across their various settlements. Names vary from nouns for things, such as the common child's name **Tiihoá** 'corn', to descriptions such as **Xahoaógií** 'big night'.

Such proper names are not examples of recursion, however, precisely because the set of names is closed and these names are the result of diachronic, rather than synchronic processes. [xii]

Here is why names are not evidence for morphosyntactic recursion:
1. Name formation is not productive.
2. Speakers do not think of the names as phrases and to point out to speakers the composition or literal meaning of the name is greeted with incomprehension or humor.
3. Some names would not be constituents and so could not be the output of rules.
4. Some names appear to be formed by processes not found elsewhere in the grammar.

The following name illustrates both points 3 and 4:

(47) **Xiabígabígabí**
xi   ab   -ig   -ab   -ig   -ab   -i
she   remain   -close   -remain   -close   -remain   -declarative

Reduplication is not found elsewhere Piraha. For the same reason this name is not a constituent.

It is always possible that new evidence could be discovered to indicate that names are formed by synchronic rules. However, based on the data currently available, I conclude that Piraha names are historical formations providing no evidence for recursion in Piraha synchronic morphological rules.

According to Everett (1983), there are eighteen suffix classes in Piraha. Nowadays I believe that the number is about twice this. But these earlier divisions will serve fine as a basis for discussing the possibility of recursion in Piraha affixation. The are, ordered left-to-right in relative distance from the verb root (see Everett 1986 for details):

(48) Pirahã verbal template
  1. VERB 2. duration 3. telicity 4. perfectivity 5. desiderative 6. negation 7.

continuative 8. interrogative 9. ingressive 10. deictic 11. iterative 12. certainty 13. frustrative 14. intensive 15. emphatic 16. complementizer/nominalizer 17. evidential 18. result

Piraha verbs have roughly 262,144 possible forms if the analysis in (31) is correct. Since I think most of these categories can be subdivided into distinct suffixes, the number is likely closer to 68 million forms for each verb if we simply say that there are, say, 2^{36} permutations. But even this many forms is not evidence that Piraha verbs are formed by a recursive process.

This complexity, at either number, results from the mathematically possible permutations of a finite set of suffixes relative to a small (18-36) number of distinct template positions. Suffixes appear to affect only the verb root or an adjacent suffix and can thus be accounted for by an analysis in terms of positional slots, along lines suggested by Nida (1946). If Piraha verb suffixes were the output of recursive morphological rules, we might expect that some suffixes form constituents of suffixes.

But if we look carefully at position number one in the template above, Verb, we recognize that this is not a simple category. There are only about 90 verb roots in Piraha and they are combined to form other verbs, as in the verb below 'bring back':

(49) **xig ab   op**
     take turn go
     'bring back'

The order of verb roots, as seen in many languages with a similar process (Wari' and Chinese come to mind), is determined by the order of events. That is, it is iconic.

And yet knowing the order in which actions were performed is insufficient to combine verb roots together to describe an event. It is also crucial to know whether the even is culturally recognized. The combination of verb roots in Piraha is therefore similar to the process described by Pawley (1987) for Kalam, in his pioneering article, "Encoding events in Kalam and English: different logics for reporting experience." Piraha has only about ninety verb roots. The combination of these verb roots is culturally governed, just as Pawley describes for Kalam. There is no evidence that a morphological rule forms stems from verb roots, i.e. any rule that applies to its own output (a recursive process). Each event is described by a culturally sanctioned verb template, constrained by iconic ordering, rather than by selecting the appropriate verb from the output of culture-blind morphological rules. (I am aware that the alternative is to say that the morphology overgenerates and that the selection of grammatical forms is handled at the interface. There is no harm in saying that of course, so long as we realize that there is no content to it.)

This is a complex issue and it is, like many aspects of any language, in need of more detailed treatment. Perhaps I will get to this in the future.

4. Predictions of a non-recursive analysis of Pirahã syntax[xiii],[xiv]
    I have argued above that Pirahã lacks recursion. Are there predictions that such an analysis makes which could be independently tested in the

grammar of Pirahã? Yes. I discuss a few of these in this section.

(50)   *First, the lack of recursion correctly predicts that factive and epistemic verbs will be absent (though there is a - crosslinguistically common - use of the verb 'to see' for 'to know').*
        This prediction is made because if Pirahã lacks recursion, then there is no way to express factive verbs as independent verbs, since these would require a complement clause, requiring embedding and thus, ceteris paribus, a recursive rule in Pirahã syntax. Pirahã expresses such notions via verbal suffixes, consistent with the 'no recursion' hypothesis, not with complement clauses.

(51)   *Second, Pirahã has no marker of subordination.*
        This is also predicted by my hypothesis, because if P lacks recursion, there is no subordination to mark.

(52)   *Pirahã has no coordinating disjunctive particles (e.g. 'or').*
        The absence of explicit markers of disjunction is predicted by my hypothesis, since disjunction entails recursion.

(53)   *Pirahã has no coordinating conjunctive particle (e.g. 'and'). There is only a more general particle, **píaii**, which may appear preverbal or sentence final and which means 'is thus/simultaneous' (vague meaning), which never works like proper conjunction, but only supplies the information that these two things were simultaneous (it is related to pixai, now).*
        Again, this is predicted by my analysis, since coordination also entails recursion.

(54)   *Pirahã has no syntactic complement clauses.*
        If Pirahã actually had recursion, where is the unambiguous data? I have claimed that it lacks them. NP&R claim that it has them, but only after stretching and straining to show that this or that example *could* be embedding. But they never hint from any earlier data of mine that there could be multiple levels of embedding, which certainly would be expected under their analysis, if Pirahã has recursion like any other language. What would stop multiply embedded clauses under their analysis? Nothing. And yet even they don't find any evidence for this.

(55)   *Pirahã does not allow (syntactically) recursive possession anywhere.*
        The point of Pirahã possessives that I have made is not simply that it lacks prenominal possessor recursion, but that it lacks recursion of possessors *anywhere* in the noun phrase. NP&R might be correct to suggest that German, like Pirahã, lacks prenominal possessor recursion. But German does have postnominal possessor recursion. Pirahã has *no* possessor recursion.[xv] This is predicted by my analysis, but not by theirs.

(56)   *Pirahã prohibits multiple modification in the same phrase.*
        As I have discussed above and in Everett (2008) and (2009), there can at most be one modifier per word. You cannot say in Pirahã 'many big dirty Brazil-nuts'. You'd need to say 'There are big Brazil-nuts. There are many. They are

dirty.' This paratactic strategy is predicted by my analysis since multiple adjectives, as in English, entails recursion, but the paratactic strategy does not.

(57)   *Pirahã semantics shows no scope from one clause into another:*
'John does not believe you left' (where 'not' can negate 'believe' or 'left', as in 'It is not the case that John believes that you left' vs. 'It is the case that John believes that you did not leave')
In this example 'not' can take scope over 'believe' or 'left'. That is not possible without recursion, so my analysis predicts the absence of such scope relations. In (59), 'who' is at the beginning of one clause but holds a semantic relation to another clause. This is also predicted, correctly, to be impossible in Pirahã under my account, since it would entail recursion. But it is not predicted by NP&R's analysis.

(58)   *Pirahã shows no long-distance dependencies except between independent sentences, i.e. discourse:*
The kinds of examples that are standardly adduced for long-distance dependencies include:

(59)   a.   'Who do you think John believes __ (that Bill saw__)?'
         b.   'Ann, I think he told me he tried to like ___'

Pirahã does not have structures like this. However, Pirahã does have gaps. There are both places where pronouns are 'understood' (what generative theory calls/ed 'empty categories') and there is some displacement of constituents (all described by me in various places). But the gaps are not like those in (59). There are structures like:

(60) | **Soxógiái** | **Paóxaisi** | **hi** | **xapaitíisi** | **xaabáítá.** |
      |---|---|---|---|---|
      | big:time:be | Dan | he | straighthead | lost/couldn't find. |
      | **Hi** | **hoísai** | **píaii** | | **kosaagá.** |
      | His | child | simultaneously | | did:not:know |
      | **Hoagá** | | **___** | **xobáaxáí** | **pixái** | **xíga.** |
      | Contraexpectations | | **___** | see well | now | emphatic |

'Long ago Dan could not speak Pirahã. His children could not either. Nevertheless, *(he)* speaks it well now.'
The latter example is a long-distance dependency involving a gap, but it is not a fact about sentential structure, but discourse structure. Generative theory itself recognizes the difference, e.g. work by Huang (1984) and Farrell (19900) on the difference between pro-drop and missing objects in languages like Brazilian Portuguese:

(61) __ Coloca __ ai. '(You) put (it) there.'

In (72) the subject gap behaves like a regular pronoun but the object gap like a discourse variable, according to some analyses.
Whether or not long-distance dependencies are different kinds of things within and without the sentence depends on the functional strategies for

questions, topics, etc. exercised by a particular language. But there aren't studies comparing and contrasting the different notions that I know of (which probably only shows my ignorance).

For functionalists, the Pirahã data might be rare, but it shouldn't be a shock, because - if I am right - these data simply suggest that the 'infinitude' produced by the computational system of Pirahã is found in discourses, not in sentences. Let's turn now to an argument for recursion that has been advanced in recent years by Jill de Villiers and her colleagues, namely that the understanding of false beliefs and the acquisition of a theory of other minds (ToM) relies crucially on the acquisition of recursive syntactic structures. If this line of reasoning were correct then either Pirahãs would lack a ToM, which is patently false, or my analysis that their syntax lacks recursion is incorrect. In fact, I believe that this entire line of research is misguided. Since the issues impinge on the analysis of Pirahã syntax, I will take some time here to say why this proposal of a strong connection between syntax and reasoning seems incorrect.

5. False beliefs: a spurious argument for recursion
5.1. Introduction - the orthodox view
Influential work by Jill de Villiers (references) and her colleagues argue in favor of an idea tracing back at least to Frege to the effect that syntactic structure forces referential opacity in embedded clauses and indirect speech. In a number of papers, de Villiers seems to advocate the view that without syntactic complementation (i.e. embedding or recursion), there can be no acquisition of important concepts of reasoning about other minds.

More specifically, de Villiers and colleagues argue in particular that the learning of recursive structures in syntax is necessary to acquire the ability to attribute false beliefs to another person (I have renumbered the examples from the original paper):

"...we proposed that a child must recruit the language faculty in reasoning about propositional attitudes, specifically the false beliefs of others (J. de Villiers, 1995; de Villiers and de Villiers, 2000) because it relies on structures that are able simultaneously to represent the truth in someone else's mind and attribute it only to that person. This kind of representation is seen in the complement clause under a mental state verb:

(62)   Bill thought that Miranda left. *(where Miranda did not in fact leave)*
The complement clause ('that Miranda left') captures the world in Bill's mind and marks it as belonging to Bill, not to the speaker. A child possessed of such a structure can then use it to support long chains of reasoning, such as to predict what Bill will do next:

(63)   Bill thought that Miranda left *so he will chase after her.*
to explain what Bill did:

(64)   Bill thought that Miranda left *so he tried to call her cell phone.*
and to account for other mental states:

(65)   Bill thought that Miranda left *so he was depressed.*
The complement clause represents the basis of the reasoning, and it is centered on a false proposition: that Miranda left which must be <u>attributed</u> to someone other than the speaker in order for the reasoning to proceed."

They also say:

"In refining the initial idea of attribution, J. de Villiers (2001, 2005) has proposed a Point of View feature, handed down from the matrix verb to its complement and affecting everything in the scope of the complement, including the noun phrases. This allows sentences like:

> *(66)   Bill thought that the most beautiful woman in the world left.*
> *(whereas we think Miranda is plain).*

In essence, then, the claim is that once the child has the grammatical machinery in place to represent a false complement, then this opens up the possibility of false belief reasoning. Before the possession of the appropriate grammatical machinery and key vocabulary (such as the mental state verbs, believe, think, etc.), children may have a range of important understandings of both their own and other people's mental states, but the explicit understanding of the content of false beliefs is not possible."

5.2. An alternative perspective on false beliefs

I think that de Villiers and her colleagues make some reasonable points in trying to answer the extremely difficult question of how children come to acquire a Theory of Mind. But I think that they are wrong to connect this so strongly to syntactic structures. The idea I disagree with specifically is that it is crucial for the child to learn an overt marking of a clause containing a false belief as a syntactic rather simply a semantic complement, i.e. hypotaxis. The Pirahã data, as we see below, do not support this. More importantly, perhaps, for our evaluation of the de Villiers proposals is that neither does English.

5.2.1. English reconsidered

The proposal of a crucial link between recursion and acquisition of false beliefs is falsified even by English data, as seen in the data in this section. What I believe emerges from a careful scrutiny of the data is that the formal marking of the content of other people's minds via embedded complement clauses is a useful tool in learning about false beliefs and other minds. But it is not necessary. Just as grammatical markings of all sorts are used in some languages but not others (e.g. suffixes to mark evidential reliability, high pitch for focus, affixes for imperfect aspect, subjunctive mood, and so on) are useful for communication, few, if any, marking devices are formally necessary for learning the relevant nonlinguistic skill. And recursion in the learning of a Theory of Mind seems equally unnecessary, as the examples below illustrate:

(67)   a. Miranda left. Or so Bill thought.
        b. Miranda left, according to Bill.
        c. Miranda left. According to Bill (anyway).
        d. Bill thought that Miranda left.

Examples (67b) and (67c) show that in English a prepositional phrase, whether in the same clause, (67b), or not, (67c), can have the same effect as an embedded complement, (78d). Moreover, the examples in (79)-(82) show that for any epistemic revelation of another's mind, non-embedded sentences in natural discourse can reveal the content (up to a point, cf. (85) and (86)) of the other's mind just as well:

It is supposedly significant, by the 'formal marking is necessary' research line that (68) - (71) contrast in truth conditions:

(68) Miranda left.
(69) Bill believes/said that Miranda left.
(70) Bill cried because Miranda left.
(71) Bill cried because he believes that Miranda left.

Example (68) is true iff Miranda left. But the truth of (61) doesn't depend on whether Miranda left, but only on whether Bill believes or said that she did, whether or not she in fact departed. Although some take this to show that embedded clauses present new types of truth conditions, this conclusion seems unwarranted. The truth conditions are altered by the nature and number of assertions made, not by the syntax of those assertions per se. So consider:

(72) Miranda left. So Bill said anyway.

(73) Miranda left. Therefore Bill cried.

Assertive force is removed in (72) by the second clause, 'So Bill said anyway'. That is, by uttering 'So Bill said anyway', we recognize that 'Miranda left' is not a stand-alone assertion, but only part of the larger (discursive) assertion that Bill said something, namely, that Miranda left. In (73), however, the assertion that Miranda departed continues and is not affected by the following sentence.

In fact, in (72), just like in the version where 'Miranda left' is embedded, only one assertion is being made, namely, that Bill said something. But in (873), whether in the form of an embedded complement or not, there are three assertions: (i) Miranda left; (ii) Bill cried; (iii) Bill cried because Miranda left.

Embedding plays no role at all in this. Rather what is crucial is that children acquire the ability to understand discourses. Sentences are part of discourse. The form of the sentences is relevant but not crucial.

One immediate consequence is that evidence truth conditions and learning about other minds cannot establish on their own whether a language, e.g. Pirahã, has recursion or embedding. Further examples showing that embedding is not necessary to learn about false beliefs and other minds, is seen in (74) vs. (75):

False beliefs in embedded contexts:

(74)   a.   John said that the price is right. (But it isn't.)
        b.   John hopes that the price is right.
        c.   John believes that the price is right.
        d.   John doubts that the price is right.
        e.   John said that Peter said that the moon is green cheese.
        f.   John believed that Peter believed that the moon is green cheese.
        g.   John said that Peter said that Bill said that Mary said, etc.

False beliefs in non-embedded contexts:

(75)   a.   The price is right. Or so John said.

b.   The price is right. John believes this anyway.
c.   The price is right. Actually, John doubts that.
d.   The price is right. Or so John hopes.
e.   The price is right. Who said that? John said that.
f.   The price is right. John hopes that(?)/so.
g.   The price is right. John denies that/so.
h.   The price is right. John supposes that/so.

It doesn't seem, therefore, that either embedding or recursion are crucial to the development of a ToM, in particular reasoning about false beliefs. What *is* important is the acquisition of discourse and knowing how to interpret juxtaposed sentences in context. This is shown in children's fairy tales, as in the formula in (76):

(76) Once upon a time, X. X = entire discourse

In (76), X, *the entire discourse*, is marked as false belief.
Having said this, it is important to emphasize that recursive structures *do* help in communicating about other minds. Recursion is an important subtool of the syntax (see Everett (2010a). In fact, without recursion, false belief attribution is limited, as the following examples demonstrate:

(77) The moon is green cheese. Or so John said. Maria reported that anyway.

(78) The Eskimos have 100 words for snow. That's Mary's claim. John told me about it. Do you believe it?

(79) You drink. You drive. You go to jail. Rich people don't go to jail though. That is what some people say. (Some people say that if you drink and drive, then you go to jail, unless you are rich.)

These examples become more difficult to interpret as they grow longer. Recursion helps to 'package' the information by clearing signaling which thought is subordinate to another in a way that is much more difficult in discourse once we move beyond simple examples.

5.2.2. Pirahã false beliefs
Unlike English, which uses both discursive and syntactic strategies, Pirahã relies exclusively on discursive strategies for communicating about other minds.

(80) ? **Kóxoí higáísai. Kohoi hi goó gáísai. Xaogií báaxáí**.
(lit: Koxoi said (that). Kohoi he what said. Foreign woman is pretty.)
'Koxoi said that. Kohoi said THAT. The foreign woman is pretty.'

(81) ?? **Kóxoí higáísai. Kohoi hi goó gáísai. Xaogií goó gáísai. Báaxáí, tíi**.
'Koxoi said that. Kohoi said THAT. Foreign woman said THAT. I am pretty.'

As in English, inference and interpretations of false belief statements becomes more difficult in Pirahã as the discursive chains grow longer. But, unlike English, Pirahã lacks recursion to help mark the relationships between the different parts. This may be why I the discursive chains about beliefs I have in my data don't seem to surpass in size example (81).

Pirahã's strategy is reminiscent of the paratactic semantics of quotatives that Davidson (1968) urges upon us in his famous article, 'On saying that'. Although Davidson's theory has fallen out of favor, it does illustrate that even for languages with recursive syntax, there can be reasons for preferring a non-recursive syntax. Hobbs (2008) makes an even stronger point in favor of paratactic semantics. My claim about Pirahã, if placed in the context of these works, asserts merely that Pirahã syntax matches more closely a paratactic semantics that some have argued for on independent grounds.

5.2.3. Summary on false beliefs

What have we learned then about syntax and false beliefs? I think that the data above show the following: Recursive syntax has a utilitarian cognitive function. Without syntactic recursion the space for discussing false beliefs and other minds is narrower. On the other hand, we have also seen, in (91) - (92), that Pirahã easily allows bi-clausal structures to express the semantic effect of what would be one level of syntactic embedding in other languages. Yet after the equivalent of three levels of embedding in English, translations into Pirahã are nearly impossible. This suggests that Quine (1960) might be correct about the 'indeterminacy of translation' for reasons he did not imagine.

In response to the question, 'Can just anything be translated from any language to any other language?', the answer seems to be 'No. Different languages might have different expressive powers in different domains.'

The key to understanding how grammar and reasoning fit together, whether talking about other minds or anything else, is the fit between a language and its containing culture, society, and situation. At the same time, the introduction of syntactic recursion into a grammar at one stage in its history (or perhaps its removal) would not be a difficult step cognitively or linguistically, since recursion is, ex hypothesi, universal in reasoning though principally utilitarian in syntax.

6. Recursion in Pirahã discourse: a finite grammar in a nonfinite language

Now let's turn to briefly consider Pirahã discourse. The reason that this is important to our current discussion is that it shows that the Pirahã language does not lack recursion - only its grammar does.

Consider the following story. This story was collected by Steve Sheldon, an SIL member who worked among the Pirahãs from 1967-1976 and who still speaks their language relatively well. This story was told to Sheldon by Toohio to another Pirahã, Xitaíbígaí. Toohio had been to Porto Velho, and had taken a trip to the airport with Sheldon to look at airplanes. While there she saw soldiers and lots of Brazilians. She and her child saw inside a jet and the steward give them candy.

(82) a. **Xitaíbígai ao-aíbá aogagai.**
Itaibigai Braz.-many soldiers
'Itaibigai there are lots of soldiers.'

b. **Gahisó aíbá ogií hi-aigáa.**
airplane many big it-REL
'There are lots of big airplanes.'

c. **Toaoaigía xisaitaógi ao-igió.**
Toohio Steve foreigner-
with
abaxaí-gío hi-pio hoagá.
only he-also go
'Toohio (her child) well he all alone with Steve went there.'

d. **Toaoaigía aógió hi-a-hoáob-á boxbóxoi.**
Toohio much he-it-gave-DECL candy
'They gave Toohio lots and lots of candy.'

e. **Xitaíbígai gahiaó oogi-áaga gáí.**
Xitabigai airplane big-has there
'Itaibigai there are big airplanes there.'

f. **Gahiaó aíbíbaaxá gahiaó.**
airplane many airplane
'There are lots of planes.'

g. Xi**taíbígai gahiaó oogi-íaga gái gahiaó.**
Xitaibigai airplane big-has there airplane
'Itaibigai the airplanes there are big.'

h. **Sogaga ao-aíbaí. Xao-abaxaí gaá hoágai.**
soldiers Braz.-many are. Braz.-only there go
'There are lots of soldiers.'

i. **Xao-aíbaí ibági ahá-taio.**
Braz.-many customers fight-RECURRING
'Many Brazilians fight.'

j. **Sogaga ao-aíbaí.**
soldier Braz.-many
'There are lots of soldiers.'

k. **Gahiaó hi-gío ábaip-í.**
airplane it-withland-STAT
'An airplane landed there.'

l. **To-ao-aigí-aogió hi-a-hoäob-á bobóxoi.**
Toohio-Braz.-REL-much he-it-gav-DECL candy
'They gave all the candy to Toohio.'

m. **Gai hi-gahiaó.**
there it-airplane
'There are airplanes.'

n. **Koo ao-ai aogió hi-a-hoäob-á bobóxoi.**
inside Braz.-do all he-it-gave-DECL candy
'Inside the Brazilians gave him. candy.'

o. **Xitaibígai gahiaó aíbá gai.**
Xitaibigai airplane many there
'Xitaibigai there are lots and lots of planes.'

p.   **Gahiaó**   **gahiaó**   **ogiaí -aagá. Koobiai gai**.

        airplane   airplane   big   -is   clear/white there
        'There are big white jets airplanes there.' (literally 'Airplane, airplane is big. It is white there.'

q.   **Gahiaó**   **ao-gahiaó**   **ak-ab-aí-áagá**   **gái**.
        airplane   Braz.-airplane   path-sit-PROG-has there
      'There is an airplane sitting path there.'

r.   **Xitaíbígai** **gahiaó**   **oogiaí-i.**
        Xitaibigai   airplane   big-STAT
      'Itaibigai, the airplanes are big.'

This discourse has the following, recursive structure:
(83) Structure of discourse in (82):
     a. First division:
         Lines 1 & 2: Setting/beginning/background
            Line 3: First event
            Line 4 Second event, subordinated to first
     b. Second division:
         •Lines 5 -8: Setting/resumption
           •Line 9: Background to 8
     c. Third
         •Line 10: Setting/resumption
•   d. Fourth
         Lines 11 & 12 Third and Fourth Events
     e. Fifth
         Lines 13 -15 Setting/resumption
     f. Sixth
         Lines 16 & 17: Clarification, new information
     g. Seventh
         Line 18: Setting/closure

Lines 3, 4, and 9 at least are all discursively subordinate. The discourse has embedded structure and there is no upper limit to the discourse. Thus Pirahã is a nonfinite language. But lacking recursion in its syntax, it has a finite grammar. But Minimalist is unable to capture this unless it abandons the sentence as the focus of grammatical theory.

7. Conclusion and ideas for future research
7.1. Future research
     If I am correct in my analysis above, the following conclusions may be drawn. First, recursion is found once in the brain, not in individual modules, and it is manifested in some grammars but not others. It is likely a discursive strategy in all languages, but not always a syntactic or grammatical one.
     Second, recursion is not a necessary component of human syntax. The non-finite nature of human language may not reside in the syntax at all, but in human story-telling capacity. If this correct, then it makes little sense to call it part of the FLN, Narrow Faculty of Language. It seems no more language-specific than short-term memory.

Third, there doesn't seem to be anything left for Universal Grammar to be about, other than the tautological assertion that it is whatever there is about human biology that makes human language possible. As I have said elsewhere, if that all UG is, then there is nothing to get hot and bothered about. The so-called language instinct is nothing more than the fact that humans communicate differently than other species.

However, it isn't clear at all that I am correct. Although I believe that the data so far support my conclusions, other experiments would need to be conducted. One such comes from Bayesian methods:

"We present a Bayesian framework for performing rational inference that enables us to quantitatively evaluate grammars with and without recursive rules and normatively determine which best describe the sentences in a corpus…" Perfors, Tenenbaum, & Gibson (2010).

I believe that by subjecting the Pirahã data to this type of more rigorous statistical scrutiny, we may find additional evidence of relevance in the debates about the nature and significance of recursion in human grammars. In the meantime, however, since I believe that my hypothesis is the best one currently available about Pirahã, I continue to assume that it lacks recursion. If this is correct, then what are the consequences for some syntactic theories?

7.2. The shrinking syntactic corner
7.2.1. Why did recursion become so important?

During the period that some have called the 'golden age' of generative grammar, it seemed like the formalisms and proposals of Chomskyan theory were on the verge of providing the first truly explanatory theory of language, its nature, use, acquisition, and origins, in the history of the study of language. It was original, brilliant, and promising. Scores of linguists, psychologists, philosophers, computer scientists, and others came to believe that it might be the most significant breakthrough ever in the study of language. Language was innate and it was a set of rules available to all languages.

But it didn't take long for cracks to appear. The biggest crack, the proper theory of meaning, led to what Randy Harris (1995) has called 'The Linguistic Wars'. From that point on, a division grew in the field between so-called functionalism and formalism. Chomsky's position changed dramatically during and after these linguistic wars. But each successive new proposal (all with their own names, e.g. Extended Standard Theory, Revised Extended Standard Theory, Government and Binding Theory, Principles and Parameters Theory, and now the Minimalist Program) met with so many counterexamples and difficulties that, in the opinion of many who have followed the debates and developments for decades, Chomsky was pushed into the corner that led him to claim, along with Hauser and Fitch, that what was really essential to language/grammar is recursion (of some unspecified variety).

In more than fifty years, Chomskyan theory has made surprisingly few empirical discoveries about language - the 'island constraints' of Ross (1968), first noticed by Chomsky (1964) and 'parasitic gaps' (also discovered by Ross in the 60s).

I think that part of the violent reaction to me and my proposals, apart from the publicity, which has exacerbated the ill will, is the fact that if a language lacks recursion, then it is difficult to make the case that it is the underlying

cognitive capacity specialized for and enabling human grammars/languages. Although many people, including Chomsky, Bickerton (see below), Hauser, and others, claim that even if I am right, it is irrelevant for theories of language, I think that the nastiness of the attacks and their various forms shows that they do not really believe this (this in spite of that fact that Chomsky has recently said, in GEO Magazine, January 2010, that my only motive is to be famous but that famous people must have ideas and I have none). I discuss Chomsky's own bizarre response to me in my paper in Language 85:2. But let me discuss now another very common reaction, using a recent quote from Derek Bickerton.

7.2.2. Recursion in cognition and the 'toolbox' argument
        In a recent book, Derek Bickerton (2009,238ff) discusses the case of Pirahã and claims that Pirahã has no bearing on Universal Grammar one way or the other. This is a common enough claim, one that I believe is based on a superficial understanding of the issues, but it is worth considering in some detail. Bickerton says that:
        "What hardly anyone noticed [in the debates about Pirahã, DLE] was that it didn't make the slightest difference whether Everett was right or wrong... Suppose he was right. Then the only question was, could a Pirahã baby learn a language that did have recursion? If it could ... [Everett 2008 in fact gives examples of exactly this and Pirahã babies certainly can learn languages with recursion] then the absence of recursion from Pirahã grammar might be rarer, but was no more remarkable than the absence of ... clicks... from English."
        This is about as deep a misunderstanding of the issues as I can imagine. The claim of HC&F was that recursion *is* the FLN (narrow faculty of language). They never claimed this about clicks. And there is good reason for that. The point of their discussion was to establish that the computational system of humans enables human languages to be nonfinite, to have infinite communication systems with only the finite means of the human brain. Recursion is at the heart of all of this. Moreover, HC&F (whether under my exegesis or the interpretation of NP&R) were concerned with building linguistic structures. And in Chomskyan linguistic theory, discourse has always been outside the computational system proper. This means that HC&F's proposal was about the sentential syntax using recursion and being nonfinite. So, whether a Pirahã child is able to learn recursive structures (again, they most certainly can) is irrelevant. This only shows that the recursion we already know to be a general cognitive ability, based on Pirahã discourse, can also be exploited in the grammar. That is not the proposal of HC&F, however, who want recursion to be responsible for infinitude of sentential syntax. If Pirahã sentential syntax is neither nonfinite nor uses recursion, then for HC&F and the Chomskyan notion of Universal Grammar as the biological endowment underlying *sentential syntax*, the jig is up.
        It matters not at all if human reasoning is recursive via human discourse/story structure, etc. The FLN is falsified if a language can be shown that expresses its nonfiniteness in discourse but not in units of sentence size or smaller.
        In recent years, a number of researchers have begun to argue that Universal Grammar is in fact a set of features that languages can choose from. Some languages choose some features, other languages choose others.

The problem with this view is that it entails a lack of clarity as to the source of these linguistic features. The question of interest has always been whether or not there is a specific component of the brain dedicated to language, Universal Grammar. All researchers agree that humans are uniquely capable of learning language. But some believe that there is no need for a Universal Grammar but that general cognitive abilities, e.g. intelligence, learning capacity, and so on, as well as the general way that the brain is wired, are responsible for language and many other skills. Saying that that there is a large grab bag of features to draw upon for language could mean that these features come from general problem-solving capabilities of Homo sapiens and not from a Universal Grammar. In fact, the 'toolbox' hypothesis favors the former interpretation over the latter it seems to me. Therefore, if what I have shown is that recursion is part of a toolbox, then this still does not tell us where the toolbox is located nor how specialized it is. Why suppose that it is completely dedicated to sentential grammar (the Chomskyan limitation), when the evidence shows that recursion can be found in cognition generally, as in Pirahã discourse? The answer is, no reason to suppose this at all given our current knowledge.

References
TO BE ADDED

Davidson 1968 "On Saying That" - offers *paratactic* theory of *Oratio obliqua*
Jerry Hobbs (2008) 'Deep lexical semantics': the **real** problem is Discourse.

NOTES

i   I dedicate this paper to the memory of Ken Hale and Peter Ladefoged. From their very different perspectives, they communicated to all linguists the importance of empirical work and the readiness of field research to contribute to linguistic theories.

I want to thank Peggy Speas and Tom Roeper for inviting me to speak at the conference on recursion at the University of Massachusetts, Amherst, and to the audience there for questions on this presentation.

ii   This conference on 'Recursion in Human Languages' was funded by Illinois State University and the Max Planck Institute for Evolutionary Anthropology, Linguistics Department, in Leipzig, Germany.

iii   Surprisingly, HC&F fail to define recursion anywhere in their article.

iv   Since Merge assumes recursion by definition, it would be circular to use it in the investigation. If evidence is found, *then* Merge may be used, if it turns out to be the best way to implement recursion formally. But Merge is not a tool for discovering recursion - nor is the number of words in sequence.

v   Although HC&F go on to review experiments in which Fitch and Hauser claim to have gotten cotton-topped tamarins to distinguish finite-state vs. phrase-structure grammars, most researchers believe that they showed nothing of the sort (see, for example, http://itre.cis.upenn.edu/~myl/languagelog/archives/002822.html). Assume however that they did show this. Nothing follows for whether or not human grammars can be constrained by cultural values.

vi   Interestingly, as I point out in Everett 2010b, even if NP&R turned out to be correct in all of their criticisms of my work, Pirahã would still manifest only one level of embedding. This means that it lacks recursion in the sense of (1) and/or that it imposes an arbitrary bounding of Merge. This would require the NP&R account to limit Merge in one of the ways mentioned (since they cannot derive the fact that embedding, under their analysis). As soon as Merge is formally limited, however, it ceases to be recursion (in any theory except MP). This sets the majority of the evidence for recursion aside. And it means that if that is what HC&F had in mind, they should have said so, because this is not what the majority of readers would have taken away from their discussion.

vii   What follows restates some evidence I have given elsewhere to support the claim that Pirahã lacks recursion. As is well-known, these claims have been criticized in a couple of papers by Andrew Nevins, David Pesetsky, and Cilene Rodrigues. It intrigues me that these three authors have always focused exclusively on arguing with minor points of my analysis without once addressing the predictions my analysis (or their own analysis) makes about the syntax of Pirahã. In fact, they discuss no predictions at all. They suggest no experiments to test their ideas vs. mine. But here is the real 'kicker': they fail to note the crucial fact that even if they are right in their criticisms of me at every point, *their own analysis produces no more than a single level of embedding for Pirahã sentences. Not recursion.*

viii Just as in Pirahã the verb **xa-ob** 'hit ear' or 'hear', can mean either 'to hear' or 'to understand'.

ix   The material in the parentheses may be understood as implicit, or not, depending on context.

x   One might ask how I missed examples of Wh-movement in my dissertation. The answer is that movement is much less common because of the ambiguity produced when the Wh word is moved – without case-marking or other devices it is more difficult to tell whether the Wh word refers to the subject or object with movement than without. This ambiguity is often difficult for the Pirahãs. It was very hard for me in the early stages of learning the language. This could also be why paratactic constructions are more common.

xi   Recently Pierre Pica suggested, following a talk of mine in Vienna, that Ken Hale and Jay Keyser's work on word meaning demonstrates that there is recursion in the lexicon, in the meanings of individual words. My response to that is that Hale and Keyser's work, while interesting, is largely theory internal. Other theories of the lexicon do not involve recursion. That is not to say that it would not be worth examining Piraha lexical structure more carefully for evidence of recursion. Or Piraha phonology for that matter. But the focus of this paper is on syntax and morphology.

xii   Descriptive phrases may become names over time. The Pirahas asked me once what the name of the plane's propeller was. I invented **Xiohói xiboítisai** '(It) cuts wind'. When I uttered this, I thought I had invented a name. I hadn't. I had described what the propeller does. The Pirahas describe it in this way, but they do not yet use it as a name, functioning, say, as the subject of a sentence.

xiii   As my former Manchester University colleague, John Payne points out, we'd need to rule out the possibility that the lack of these characteristics are not due to sampling error or unrelated historical developments. True enough, but my account predicts them and so, for now at least, I take their absence in Pirahã to support my position.

xiv   There is much to be done yet to round-out argumentation for the absence of recursion in phonology, morphology, and semantics. In semantics, researchers like Hobbs (2009) have already argued against the need for recursion and in favor of a paratactic approach, contra HC&F. In morphology, my findings, since Everett (1986) are that Pirahã morphology is templatic and non-recursive. For phonology, I can only say that there seems to be no recursion. Even though Everett & Oliveira (2010) argue that Pirahã has Boundary Tones and Phrasal Tones, assuming a ToBI-AM approach to Pirahã intonation, this does not entail recursion, only that one set of symbols are constituents to another. Though some linguists treat hierarchical structure as though it were recursion, it is not. Likewise, if Pirahã syntax turns out to be little more than a set of words ordered by Linear Precedence Rules (see (Everett 2010a)) and then labeled as a set 'S', this doesn't mean recursion, only hierarchy.

xv However, the assertion that German lacks prenominal recursive possession is suspect. As Jan Wohgemuth says (email November 07, 2010 to me) "... in my variety of German you can and do have prenominal possessor recursion: "*Meines Vaters Freundes Bruders Haus*" 'my father's friend's brother's house', although I am not sure how many layers would be acceptable..."