Putting Grammar in its Place with Scaffolding Theory

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Introduction

Jerome Bruner's *Child's Talk* (Bruner, 1983) was a breakthrough in our understanding of how children come to acquire language, not because he solved all the problems, but because he changed the way we think about the role of grammar in language acquisition, by giving us a tenable way to think of language acquisition as other than purely grammar acquisition. Bruner explains the acquisition of language in terms of standard routines—scripts and games like peek-a-boo and hide-and-go-seek, played by prelinguistic youngsters. The scripts have an almost grammar-like structure onto which the use of linguistic grammar can be slowly grafted as the youngster gains more and more proficiency and the script (which is co-improvised with the youngster's caregiver) becomes more and more sophisticated.

Something like this might provide at least a partial answer to nativists, like Noam Chomsky (Chomsky, 1957, 1965) and Steven Pinker (Pinker, 1994), who believe that language is almost entirely innate. I will examine Bruner's idea that the grammar-like structure of infant games like peek-a-boo facilitates the later learning of linguistic grammar, with an eye to determining whether and to what extent this aspect of Bruner's work could be said to refute, or at least mitigate, the claims of nativists—and in particular, I will use Pinker as a reasonable representative of the contemporary nativist Chomskian position.

The Nativist Position According to Pinker

Nativism

Pinker has said that grammar—with all its complexity of embedded phrases and the like—springs from the mind of a child virtually fully formed in the late twos to mid-threes, or at least at such a rapid pace that the process defies analysis (Pinker, 1994, p. 269). The development of sophisticated grammatical devices in such a short span is, he says, evidence of the existence of an innate hard-wired capacity for human grammar that is encoded in our genes, and selected for by natural evolution. There develops in the youngster's brain, according to a preset genetic developmental schedule, what Chomsky calls an L.A.D., or Language Acquisition Device, that enables the child to learn the language of its environment with a speed and efficiency that would simply not be possible if language were learned like any other learned skill (musical notation, riding a bicycle, differential calculus, or whatever). The development of an L.A.D. is *not* seen as simply a genetic predisposition to learn grammar, but rather as a kind of innate knowledge of basic human grammar that comes built into our brains.

Universal Language

Obviously, Pinker and Chomsky do not believe there is *no* learning whatsoever involved in the development of a language. Each individual language does, after all, have its own peculiarities—its own lexicon (or mental dictionary) and its own idiosyncrasies of grammar. However, Pinker is convinced that these peculiarities pale in comparison to the universals that are the same, and always the same, across *all* human languages. He lists some of the major universals (with no claim to exhaustiveness) that have been discovered so far (Pinker, 1994, pp. 237-238):

- a vocabulary in the thousands or tens of thousands.
- words are sorted into parts of speech. including noun and verb.
- words are organized into phrases, which have a recursive structure (one phrase is made up of grammatically arranged constituent phrases, which can be further filled in with further embedded phrases, etc.).
- a phrase connects together certain key words or sub-phrases, called "role-players" or "arguments".
- each phrase has a main role-player or "head" that is the essence of what the entire phrase is most about, and representative of the entire phrase when it comes to relating the phrase to other phrases (the head is generally a verb for a verb phrase and a noun for a noun phrase).
- it is the verb that determines the overall structure of the sentence. Each verb in the lexicon comes with a list of possible relationships it might have with other words/phrases in a sentence. Nouns are marked for case and assigned semantic roles by the verb.
- phrases can be rearranged from their underlying basic grammatical structure (their "deep structure") by transformation rules, in which one element might be displaced from its normal grammatical position in a sentence, thereby leaving a gap or "trace," in the rearranged "surface structure", and forming questions, relative clauses, passives, etc.
- the higher levels of phrase structure include auxiliaries, which signify tense, modality, aspect, and negation.

- new word structures can be created and modified by derivational and inflectional rules. Inflectional rules primarily mark nouns for case and number, and mark verbs for tense, aspect, mood, voice, negation, and agreement with subjects and objects in number, gender, and person.
- the phonological forms of words are defined by metrical and syllable trees and separate tiers of features like voicing, tone, and manner and place of articulation, and are subsequently adjusted by ordered phonological rules.

The first seven universals above could be said to roughly characterize a Chomskian transformative generative grammar. Such a grammar is "generative" because it uses a recursive structure to build sentences of arbitrary complexity from simple elements using combinatorial rules. Most English sentences greater than a few words in length are like snowflakes—unique, never having been uttered before. The number of possible sentences of English (or any other natural human language) increases exponentially with the number of words in the sentence. In Chomsky's system, phrases, not words, are combined according to certain grammatical rules, which allow phrases inside phrases, and so on, yielding an exponential variety of possible sentences.

Chomsky's grammar is "transformative" because it can rearrange and vary the basic underlying grammar, or "deep structure" of a sentence, to produce a wide variety of corresponding "surface structures". Each natural human language has a set of such transformation rules. Thus, a grammar can have two sentences with the *same* surface (apparent) structure, but with *different* deep structures (the sentence "John is easy to please", for instance, looks on the surface to be the same basic grammatical structure as

"John is eager to please", but the former transforms into the entirely different, deeper structure "It is easy to please John").

Generative Grammar

Figure 1 shows a simple example of a phrase structure tree for the English language noun phrase (Pinker, 1994, pg. 98).

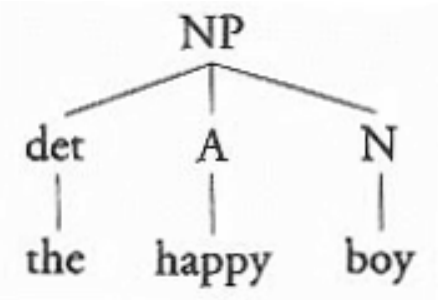

Figure 1. A Noun Phrase.

The grammatical rules for the generation of a noun phrase (or NP) allow a determiner (an article) like "the" or "a" to be following by an adjective plus a noun. The noun is the core of the phrase—its "head"—not the adjective. In "the happy boy", it the noun "boy" that is the essential noun of the phrase, the part that can be taken as representative of the entire phrase for the purposes of relating the phrase to other phrases in a sentence. Note that the issue of whether to put the head at the beginning or end of the phrase is *not* a universal. Some languages are "head-first", some are "head-last".

There are many other noun phrases in English that follow this "det A N" pattern—like "a sorrowful tale", for instance. These noun phrases can then be combined into larger phrases or sentences according to the particular rules of the grammar, as in figure 2 (Pinker, 1994, pg. 99)

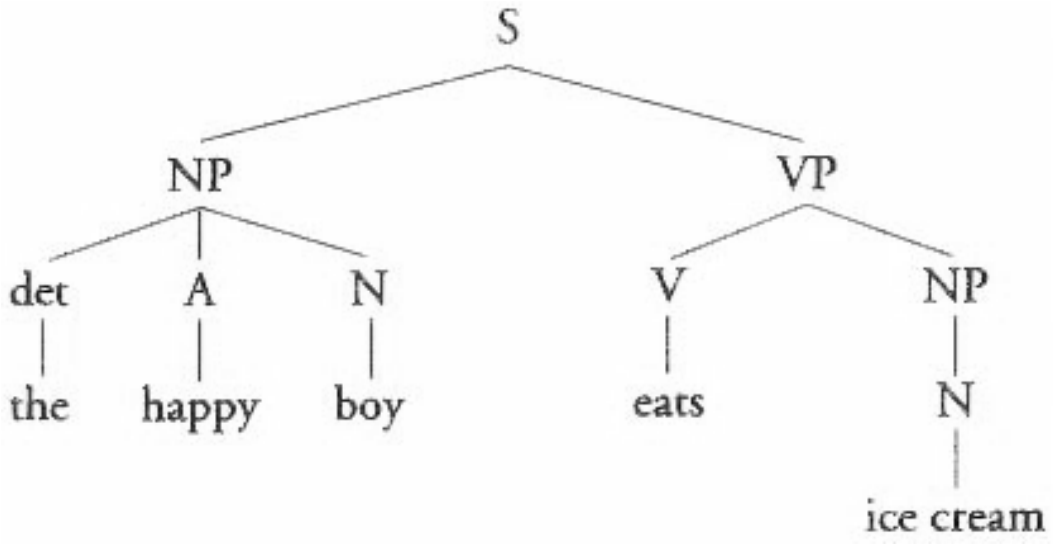

Figure 2. A Sentence: NP + VP.

The verb phrase (or VP) is constructed much like the NP, but the rule calls for a verb followed by a noun phrase (note that there could be alternative possibilities for the expansion of VP in the grammar as well). In the above example, the head of the verb phrase is "eats".

It is the verb that controls the essential structure of the sentence—once the grammar analyzer, or parser, in our brains has determined the identity of the main verb, it is this word that dictates the structure of the rest of the sentence. The verb is looked up in the lexicon, or mental dictionary, which tells the parser what surrounding grammatical context *that* particular verb demands. If it is a transitive verb, it requires an object in the form of a noun phrase. Other verbs might require no object, or an object linked with a preposition like "to" or "from", etc.

Almost anywhere a noun appears, the grammar will allow its replacement with a noun phrase, and likewise for verbs and verb phrases. Entire sentences can even be embedded as phrases inside larger sentences, as in figure 3 (Pinker, 1994, pg. 101).

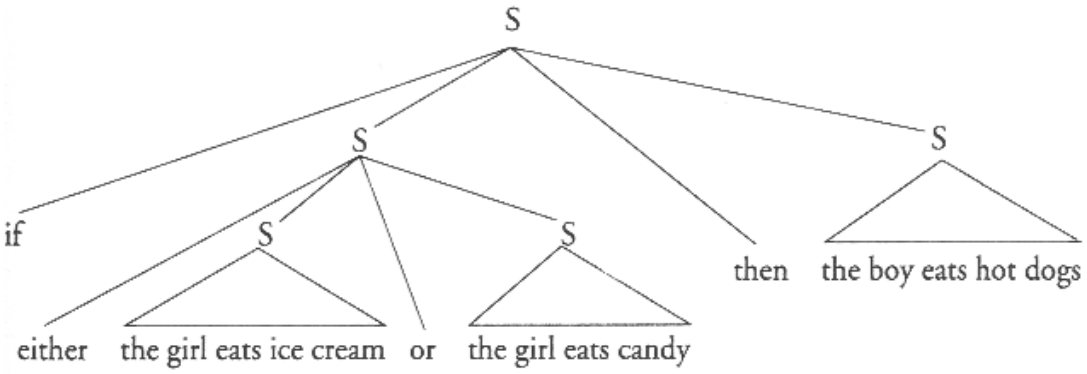

Figure 3. Sentences Embedded as Phrases within Sentences.

It is this embedded phrasal structure that gives a generative grammar the ability to produce a combinatorial variety of different sentences. The rules for the grammar can be codified as a set of production rules, telling how each type of phrase can be further expanded. The above three trees, for instance, use the following production rules:

N → N | [det] + A + N
VP → V | V + NP
S → N + VP | "if" + S + "then" + "S" | "either" + S + "or" + S
N → …noun…
A → …adjective…
V → …verb…
det → …article…

Notational details can vary, but I will use the above notation where the expansion of a phrase is indicated by the arrow "→", the concatenation or joining of two phrases by the plus sign "+", and optional features are enclosed in square brackets "[ ]". When there is more than one alternate way to expand a kind of phrase, the choices are separated by vertical bars "|", which can be read as meaning "or". Primitive words that cannot be expanded are placed in quotes, and phrases that can be expanded only by looking up the appropriate part-of-speech in the lexicon are indicated by placing the name of the part of

speech between two ellipses "… …". Note the difference between the phrase structure trees and the production rules. The trees give the expansions taken in the generation of a particular sentence, whereas the production rules provide the complete syntax of the language, providing the means to produce any grammatical tree, or determine the grammatical correctness of any tree. The actual set of production rules for English would be, or course, much more complex than the few rules given above, which reflect only the grammar of the previous three example trees.

There is, of course, in addition to this grammatical component, the ability to attach meaning to such structures, both in their generation and in their comprehension. Chomsky's system is not intended to reduce all of language generation and understanding into grammar, but it *does* clearly separate the two, implying that there are largely separate circuits in the brain devoted to parsing and syntax, as opposed to conceptual understanding, even if there is an intimate and close association between the two. Chomsky's system thus readily suits the common division of language into three separate aspects: *(1) syntax*, or grammatical structure, *(2) semantics* or meaning and *(3) pragmatics*, being everything else that is involved in the use of language in the real world.

In order to show the advantages of a phrase structure grammar over alternatives, Pinker illustrates how the above sentence might arise from a grammar based instead on linear chains, one which potentially gives options at each step as one builds the sentence from left to right, as in figure 4 (Pinker, 1994, pg. 96).

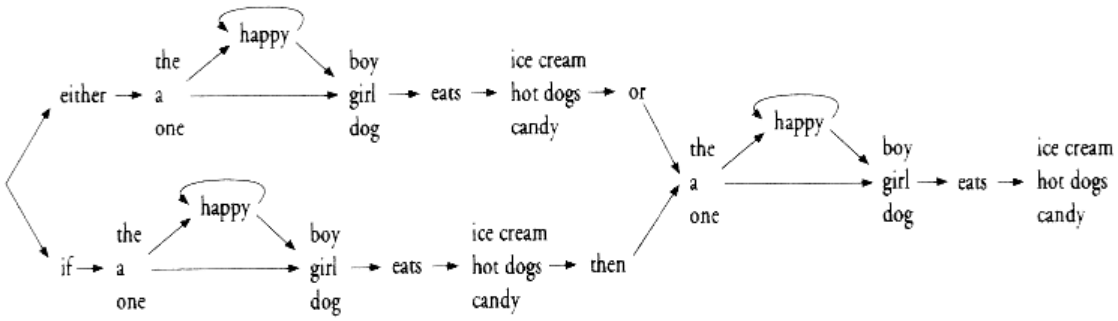

Figure 4. A Linear Chain Grammar.

A variety of sentences similar (or identical) to the one from figure 3 can be generated from such a grammar. If each transition, or arrow, in the diagram is accompanied by a probability, the chain is called a "Markov chain". Such chains are common in mathematical modelling, and for some phenomena are quite realistic. But for grammar, they fall short. While there is some ability for recursively embedded phrases ("happy happy happy boy"), the system entirely lacks the combinatorial variety (exponentially increasing) number of possible sentences that can be built. When a phrase structure like the one in figure 3 is used, on the other hand, any phrase within a sentence could be further expanded in any number of ways. For instance, "the girl eats candy" could be further expanded into "the girl whom I saw yesterday eats candy". There is no limit to the degree to which this can be taken (in principle, that is; obviously considerations of human information processing place some limits on the degree of recursivity a person can handle all at once). With a linear chain, however, there is nothing like this kind of flexibility and variety.

Transformative Grammar

Chomskian grammars are transformative because they allow certain types of phrase structure trees to be transformed into entirely different tree structures. The example given

earlier was the transformation of "John is easy to please" into "It is easy to please John". Pinker gives another common example (Pinker, 1994, pg. 122) in the transformation between passive and active structures, such as the passive (surface) construction "the car was put in the garage" and the deeper "… put the car in the garage" (see figure 5). The transformation goes from surface to deep in language understanding, and from deep to surface in language comprehension.

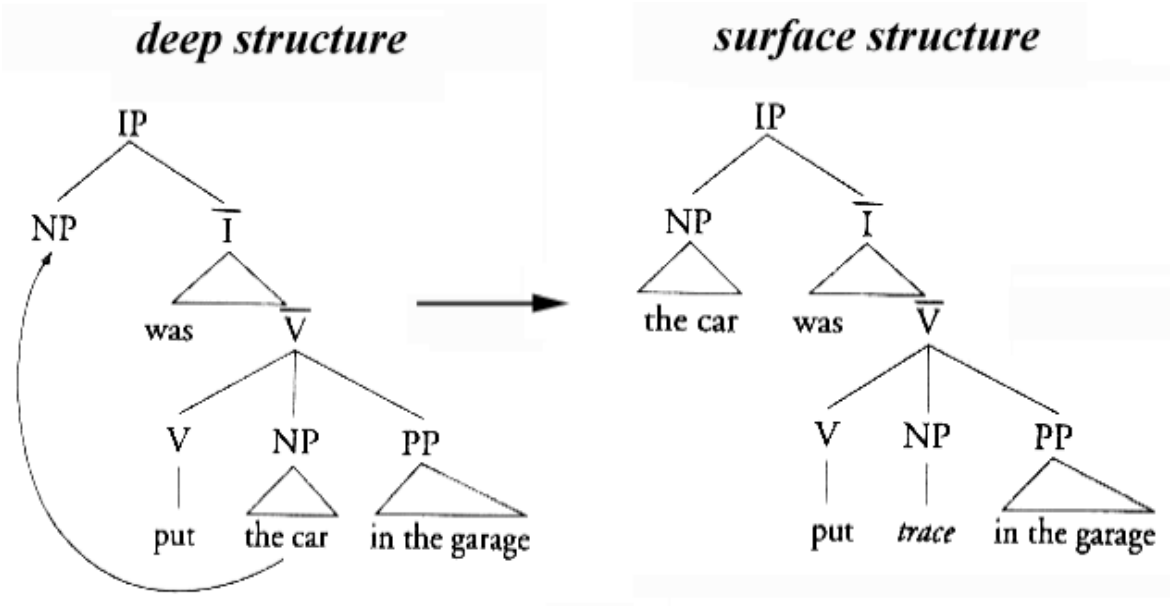

Figure 5. Transformation from active (deep) to passive (surface).

The displaced noun phrase "the car" in the above sentence leaves behind what the Chomskians call a "trace", an implicit mental marker in the gap that is left in the sentence, which provides a link to the new location of the phrase, and thus ties the surface to the deep structure.

Note that the transformation from deep to surface is not the same as the generation of sentences using production rules, although both can be considered kinds of "transformation". Production rules produce particular grammatical sentences by piecing

together words and phrases according to the rules. Transformation rules, on the other hand, transform between entire tree structures, implying a semantic connection between the two structures, rather than simply that they are grammatically correct. It is always possible, of course, that the primacy of one such structure over the others as "deeper" will prove illusory, and that there is simply a series of transformations on the same level, without the distinction between deep and surface. Pinker indicates, in fact, that Chomsky himself is moving away from the notion of deep structures as an integral part of his system (Pinker, 1994, pg. 120-121).

It is supposed by some that the deep structures are somehow closer to "mentalese", the so-called "language" in which thought occurs. Others suppose that deep structures are closer to the grammar of the universal language. Pinker wisely chooses to separate these different issues, however, and takes phrase structure transformations, along with their distinction between deep and surface, as simply a grammatical tool universal to human language, rather than seeing the specific grammar of the deep structures itself as constituting a universal grammar, let alone a grammar of thought (Pinker, indeed, does not really believe in a language of thought).

The Argument for Nativism

Although Pinker's nativism is based on a view of language as a transformative, generative grammar, many of his arguments for it could feasibly be advanced independent of the specifics of that particular linguistic theory. We need to have a basic grasp of these general arguments if we are to decide whether Bruner's theory gives a plausible alternative. I will look briefly at the two major aspects to Pinker's arguments: universality and the poverty of the stimulus.

Universality

The universality of certain particular details of human grammar (some of which were listed earlier) gives Pinker justification for the nativist position. The main counterargument is the contention that the features in Pinker's list are all universally *useful* means of communicating, given the facts of human cognition and environment, and thus might arise out of necessity rather than genetic predetermination. Pinker states, on the other hand that "though many of these arrangements are in some sense useful, their details, found in language after language but not in any artificial system like FORTRAN or musical notation, give a strong impression that a Universal Grammar, not reducible to history or cognition, underlies the human language instinct" (Pinker, 1994, pg. 238). Indeed, if Martians were to study humans, they would conclude that all humans speak the same language, says Pinker (Pinker, 1994, pg. 37).

Pinker uses the comparison with artificial languages like FORTRAN or music more than once. That his list of natural language universals does not apply to these artificial languages impresses Pinker. After all, computer programming languages and musical notations are creations of human beings, just like natural languages. If the features in his list arise from general considerations of communication and human cognition, then why are these same features not found in the artificial languages which *also* are intended for human communication?

The problem with this argument lies in the assumption that just because FORTRAN and classical music notation are used by humans for communication that the inherent constraints on them must be the same as those for natural languages. But this is not necessarily the case, and on reflection indeed seems rather unlikely. If the constraints are

the same, then we could presumably just go ahead and use natural language to communicate computer programs and music. Computer programming languages, by their very natures, are among the most analytical of all languages. Their purpose is to communicate precise processes in as exact and unambiguous a manner as possible. They need *not* be readily interpretable by human beings without a great deal of analysis and work. It is also not clear that music has the same natural constraints as a human language, its primary purpose being more the communication of emotion than conceptual content. These differences in use and purpose between natural and artificial languages could thus just as well be the source of the universals in Pinker's list as some accident of evolution in the evolution of brain circuitry.

This brings us to a sticky point in this entire debate. In order to confirm the innate nature of language, Pinker is compelled to argue that its features are, at least to some extent, arbitrary. In other words, that there are characteristics universal to human language that could conceivably have been otherwise, but instead turned out the way they are through s sequence of accidents in the way the L.A.D. evolved. To support this, he has to argue that there are alternative grammars that would be as useful but which just happen to have a different structure. Yet, the examples of such alternatives that Pinker gives are very weak, for instance he asks why no language has ever used the rule of direct inversion of a sentence—literally running it backwards—to form a question. This is a silly example, surely, as it is not at all hard to imagine that general rules of information processing, human cognition and the requirements of communication would eliminate the unnecessarily complex procedure of completely inverting a sentence regardless of its internal structure.

In arguing against the idea that universals are general features of communicative function and human information processing, Pinker actually claims that for many universals, such an explanation does not work at all. He gives as an example, Greenberg's universal:

> "Greenberg noted that if a language has both derivational suffixes (which create new words from old ones) and inflectional suffixes (which modify a word to fit its role in the sentence), then the derivational suffixes are always closer to the stem than the inflectional ones. … we saw this principle in English in the difference between the grammatical *Darwinisms* and the ungrammatical *Darwinsisms*. It is hard to think how this law could be a consequence of any universal principle of thought or memory: why would the concept of two ideologies based on one Darwin be thinkable, but the concept of one ideology based on two darwins (say, Charles and Erasmus) not be thinkable (unless ones reasons in a circle and declares that the mind must first find *-ism* to be more cognitively basic than the plural, because that's the order we see in language)?" (Pinker, 1994, pg. 236)

Pinker makes the rather strange assumption here that the constraints of "thought and memory" must be entirely of a semantic nature (asking why the *concept* of Darwinism should be thinkable, but Darwinsism not), even though his point is largely a grammatical one! The question is not why such a concept of "Darwinsism" should be unthinkable, but rather why the process of applying an inflectional suffix before a derivational one should be inefficient or unuseful (or whatever), given the use to which language is put, and given the way humans already process information. Pinker thinks it a stretch to imagine how such constraints could give rise to such a universal. Yet, one could equally well argue that it is hard to imagine how constraints of use and cognition would *not* produce a plethora of universal features for which no obvious explanation could be found. Any computer programmer, especially one in the field of AI (artificial intelligence) or robotics, can tell you that extremely complex information processing systems, especially those acting in real-time interaction with their environment, invariably develop all kinds

of incidental idiosyncratic traits that were by no means intentionally programmed in, and which have no simple explanation, but which simply arose through the complex interaction of all the system's parts. Some of these may be arbitrary, but others may naturally arise due to unforeseen relationships between the various parts and functions of a complex system and its environment.

Even aside from unintentional artefacts, a typical AI programmer will also tell you that there will be many unexpected features programmed into a complex system, once designed and implemented, that could not have been *a priori* anticipated. And nobody, I would think, can claim to have that kind of intimate knowledge of brain functioning.

So there could be any number of reasons why natural languages would have certain universal features that have no direct and obvious function, but which are not mere accidents either. Indeed, we ought to expect that there will be many such features, whether language is innate or not, and it will be by no means obvious to an observer what the source of such traits is. To suppose that the only universal features of language that could arise from general processing and functional constraints are those that are strikingly and immediately obvious as such to observers—who have only a passing acquaintance with how the system works internally—seems to me untenable to say the least. And yet this is the assumption we must make if Pinker's argument is to carry any weight.

Who knows exactly why *-ism* cannot be added after the plural *-s*? Perhaps there really is a legitimate cognitive reason why the -ism is a more basic construction to humans than -s, or perhaps there is some obscure information processing principle that guarantees this universal, one that we could understand properly only if we reverse engineered the brain of a language user (a task way beyond the current state of the art). Or perhaps there is

some reason why this rule is simply more efficient and useful than the alternatives. Or perhaps there are multiple reasons similar to all of these that act together to determine this universal. Our ignorance of the reasons may prevent us from concluding that they lie in general processing or cognitive constraints, but it does not thereby allow us to conclude that they lie in the prewired nature of the grammatical circuits either!

Pinker seems to anticipate this counterargument to some extent when he imagines an opponent who "reasons in a circle and declares that the mind must first find *-ism* to be more cognitively basic than the plural, because that's the order we see in language". But it is Pinker who is guilty of faulty reasoning here. It is not reasoning in a circle to suggest that the priority of -ism *might* be a natural tendency of human cognition, and thus its universality does not prove that it is explicitly prewired. Such an argument does not presume, as Pinker claims, that there *is* such a cognitive constraint "because that's the order we see in language". Rather, it simply points out the existence of a *possible* alternative explanation, thus illustrating that Pinker has not yet demonstrated his point.

Of course, it is entirely feasible that language could be innate and yet *still* all its universal features might be explicable in terms of cognitive/functional constraints. Thus, while Pinker's position is potentially confirmable, it would seem that it might actually be unfalsifiable—at least with respect to the argument from universality. For this reason, arguments from universality are weak when considered on their own. It may be possible to demonstrate exactly where the universality of certain features comes from, but it seems unlikely that one could do so conclusively by just compiling lists of such features. One would need to actually study the neurology and evolution of the brain in detail to actually demonstrate innateness from universality, but such arguments are currently way beyond

our capability. A much more convincing argument for innateness comes not from universality but from the poverty of the stimulus.

The Poverty of the Stimulus

The most convincing argument for nativism is the extreme ease with which children seem to learn apparently very complex grammars. Surely anything as difficult to learn as grammar, the argument goes, would require much more rigorous training and would not be so totally automatic as language is once it is learned.

Pinker points out that children go from simple nonrecursive phrases to the full power of generative grammar in a matter of months, at a rate so fast that the transition cannot be properly analyzed. Children simply do not get enough examples of language in that time to learn to do all the complex things that they do with it. Most of the machinery of grammar is therefore innate, he claims. Particularly convincing is his argument from creolization (Pinker, 1994, pp. 32-39)—that children raised in environments with grammatically inadequate pidgin languages will develop their own full-blown sophisticated languages, different from their parent's in kind not just degree, *in one generation*. Similarly, he gives the example of the deaf child Simon (Pinker, 1994, pp. 38-39) raised by parents who sign ASL (American Sign Language), but only inadequately, having learned it in adulthood. Yet Simon, in spite of obviously inadequate training, learned many of the subtleties of full-blown ASL *on his own* without any explicit training at all. This is not just poverty of the stimulus, but more like complete lack of stimulus!

One could always counter this argument in a manner similar to our critique of the universality argument—by suggesting that skills not acquired through explicit training

develop due to more general cognitive and functional constraints. And indeed, one must be wary of assuming that Simon hit upon the above-mentioned subtleties of ASL solely because they were already prewired in his brain, since it is at least theoretically possible that they could have developed due to more general constraints. However, this does not I think fully mitigate the force of Pinker's argument, since if children really do learn language as fast as he claims, a convincing argument to the contrary will, I think, have to do more than just note the theoretical possibility that the process is really a learning process. One could explain away almost any striking pattern in this way. In the case of the universality argument, there was, I think, less onus on Pinker's opponents to explain where the universal traits come from, since any complex information processing system can be expected to have such idiosyncratic artifacts—both due to their programming *and* to more general constraints—and it is not always possible to disentangle these differing factors from each other, since we are dealing with a complex system with complex emergent properties. The whole argument from universality therefore has less force than the argument from the poverty of the stimulus, which is tougher to dismiss. The fact is: children learn language *really fast!* This is not a characteristic that we would have expected if language were completely learned, and thus—unlike a collection of arbitrary universals, which we would expect to find in a complex system in any case—here is something that begs for explanation! Just how can children develop full linguistic ability with such staggering speed? How can they do so without an explicit grammar engine already built in?

It is perhaps appropriate at this point to advance my own opinion that there is no great need to decide between the nature and nurture camps. It is entirely possible, perhaps even

likely, that the truth is somewhere in between the two extremes, and language acquisition is a complex interaction between prewired predispositions and instincts and learned behaviour under certain universal cognitive and functional constraints. However, Pinker's argument is at the extreme nativist end of the spectrum, and if we are to critique this position, whether we are on the opposite end of the spectrum or just proposing a middle ground, his argument from the poverty of the stimulus is still one to be reckoned with. Some plausible story must be given for how grammar can develop so fast without being *entirely* (or almost entirely) prewired.

Bruner's theory of language acquisition—which has come to be known as "scaffolding theory"—provides one promising alternative to the extreme nativist position, by positing that much of the complex machinery of grammar has in fact *already been learned* at the beginning of the grammatical explosion described by Pinker, since—and this is Bruner's great contribution—the learning of language goes beyond the mere learning of language.

Bruner's Scaffolding Theory

Bruner's basic premise is that, contrary to the Chomskian picture, syntax, semantics and pragmatics are necessarily inseparable and interdependent. Hence, it is a mistake to look at just the sentences that a child produces, charting their grammatical progress, and claim that this maps out the linguistic learning process. Pinker does something like this when he concludes that grammar learning explodes at speeds that defy analysis.

But the child is not spending his entire life taking grammar lessons! In fact, Bruner points out that parents do not really teach children grammar at this stage. The feedback the children are given is based on communicative effectiveness, not grammatical

correctness. In other words, if the child is effectively communicating, the parent is satisfied, whether the grammar is correct or not. Most of what the child is learning at this stage is not linguistic, but involves social interaction and communication—more often than not with Mommy or other primary caregiver. Bruner takes the important and radical step of considering that the learning of these (apparently) nonlinguistic skills might in fact be part and parcel of the learning of language. If this is the case, children may have, in a sense, already learned a great deal of language (or at least much of what is required in order to learn language) before they speak a single word!

Bruner claims—and his claims are based on extensive case studies of language development in young children—that the focus for a child in the pre-linguistic stage is the learning of fixed routines or scripts that are repeated over and over again, and follow a set ritualistic pattern. Many of these are games, like peek-a-boo and hide-and-go-seek. They are not learned by example, in a linear stimulus-response fashion. Rather, each routine is a complex interaction between child and parent, each modifying their action in real-time according to the feedback from the other communicating partner. The behaviour is goal-directed. It is a tightly close interactive feedback loop (the "closed loop" of cybernetics and feedback control theory) in which the child learns to interact with Mommy to achieve some (possibly shared) goal.

This highly nonlinear cybernetic process often involves a shared focus on some object, which will result in labelling the object with a word or phrase. But it is wrong to suggest that the mother is taking the child around and pointing to objects and naming them. The object comes under joint attention within the context of a systematic routine script or game, which has its own goals quite independent of the naming of objects.

Phrases and even sentences are often used in the script, but in the early stages their internal grammatical structure is irrelevant. Their function is to mark certain milestones in the game, and as such, while they may have internal structure to Mommy, she implicitly understands that to the child they are simply vocal markers.

Yet, even at this prelinguistic stage, the child is capable of learning a complex script with its own structure. This structure, Bruner claims, is "virtually syntactic." Indeed, even before the child can speak with any sort of grammar at all, such games could be considered genuine "protoconversation" (Bruner, 1983, pg. 46-47). Bruner is not specific as to just how much of the traditional grammatical machinery children are supposed to be able to learn at this stage, but his theory is only an interesting response to Pinker if such games have at least the basic structure of transformative generative grammars, and so it is this possibility that I would like to explore. Is it possible that by the time a child begins to produce grammatical sentences that it has *already* learned the basics of producing combinatorially recursive, perhaps even transformative, structures? Certainly, if the games of early childhood could be shown to have such language-like structure themselves, even while being what would traditionally be called entirely nonlinguistic, then this would go a long way to dispelling the idea that grammar must be entirely prewired simply because it is learned with such blinding speed. Considered in tandem with the learning of games, the entire language acquisition process might be much more gradual than it seems to be from within the Chomsky-Pinker paradigm—and perhaps it will now cease to defy analysis, since an integral part of the process is no longer being dismissed as "nonlinguistic" and therefore of no interest.

Of course, there must still be a route from grammar-like game to actual grammatical speech. But it is plausible that such a route could be gradual and non-miraculous. The games already have vocal markers. As the child's sophistication with the game increases, two important things happen, according to Bruner, to change the structure of the game. First, more and more of the machinery of the game is handed over to the child (Bruner, 1983, pg. 60). Secondly, the game is gradually improvised and modified, becoming more and more complex, until the child can eventually generalize the procedures beyond the context of the narrowly defined game: "In time, the child was able to turn virtually any situation into a kind of hide-and-seek. This 'detachability' of form from context confirms one in claiming the abstractness of children's early behaviour." (Bruner, 1983, pg. 122).

Perhaps, as this process develops, some of what used to be handled by acting out could be transferred onto the vocal markers, which would then be required to have structure. But they would be taking over the structural role of a sequence of actions already learned. If these actions were played out according to grammar-like rules, and more and more of the game were then transferred over to vocalization, it is just feasible that the child might appear to learn grammar unreasonably fast, if the game in which the learning of the grammar was initially embedded were not considered as part of the learning process.

This whole process of learning structure through games, and then gradually moving the games from nonlinguistic to linguistic, has come to be called "scaffolding theory", in analogy with a scaffold, which provides an initial rudimentary structure upon which to build an intended structure, but which is itself thrown out once it has served its purpose.

The "Grammar" of Peek-A-Boo

Figure 6 shows Bruner's tree diagram of the structure of a common childhood game, peek-a-boo (Bruner, 1983, pg. 50). In this case, the mother hides a small clown figure, which repeatedly reappears and disappears, to the delight of the child. A typical script of the mother's utterances can be read off from the bottom leaves of the tree, from left to right.

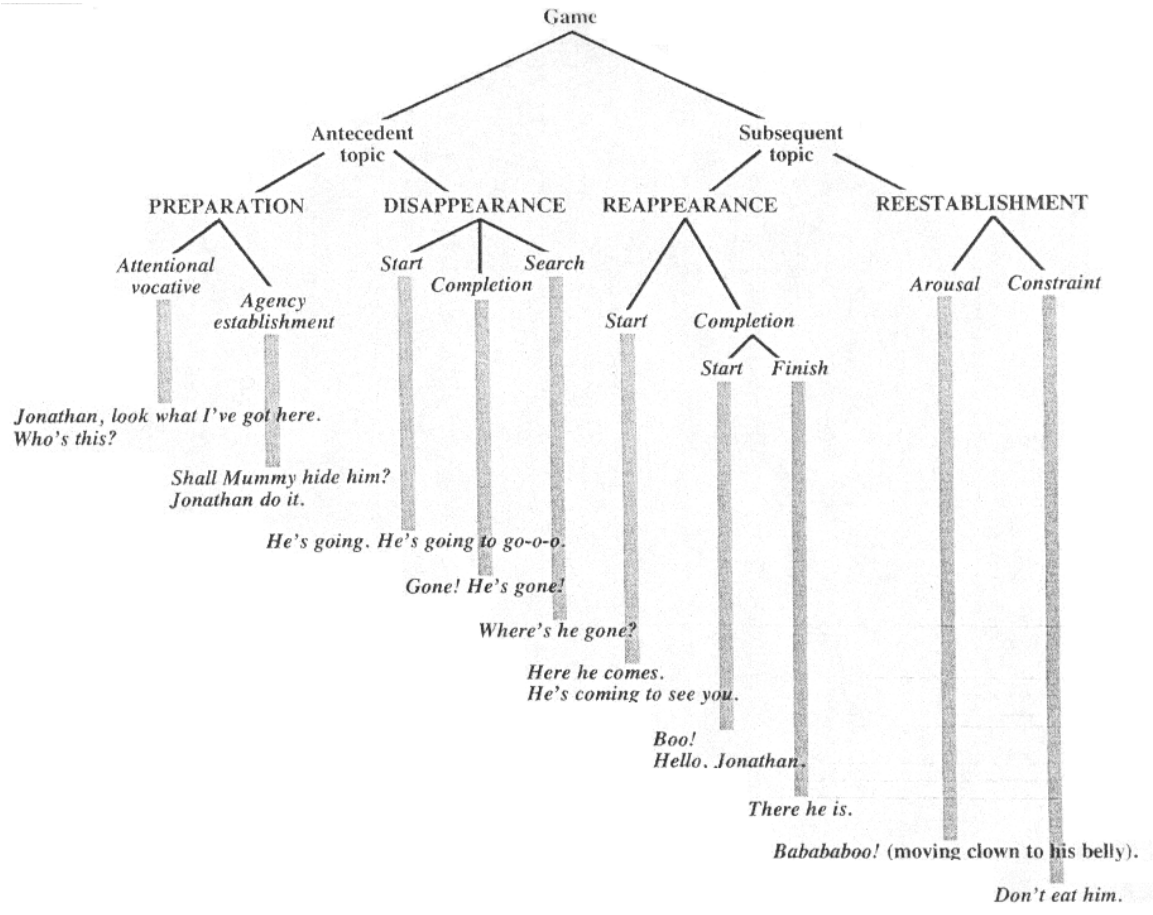

Figure 6. The Structure of Peek-A-Boo.

The tree-like structure is intriguingly similar to Chomsky's phrase structure diagrams, enough to make us wonder whether the learning of such a game might indeed be related cognitively to the learning of grammar. I am personally by no means ready to concede

this point. In some ways, it seems implausible, since the nature of games seems so different from the nature of language. On the other hand, to someone who did not know better, the gestural behaviour of ASL speakers might seem equally nonlinguistic, and yet this behaviour is almost universally recognized as linguistic.

My goal here is not to prove Bruner right, but lay out some of the more general features that his games should have if they are to be said to bear directly on the learning of grammar, and to make the best case I can for their having such structure. I do not, however, have access to actual data on childhood games, so my conclusions will be tentative only, and contingent on experimental verification. I will therefore not claim that childhood games *have* certain grammatical features, but will content myself to lay out *which* features they must have for Bruner's theory to provide a strong response to Pinker (it should be noted that the main goal of Bruner himself is to provide a better idea of how language is acquired, not to *directly* refute Chomsky or Pinker).

The Problems With Bruner's Peek-a-boo "Grammar"

At first, Bruner's scripts seem a poor way to teach grammar, since the child is not even given feedback on the basis of grammar, but rather on the effectiveness with which they play the game. Yet if we look at the structure of the game itself carefully, rather than of its sentences which are merely a few of its parts, we find that it has a certain grammar-like structure all its own—we might even attempt an analysis like figure 6 that is reminiscent of phrase structure diagrams. Bruner even talks of the “deep structure” versus the “surface structure” of such games. Peek-a-boo, for instance, can be varied in all kinds of ways, yet the basic underlying structure of disappearance followed by reappearance (the "deep" structure) remains the same.

There are serious deficiencies with this scheme as Bruner presents it, however. He makes no detailed analysis of the structure of peek-a-boo or the other routines he mentions, beyond the sort of analysis provided in figure 6. However, the structure in figure 6, as it stands, does not really appear to be a grammar in Chomsky's sense at all, as it lacks certain basic features of a transformative generative grammar. I do not mean to suggest the Chomsky's theory is the last word on what language is, but it clearly has been very useful in describing what makes language as powerful a tool as it is, and what its grammatical features are, and Bruner clearly means to compare his games to Chomskian grammatical structures. Therefore, for his point to carry through, his analysis must allow for combinatorial recursive generation, at the very least, and hopefully something like transformation between deep and surface structures as well. Unfortunately, it is not clear from figure 6 that his games can do either of these things. The "grammar" in figure 6 could be formalized in production rules as follows:

Game → Antecedent Topic + Subsequent Topic
Antecedent Topic → Preparation + Disappearance
Preparation → Attentional Vocative + Agency Establishment
Disappearance → Start + Completion + Search
Reappearance → Start + Completion
Reestablishment → Arousal + Constraint
Completion → Start + Finish

These rules give us no means for recursive expansion at all, and the possibility of transformative grammar is really only hinted at by Bruner. Furthermore, neither phrase-structure recursion nor tree-structure transformations are readily apparent in the example games Bruner relates. Indeed, the above rules seem almost intentionally designed to avoid the possibility of recursion! "Reappearance" is expanded into "Start + Completion", while "Completion" expands into "Start + Finish". Now what is the

difference between "completing" and "finishing"? Why not consider these the same type of action? If we replace "Completion" with "Finish", in fact, it provides the possibility of recursion. A disappearance could now have any number of levels or substages of completion. It almost seems as if Bruner wants to avoid the messiness and possible infinite regress inherent in recursion, and yet this is exactly the feature he needs if he is to call his structures "virtually syntactic".

Of course, to really make Bruner's grammar into a recursive generative one, we will want to provide more opportunities for recursion than just this. The child should have the option, for instance, of embedding entire games within other games, or having sub-games that can be embedded within a variety of different kinds of other games. Of course, it is possible that Bruner does not illustrate this sort of structure because he did not find it in his empirical studies. However, I suspect it is equally possible that such detail was simply beyond the scope of his research at the time. However, if his theory is to be a strong alternative to Pinker—and even if it is to meet all the claims that Bruner himself makes for it—it must provide for recursive structure.

A Recursive Transformative Action-Structure Grammar

I have attempted to modify Bruner's production rules to make them more recursive, and allow for something more like combinatorial variety. In addition, I have generalized some of the "phrase" types so that they are not specific to the peek-a-boo game, but more on the level of generality of "sentence" and "noun phrase", since Bruner's grammar seems to mix the two levels of abstraction somewhat—it is not clear to me whether his "Game" means "structure of games in general" or "structure of the peek-a-boo game". So, for instance, disappearance is replaced here with the more general "Conflict" and

reappearance with "Resolution". More specific recursive rules could, of course, be created for the peek-a-boo game itself.

Production Rules:

Game → Antecedent Topic + Subsequent Topic
Antecedent Topic → [Preparation +] Conflict
Subsequent Topic → Resolution [+Reestablishment]
Preparation → [Attentional Request] + [Agency Establishment]
Attentional Request → Attentional Vocative | Attentional Gesture
Conflict → Action
Action → [Start] + Finish [+ Segue] | Game
Segue → Action
Finish → [Action] + Event + [Outcome Establishment]
Start → [Attentional Request] + [Action Initiation]
Resolution → [Action +] Outcome Establishment
Establishment → Object Establishment | Agency Establishment
Outcome Establishment → Reestablishment | Object Establishment | Absence Establishment
Reestablishment → Arousal + Constraint
Action → …action…

Actions (lexicon):

Events:
- Object Coming: "Here he comes", "He's coming to see you"
- Object Going: "He's going", "He's going to go-o-o"

Protocols:
- Arousal:
  - "Babababoo!", "Boo!", "Hello, Jonathan"
- Constraint:
  - "Don't eat him!"
- Establishment:
  - Object Establishment: "There it is!", "There he is!"
  - Agency Establishment: "Shall Mummy hide him?"

Requests:
- Attentional Request:
  - Attentional Vocative: "Look what I've got!", "Look at this!"
  - Attentional Gesture
- Identification Request: "Who's that?", "What's that?"

I make no claim that the rules as I present them are ideal or even correct in their details. The details are unimportant for our present purposes, since they must be worked out by those in possession of empirical data. What is important for the time being is only

that these new rules allow games and sub-games to be recursively embedded within each other, with some degree of flexibility.

So, for instance, any "Action" allows for a transition action, or "Segue" (which is a "Search" in peek-a-boo), which can itself have further internal structure. Actions can have any number of levels of nested subactions, or they can terminate, either with a single action or some nonrecursive structure ("Start + Finish"). Note also that any action can also be itself an entire sub-game within a game.

Our new production rules yield a somewhat different expansion of the peek-a-boo game from figure 6, shown in figure 7.

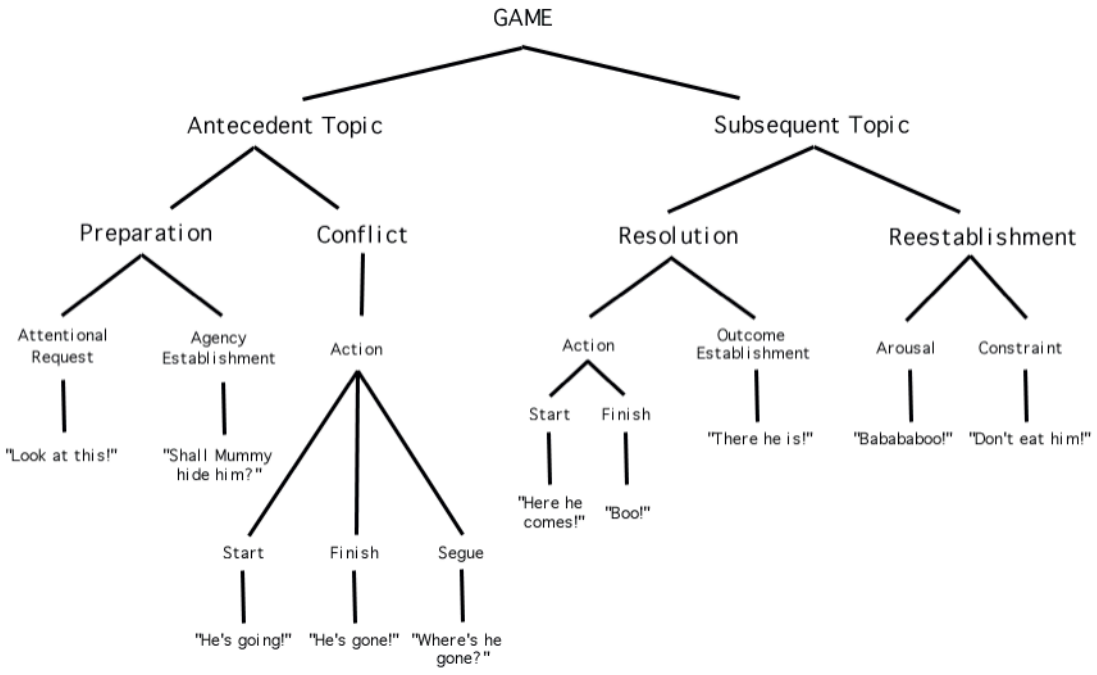

Figure 7. Recursive Peek-A-Boo.

Since this is actually the same game as in figure 6—just a reanalysis of it—there is still a lack of obvious recursivity for our purposes. But with our new production rules, we could easily imagine a game with a more complex structure. Figure 8 shows a hide-and-

go-seek game with a peek-a-boo game embedded within it. This particular hide-and-go-seek game involves hiding a doll, and then searching it and finding it. It might be played with an adult or other child, where one hides the doll and the other seeks it, or it might be rehearsed by the child alone, where they pretend not to know where they hid it once they go looking for it. Once the doll is found, the reestablishment consists in the child cradling the doll, examining it, or otherwise making sure it has survived its ordeal and is in good health.

In the example shown, immediately after the doll is hidden (conflict creation), and before the doll is found (conflict resolution), there is an opportunity for an (optional) segue or interlude. In this case, it takes the form of a peek-a-boo game. The child hides the doll, which immediately begins a peek-a-boo game, which could repeat several times until the child returns to the hide-and-go-seek game, and the hidden doll now reappears, not as part of hide-and-go-seek, but as part of peek-a-boo.

Whether and to what extent children actually do embed games within games, or actions within actions, is an empirical question I do not attempt to answer. But if it could be shown that children's games do have this kind of recursive structure, Bruner's theory as an alternative to the extreme nativism of Pinker starts to look at least plausible.

Note that since the preparation for peek-a-boo has already been set up by hide-and-go-seek, this leaves a trace in the peek-a-boo tree, arguably an instance of structure transformation. The only problem with arguing that this is an instance of transformative grammar is that the actual sequence of events for peek-a-boo remains fixed. It might be argued that this "trace" is, in this instance, more of an overlap between the two subtrees than an actual gap in one.

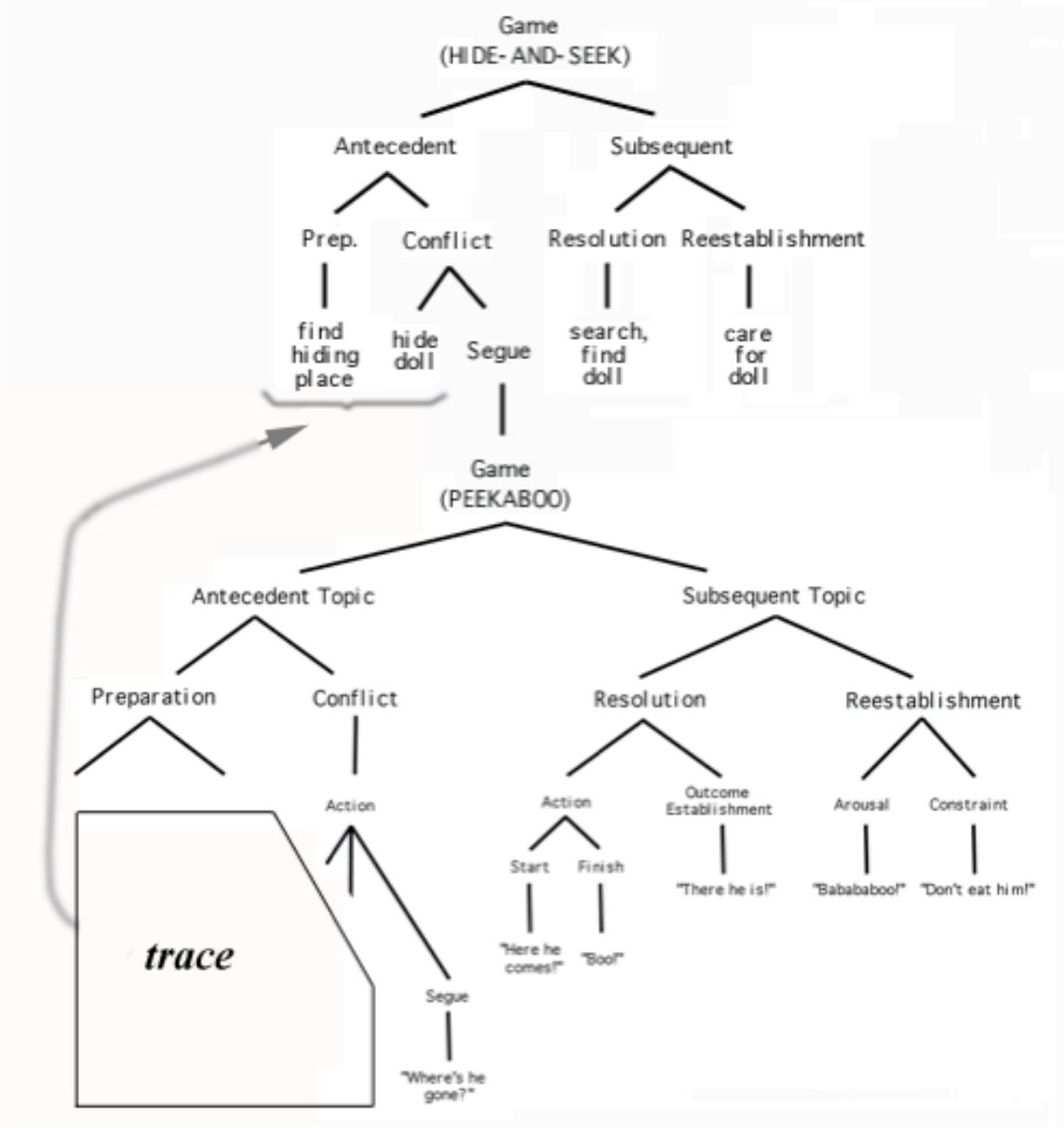

Figure 8. Embedding a Game within a Game.

Figure 9 shows a clearer example of what a trace might look like in a children's game. This is a new kind of construction, called a "flashback game", which works much like a literary flashback. Let us say, for instance, that the child happens upon the doll lying in a heap, apparently in bad shape. The child picks the doll up and cradles it, going through the caring motions involved in the reestablishment phase of hide-and-go-seek. The child asks, in effect if not with actual language, "How did you get here, dolly? What oh what

has happened to you?" This triggers the hide-and-go-seek script, but it is now out of order. The child therefore flashes back, acting out the hide-and-go-seek script that lead up to the doll being in the sorry condition in which it was found. When the child reaches the reestablishment phase, it is back where it started and may not choose to fully act it out again, since it has already established this part of the game, and is just returning to where it was.

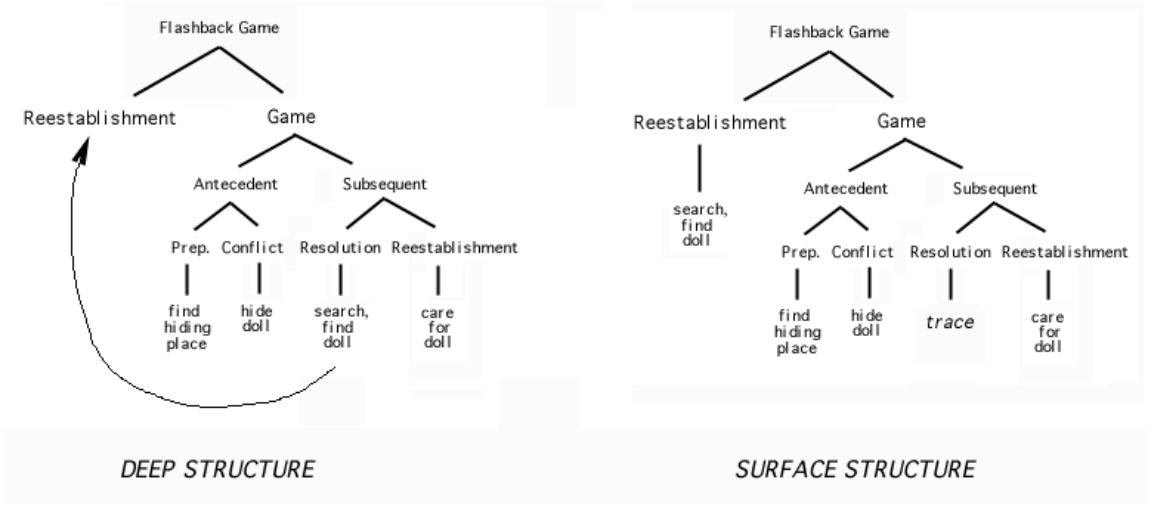

Figure 9. Transformative Action Grammar.

I do not mean to suggest that this example is realistic or even described at the right age level for our current purposes. These are issues that need to be addressed by someone with the proper empirical tools. My purpose is only to show the *kind* of structure the games need to provide a strong explanation for the grammatical explosion that so impresses Pinker. If indeed it could be shown that such games *at the right time in a child's development* have at least some significant recursive and transformative structure, then Bruner's theory becomes an intriguing possibility. If it could be shown that there is no such complexity of structure in a child's games, then Pinker's argument from the

poverty of the stimulus stands in almost as much need of explaining as ever, even if Bruner's theory still has some interesting things to say about language acquisition.

Conclusion

The sceptical reader may be thinking "A game is a game; it is not language. How could these kids generalize from action-structure manipulation to similar linguistic manipulation without innate knowledge?" Bruner's answer would be, of course, that they were not expected to suddenly make the jump. The games themselves contain embedded phrase structures within their action structures, and sophistication of manipulation in the latter is *gradually* expanded, within the context of *meaningful* communication with the parent, to include the phrase structures. So, while to an adult linguist, the competence "miraculously" displayed by the child in grasping the deep structure of a passive sentence seems to "come from nowhere", to the child it is just the next step in a process that has been gradually evolving almost since birth. To the child, there is no strong line of distinction between what it is doing in the phrase-structure manipulation and in the action-structure manipulation. This distinction will come to mean more to it as it grows older, perhaps eventually becoming a professional linguist, but to the two or three year old just learning language, it is all part of the same process.

At least, this is the best case I can make for Bruner at this time. I confess I still share some of the scepticism mentioned above. First of all, it is not clear to me that children do reach the required degree of sophistication at the appropriate time in their development—however, that is an empirical question to be answered by others. More significantly, it is still not entirely clear to me whether a recursive game could be said to explain recursive grammar. The proficiency of a child at talking is still remarkable and striking, and even if

Bruner's games turn out to have the required structure, it is very possible, even likely, that Pinker might have a plausible and strong counterargument against it. Nonetheless, it would provide a plausible alternative to which Chomsky, Pinker and other nativist transformative generative linguists would need to carefully respond.

Personally, I do not think there is any easy answer to the question of the innateness of language. While Chomsky and Pinker may go too far in one direction, it is, I think, equal folly to go to the other extreme and assume that language is entirely a learned behaviour with absolutely no innate predilection to its acquisition. Even if Bruner's explanation turns out to be too weak to explain away the poverty of the stimulus, and Chomsky and Pinker's basic point remains—that children learn complex linguistic behaviour more readily than one would expect if it were purely learned in the way, say, working pottery is—still, this would not justify an extreme nativist position. Accepting that children are pre-wired in such a way that they are good at acquiring language is not at all the same as saying that they have linguistic *knowledge* pre-wired in their brains, which is what the whole notion of a universal grammar seems to be about. The truth may be in the gray area in the middle that is always so hard to clarify with black-and-white laboratory experiments. Children may come with a certain pre-wiring that makes them good at learning to play certain kinds of games, like the linguistic one—perhaps even especially the linguistic one—but which is part and parcel of their general ability to act out social scripts and to *communicate*. Scaffolding theory provides a way of unifying these more general abilities with that of language so that they are seen as a whole, rather than as isolated modules, one of which is labelled "language".

If, however, Bruner's theory does pan out in something like the way I've outlined above, it is possible that Chomsky and Pinker are making a dangerous mistake in assuming that the stimulus is impoverished at all, because they fail to recognize the principle Bruner starts out with: that syntax, semantics and pragmatics are all part of a single, inseparable, interdependent process of communication and social interaction.

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