

10 The Innate Endowment for Language: Underspecified or Overspecified?

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Some linguists argue that people have explicit innate knowledge, not only of the universal aspects of language, but even of the options that define different languages. Other researchers find this view unparsimonious and perplexing from an evolutionary perspective. They claim that linguistic diversity shows that our innate knowledge of language is incomplete, and is filled in by nonlinguistic learning—a view that they claim should be preferred on a priori grounds. This chapter questions whether the underspecification view is really feasible and whether it is more parsimonious than the overspecification view, drawing on examples from certain African languages. It also shows that the perplexity evoked by overspecification theories disappears if language has a concealing purpose as well as a communicating purpose, similar to a code.

1 A fundamental puzzle of language

Since the beginning of the cognitive science research paradigm, language has provided some of the strongest evidence that the human mind has substantial innate structure. Noam Chomsky has forcefully presented the basic arguments for more than forty years, and they have been confirmed, extended, and supplemented by many others. Adult speakers of a language have robust and reliable judgments about which sentences are or are not possible, and what their range of interpretations can be. These judgments exist for configurations that speakers have no prior experience with and for which there is no simple account by analogy to simpler sentences. Typological work has revealed important linguistic universals that are not a priori true of any moderately well-designed communication system, but that are contingently true of all human languages. Developmental research has shown that children acquiring a language never make certain types of errors that seem like reasonable inductive conjectures. Children do make mistakes, but only mistakes that fall within the constrained range of possibilities that are attested in actual natural languages (see Crain and Pietroski (this volume) and references cited there). Studies of creolization and deaf populations have shown that people

spontaneously create a complete and orderly language out of the unsystematic semi-meaningful chaos that surrounds them. These lines of evidence converge into a powerful argument that humans are born with the foundational principles of human language. This idea is so important to much linguistic research that we linguists have our own name for the innate endowment as it applies to the human capacity for language: Universal Grammar (UG).

Yet language is not completely and uniquely specified in human minds from birth. Humans obviously speak different languages. And the differences reach to the deepest levels of sentence structure and interpretation. Compare, for example, the Japanese sentence in (1) with its English translation.

- (1) John-ga Mary-ni hon-o ageta.
 John Mary-to book gave
 ‘John gave the book to Mary.’

In addition to the individual words in Japanese being different, they are arranged quite differently. In Japanese the verb comes at the end of the sentence, after the direct and indirect objects, whereas in English the verb comes before such elements. Moreover, in Japanese the preposition meaning ‘to’ comes after the noun ‘Mary’, whereas in English it comes before. Overall, the Japanese rules for ordering words into phrases, clauses, and sentences are systematically different from the English rules. For some domains of cognitive science—visual perception, or motor coordination, perhaps—it might be reasonable to suppose that all the interesting cognitive structure is uniquely innately specified, but this is not plausible for language. Indeed, the differences among languages are usually more striking than the similarities. It takes education and sophistication to see the similarities among languages, whereas the differences are manifest, and torment us in foreign language classes and train stations.

The study of language is thus particularly interesting for cognitive science in part because one cannot ignore either its universal features or its culturally variable ones. It is an ideal domain for investigating the interplay of similarity and difference.

Granted that the innate endowment for language does not specify one grammatical structure for all human languages, there are only two logical possibilities. The first is that UG could *underdetermine* the grammar of particular languages. This would mean that some grammatical points are left open to be filled in from the

environment using general learning devices of some kind. The alternative is to say that UG *overdetermines* the grammar of particular languages. On this second view, UG specifies multiple choices at certain points, with the result that young children in some sense “know” many grammars. Grammatical development can then be thought of as identifying which choices characterize the ambient language and discarding the rest. These choices are known as *parameters* (see Baker (2001) for details). On the first view, the innate endowment contains less information than is needed to construct a coherent natural language; on the second view it contains more than is needed. A foundational question is which of these views is correct. Is UG like an unfinished novel with the ending left to the reader’s imagination, or like a book with several endings from which the reader may pick? Is it like a recipe that says nothing about how the dish should be spiced, or like a recipe that specifies different spicing formulas depending on whether one wants it hot, or sweet, or bland?

Both views have their proponents. Among psychologists, the underdeterminist view predominates. Pinker and Bloom (1994), for example, endorse it in the following passage:

Parameters of variation, and the learning process that fixes their values for a particular language, as we conceive them, are not individual explicit gadgets in the human mind.... Instead, they should fall out of the interaction between the specific mechanisms that define the basic underlying organization of language (‘Universal Grammar’) and the learning mechanisms, some of them predating language, that can be sensitive to surface variation in the entities defined by these language specific mechanisms.

The linguist Frederick Newmeyer (1998: 363-64) also takes this view:

It ... strengthens the case for individual parameter settings being learnable without demanding that the child literally choose from an innately-specified set.

However, it does seem clear that one does have to reject the idea that all principles, and their range of possible parametric variation, are innate.

Most so-called functionalist linguists would concur, since they generally downplay the Chomskian notion of Universal Grammar anyway.

In contrast, Chomsky since about 1980 and many linguists who follow him are overdeterminationists. Some representative passages from Chomsky's writings include:

Each of the systems of [Universal Grammar] has associated with it certain parameters, which are set in terms of data presented to the person acquiring a particular language. The grammar of a language can be regarded as a particular set of values for these parameters, while the overall system of rules, principles, *and parameters* is UG, which we may take to be one element of human biological endowment, namely, the "language faculty". (Chomsky 1982: 7)

Languages may select from among the devices of UG, setting the parameters in one or another way, to provide for such general processes as those that were considered to be rules in earlier work. (Chomsky 1981: 7)

Within the P&P approach the problems of typology and language variation arise in a somewhat different form than before. Language differences and typology should be reducible to choice of values of parameters. (Chomsky 1995: 6)¹

Here the child's task is seen not as filling in what is left open, but as choosing among several specified options. Encouragement for this view comes from properties of phonological development. Very young infants are able to distinguish pairs of sounds from any language when they hear them, but they lose this ability for all but the sounds in their native language after about six months (Pinker 1994: 253-64 and references cited there). In a sense, the youngest infants "know" more sounds than older ones do. Overdeterminists believe that this extends to other domains of language as well.

Ultimately the choice between overdeterminism and underdeterminism is an empirical one. But relevant facts are not easy to come by in this area. Babies are complex and squirmy, and there are limits to what one can do to them. This chapter thus explores some of the more conceptual dimensions of the issue, so that we can judge

¹ It is debatable whether the "Minimalist Program" outlined in the later chapters of Chomsky (1995) represents an important shift in this conception or not. I do not explore this issue here.

more precisely what to look for and how hard to look for it. I argue against “easy underdeterminism”, the attitude that underdeterminism is self-evidently true, or at least so plausible that it should be abandoned only in the face of overwhelming evidence to the contrary. After reviewing the embryonic arguments that are offered for underdeterminism, I show that, when one looks at some realistic cases of crosslinguistic variation, it is not so obvious that underdeterminism is feasible, or that it is simpler than overdeterminism. I also claim that there could be a useful function for overdeterminism, in that natural languages can be used as ciphers—tools that reveal information to your friends while concealing it from your rivals. I conclude that cognitive scientists should be open to the idea that the innate endowment is so rich that it specifies more than is necessary for any one organism to function—at least in the domain of language, and perhaps in other cognitive domains as well.

2 The Appeal of Underdeterminism

Why do most cognitive scientists not under Chomsky’s direct influence find themselves drawn toward the underdeterminist view? I think their reasons can be boiled down to three key themes: underdeterminism seems *possible* and *parsimonious*, whereas the existence of an overdetermined UG would be *perplexing* from an evolutionary perspective. Therefore, underdeterminism is to be preferred.

The argument from possibility goes roughly as follows. Some features of language seem easy to characterize with relatively little language-specific knowledge. Word order in Japanese as opposed to English is a good example. We certainly have a nonlinguistic ability to detect differences in the temporal order of two stimuli: we can distinguish a “beep” followed by a “thunk” from a “thunk” followed by a “beep”, for example. Now every transitive sentence in Japanese has the object before the verb and (almost) every transitive sentence in English has the object after the verb (see (1)). There is nothing subtle or obscure about this grammatical difference, nothing that obviously puts it beyond the capacity of relatively dumb nonlinguistic cognition. If children can hear objects as “beep” and verbs as “thunk”, they should be able to learn the word order difference reliably without the help of UG. Parameters such as these can therefore be left unspecified by the innate endowment without jeopardizing the reliability of language learning. So underdetermination seems possible.

Given that underdetermination is possible, it seems clear that it is more parsimonious. Underdeterminism by definition attributes less innate knowledge/structure

to the human mind than overdeterminism does, and less is better. General considerations of scientific simplicity and elegance thus favor underdeterminism without compelling evidence to the contrary. Evolutionary theory might give additional bite to this parsimony argument. An underdetermined UG that represents less information should be easier to represent in the genome, should require fewer mutations to arise in the course of evolution, and thus should be easier to explain in evolutionary terms.

Evolutionary considerations also feed into the argument from perplexity. There seems to be no good reason why UG should bother encoding multiple parametric possibilities when one possibility would fully serve the need to communicate. On the overdeterminist view, children “forget” (lose access to) those grammatical options that they do not detect in the language spoken to them. This information thus plays no role in the cognitive life of a child after a certain age—an age after which they do most of their surviving and reproducing. So there seems to be no evolutionary benefit to having an overdetermined universal grammar. If UG exists to make it possible for us to acquire quickly and reliably a language rich enough to encode propositional information, then parameters seem like a design flaw; they make language learning harder with no increase in function.

Nowack, Komarova and Niyogi (2001) purport to study mathematically the conditions under which a parametrized UG could evolve, but they make one very unrealistic assumption. They assume that different languages are better suited to talking about some kinds of evolutionarily significant contingencies than others. It is easy to see how their result follows if we grant this assumption. If (say) one can describe how to survive a sandstorm better with English-style Subject-Verb-Object order and how to hunt walruses better with Japanese-style Subject-Object-Verb order, then it will be advantageous to children to be able to acquire either type of language, depending on where they happen to grow up. But the assumption is wildly implausible. Either “First, the headman the walrus spears” or “First the headman spears the walrus” will do perfectly well in the Arctic. And (not surprisingly) there is no ecological or cultural regularity to how the major linguistic types are distributed around the world (see Baker (2001)). But if there is no difference in the evolutionary fitness of different languages in different environments, then there is no advantage to being able to learn different languages. Under these conditions, Nowack et al’s mathematics shows that a parameterized UG is disfavored, because it makes language learning less reliable. There

seems to be no evolutionary advantage to having an overdetermined UG, making its existence perplexing if true.

Here are two sample quotations from underdeterminists. In each quotation, I have highlighted and tagged phrases that communicate considerations of possibility, parsimony, or perplexity.

Often *there are plausible explanations* for a typological pattern that do not involve appeal to an innate UG principle [possibility]. In such cases, harm is done by assuming innateness. What we would then have are two contrasting explanans: one that says the pattern results from such-and-such motivated principle or force, the other that says that it is *merely a genetic quirk* [perplexity]. *All other things being equal*, we should choose the former [parsimony]. (Newmeyer 1998: 362).

Why is there more than one language at all? ... Some aspects of grammar *might be easily learnable from environmental inputs* by cognitive processes that may have been in existence prior to the evolution of grammar, for example, the relative order of a pair of sequenced elements within a bounded unit [possibility]. For these aspects *there was no need to evolve a fixed value*, and they are free to vary across communities of speakers [perplexity].

It may be difficult to evolve a huge innate code.... The size of such a code would *tax the time available to evolve* and maintain it in the genome in the face of random perturbations from sexual recombination and other stochastic genetic processes [parsimony] (Pinker and Bloom 1990:716)

These then I take to be the three main strands of underdeterminist thought about linguistic variability. Underdeterminists seem to have a powerful argument, if not that underdetermination is true, at least that it deserves to be the null hypothesis.

Or do they? In the next three sections, I consider each strand individually, to show that it does not seem so compelling when one knows more about the details of linguistic variation and when one considers alternative hypotheses about what the purpose of language might be.

3 Is Underdetermination Possible?

In explaining their underdeterminist intuitions, Pinker, Bloom, and Newmeyer illustrate with what I call the Head Directionality Parameter (HDP), which distinguishes Japanese-type word order from English-type word order. I begin by giving some more information about this parameter, and how it compares with other putative parameters. Although it seems reasonable that this particular parameter taken alone could be handled underdeterminist-style, it is not at all obvious that that is true for other parameters.

The HDP characterizes the difference between the Japanese sentence in (1) and its English equivalent. This parameter's net effect on sentence structure is huge. (2) and (3) highlight this by comparing a more complex English sentence with its rough equivalent in Japanese:

(2) Taro might think that Hiro showed a picture of himself to Hanako.

(3) Taroo-ga Hiro-ga Hanako-ni zibun-no syasin-o misetato omotte iru.

Taro-SUBJ Hiro-SUBJ Hanako to self-POSS picture-OBJ show that thinking be

'Taro thinks (literally, is thinking) that Hiro showed a picture of himself to Hanako.'

Yet the rule that underlies these observed differences is remarkably simple: English forms new phrases by adding words at the beginning of already constructed phrases, whereas Japanese forms new phrases by adding words at the end. Both languages make prepositional phrases out of noun phrases; English does it by putting *of* before the noun phrase (*of himself*), and Japanese does it by putting *no* after the noun phrase (*zibun-no* 'himself of'). English puts a noun before a prepositional phrase to make a noun phrase (*pictures of himself*); Japanese puts a noun after a prepositional phrase to make a noun phrase (*zibun-no syasin* 'himself-of picture'). English puts a verb before a noun phrase to make a verb phrase (*show pictures of himself*); Japanese puts a verb after a noun phrase to make a verb phrase (*zibun-no syasin-o miseta* 'himself of picture show'). This difference applies to the full range of phrases found in either language (see Baker (2001: ch. 3)). Although it is a simple rule, it has a huge impact on the character of a language because it applies many times in a sentence of moderate complexity. This parameter is one of the most elegant, robust, and high-impact parameters known. About 45% of the languages in the world are clearly of the Japanese-type and another 45% are of the English type. This was also one of the first parameters to be discovered, having its roots

in Greenberg's (1963) pioneering study of universals in language. As such, it is a favorite of linguists, and a natural case for underdeterminists to consider.

How can this property of natural languages be captured? In the overdeterminist version, UG would somehow express the following disjunctive statement:

(4) *The Head Directionality Parameter (HDP): (overdetermination version)*

When a word is combined with a phrase to make a larger phrase, the added word comes first *or* it comes last.

English chooses the "first" option; Japanese chooses the "last" option. Underdeterminists want to get the same effect without having (4) as part of the innate endowment for languages. They want to get by with only a statement like (5).

(5) Form a new phrase by adding a word to a phrase. (Underdeterminist version)

The underdeterminist idea is that when language users put (5) to use, they come up against the fact that speech is a serial medium, with each word strictly ordered with respect to all other words in an utterance. When one combines a word and a phrase into a grammatical unit, there are only two possibilities: the added word can come before the phrase, or it can come after it. There is no a priori reason to prefer one order to the other, and users have no innate knowledge that guides them on this. Therefore, they look to their environment to learn which order is in fact used in the language around them. As already mentioned above, it is well within the power of our nonlinguistic cognitive system to detect the difference between the sequence A-B and the sequence B-A. In this way, children in a Japanese speaking environment learn one version of the parameter and children in an English speaking environment learn the other. This is not unreasonable, so far as it goes.

There is, however, much more to grammar than the HDP. Linguists know of at least 15 fairly well-established large scale parameters that concern syntax (see Baker (2001: ch. 6) for a list), plus many others that govern other aspects of language. Furthermore, linguists frequently propose new parameters to handle fine-grain distinctions among familiar languages or the large-grain distinctions that characterize less familiar languages. It is reasonable to ask if the underdeterminist account is as plausible for other known parameters as it is for the HDP.

In order to assess this, I consider briefly a new parameter, which comes up in my current research in collaboration with Christopher Collins. This parameter, which we may call the “Target of Agreement Parameter” (TAP), concerns a systematic difference between Indo-European (IE) languages and Bantu languages. In languages of both families, tensed verbs have an affix that agrees with the features of their subject. (6) shows this for English and Kinande (spoken in the Congo).

- (6) Abakali *ba*-gula amatunda vs. Omukali *a*-gula amatunda.
 Women AGR2-buy fruits woman AGR1-buy fruits
 ‘The women buy fruits.’ vs. ‘The woman buys fruits.’

In other sentence types, the behavior of agreement on the verb diverges in the two language families. For example, in certain passive sentences either a noun phrase or a prepositional phrase can come before the passive verb, as shown in (7) in English.

- (7) a. John put some peanuts/a peanut on the table. (active sentence)
 b. Some peanuts *were* put on the table. (passive sentence, NP moved)
 A peanut *was* put on the table.
 c. On the table *were* put some peanuts. (passive sentence, PP moved)
 On the table *was* put a peanut.

In English, the form of the verb *be* is determined by whether the remaining noun phrase is singular or plural. It does not matter where that noun phrase appears in the sentence. Bantu languages allow a similar range of word orders, but the agreement patterns are different, as shown in (8) from Kinande.

- (8) a. Kambale *a*-hira ehilanga oko-mesa. (active sentence)
 Kambale AGR1-put peanuts on-table
 b. **Ehilanga** *hya*-hirawa oko-mesa. (passive, NP moved)
 peanuts AGR2-were.put on-table
 c. **Oko-mesa** *kwa*-hirawa ehilanga. (passive, PP moved)
 on-table AGR3-was.put peanuts

The agreement prefix in (8c) is different from (8b), even though the number of the noun phrase ‘peanuts’ does not change. When the prepositional phrase is the preverbal element in a Kinande passive, the verb agrees with it, rather than with the noun phrase.

A related difference is found when direct objects are brought to the beginning of a transitive sentence. Many languages allow this in one form or another (e.g. *That woman, I met in town.*) In some, when the object is moved to the front the verb also moves, so that it comes between the fronted object and the subject. This is known as the “verb second” phenomenon. It is found in most Germanic languages, and survives to some extent in an archaic/poetic register of English:

- (9) a. **I have** never seen a more beautiful woman.
 b. ?A more beautiful woman **have I** never seen.

Notice that the verb agrees with *I* in (9b), not with the fronted object *this woman*, even though the linear order is different: it is *have*, and could not be *has*. This fact holds true also in Dutch and German, in which (9b)-like word orders are commonplace.

Some Bantu languages also allow objects to be fronted in special discourse situations, with the verb coming second, between the fronted object and the subject. But in Bantu object-fronting does affect the agreement on the verb. Without object-fronting, the verb agrees with the subject; with object-fronting, it agrees with the object.

- (10) a. *Abakali si-ba-lisenya olukwi l’omo-mbasa.*
 Women not-AGR1-chop wood with-axe
 ‘Women do not chop wood with an axe.’
 b. *Olukwi si-lu-lisenya bakali omo-mbasa.*
 Wood not-AGR2-chop women with-axe
 ‘Wood, women do not chop with an axe.’

This is a second systematic difference between IE languages and Bantu languages.

These two differences in the behavior of agreement (and several others not reviewed here) can be unified under the following parameter:

(11) *The Target-of-Agreement Parameter (TAP):*

The “subject” agreement affix associated with a verb must match either:

- (a) the noun phrase on which it licenses nominative case, *or*
- (b) the phrase that immediately precedes it.

(11a) is the IE value of the parameter. It capitalizes on the fact that there is a correlation between nominative forms of pronouns and other noun phrases and the presence of tense on the verb. For example, the nominative form *I* is found in (12a), where the following verb is tensed, but when the verb is an infinitive (as in (12b)) the accusative form *me* is required.

- (12) a. They believe ***I am*** a fool.
- b. They believe ***me to be*** a fool.

So tensed verbs make possible nominative case subjects. Tensed verbs also bear agreement affixes, and in IE languages the phrase they agree with is same as the phrase that they induce nominative case on. As a result, agreement is not affected by minor variations in word order in IE languages, as shown in (7) and (9). The Bantu languages, in contrast, use (11b). In simple cases like (6), the two rules give the same result. But since the Bantu version is keyed specifically to linear order, agreement in Bantu languages is very sensitive to minor permutations of the sentence, as shown in (8) and (10). The TAP thus accounts for a cluster of differences in how agreement works in IE languages as opposed to Bantu languages. It provides a fair example of how new parameters emerge routinely in the ongoing task of doing large-scale comparative linguistics.

Now the question is what would be involved in translating this parameter out of the overdeterminist format in (11), with its explicit disjunction, and into the underdetermined format recommended by Pinker, Bloom, and Newmeyer. It is hard to see how it would work out in this case. The starting point would presumably be something like (13).

- (13) The tensed verb must agree in person (gender) and number with some phrase in its environment.

So far so good. But language learners now must infer from the underspecified statement in (13) that there are exactly two ways of identifying possible targets of agreement: linear precedence and nominative case. But why should that be? Why shouldn't they also consider the phrase that immediately follows the verb, or the phrase to which the verb assigns accusative case, or any of a variety of plausible grammatical relations, together with their Boolean combinations? The space of hypotheses for the HDP is plausibly constrained by the external condition that spoken language takes place in a serial medium. But there are not such obvious external constraints on (13).

The next step in the underdeterminist account would be to use language-independent learning gadgets to decide how (13) should be filled out by the learner. This too is tricky. It is fairly easy to see how one can learn the order of two adjacent elements with language-independent cognition. But how could one learn whether a verb agrees with a nominative noun phrase or a noun phrase that immediately precedes it using cognitive processes that are evolutionarily prior to language? What is a language-independent analog of a verb agreeing with a noun phrase? The closest thing that comes to mind is our ability to detect when one thing has a feature in common with something else, perhaps because there has been contact between the two. One might say that a mud patch "agrees" with the deer that left a footprint in it, for example. But that seems like a rather remote analogy to the case at hand. More problematic still, what is a language independent version of "noun phrase whose nominative case is licensed by the verb"? This parametric choice seems intrinsically tied to concepts that are only meaningful within the language faculty itself, raising doubt that it can be learned by cognitive principles that are not part of that faculty. I am sure that it is *possible* for one to learn the value of (11) without using the language faculty; presumably that is what I did, using my science-forming ability. But that isn't what children in the Congo are doing. And the TAP is probably more typical of parameters in general than the HDP in these respects. The intrinsic plausibility of the underdeterminist view of the HDP thus does not carry over to other plausible parameters. We cannot take it for granted that the underdeterminist option is a viable approach, sufficient to answer the questions about typology and acquisition that parameters were created to solve.²

² Further questions about the possibility of underdeterminism arise when one considers carefully the very first stages of language acquisition. Learning whether a language has verb-object or object-verb word order seems easy, since the information is there in any

4 Is Underdeterminism More Parsimonious?

Next let us consider whether the underdeterministic approach is more parsimonious than the overdeterministic one, and hence to be preferred on general grounds of scientific simplicity and because it minimizes the mystery of how UG evolved.

Considerations of simplicity of course apply only to theories that can be shown to do the basic explanatory work. One does not ultimately prefer a simple and inadequate theory to a more complex but more adequate one. The putative parsimony of underdeterminism is only relevant if its possibility has been established. And that still remains to be done, as already discussed.

But there is another point to make as well, which is that simplicity must usually be evaluated relative to the particular representation system in which the theory is couched. To see how this general point could apply to questions about UG, consider once again the HDP. Pinker, Bloom, and Newmeyer take it for granted that a UG that is silent about word order like (5) has a smaller and simpler mental representation than a UG that includes explicit disjunctive statements about word order like (4). Maybe this is so, but it is not *necessarily* so.

Imagine two ways in which linguists could express how sentence like (2) or (3) are structured into phrases. One possibility is that they could type the sentences on their word processors, and include labeled brackets to indicate which groups of words constitute phrases. A second possibility is that they could build Calder-style mobiles in which a symbol for every word is attached by pieces of wire to nodes that stand for the phrases that the word is contained in, the whole mobile then being hung from the ceiling. Both representations could be perfectly adequate expressions of phrasal grouping; indeed they could be logically equivalent (although the reader can probably guess which method is in common use). But the two differ markedly in how they would treat word order. In the mobile style of representation, no intrinsic order is implied. Two words X and Y

transitive sentence. But this presupposes that the learner already know many other things—such as what which word is the verb, which is the object (as opposed to the subject), and which sentences have basic word order (as opposed to an order affected by considerations of topic and focus). But these things cannot be taken as known when the very first parameters are learned. This makes the learning issues much harder. See Gibson and Wexler (1994) and Fodor (1998) for discussion of this issue.

could be part of the same phrase by virtue of being hung from the same piece of the mobile, but sometimes X might be to the right of Y, and other times X might be to the left of Y, depending on the air currents in the room at the time. In this style of representation, it really does take something extra to specify a linear order for X and Y; one would have to solder in an extra piece of metal to prevent them from swinging in the breeze, for example. If mental representations are like Calder mobiles, then it is parsimonious to leave word order unspecified.

Things come out differently in the style of representation produced by word processors. This format automatically imposes an order onto any representation, whether one is desired or not. Even if one tries to type two characters at exactly the same time, the computer will detect tiny differences in timing and produce a strictly ordered representation, with X unambiguously to the right of Y or vice versa. In this representational medium, fixed order comes for free, and additional work is required to overcome it. For example, linguists who want to talk about verb phrases in a way that is neutral between Japanese-like languages and English-like languages have to add an additional tag, like “[*VP eat spinach*], *order irrelevant*,” or create some notational convention to this effect. It is intrinsically difficult to leave order unspecified in this medium, so one resorts to explicit disjunctions or the equivalent. If mental representations are like word processors in these respects, then a UG that leaves word order open could be less parsimonious, rather than more.

So the parsimony issue hinges on whether the mental representations of languages are more like Calder mobiles or word processors. Which is the case? I think we must admit that we do not know. We know nothing about the details of how the innate endowment for language is realized that would allow us to make a firm judgment. It is true that the brain is a 3-dimensional structure rather than a 2-dimensional structure. Maybe this is a relevant similarity to the Calder mobile. But the brain is also known to be full of topographic mappings in (for example) the visual system, where adjacent points on the retina are represented by adjacent sets of neurons of the brain (see Marcus, this volume). Thus there is reason to think that 1- or 2-dimensional order is often significant in the neural medium. This could be a relevant similarity to the printed page. In this state of ignorance, we should not be too swayed toward underdeterminism by claims of parsimony.

There is also a detail of about word order in languages of the world that suggests that linguistic representations are intrinsically ordered in a way that makes more sense within the overdeterminist picture. (14) and (15) repeat the two versions of the HDP.

(14) Overdeterminist version:

Combine a word with a phrase to make a larger phrase by putting the new word first *or* by putting the new word last.

(15) Underdeterminist version:

Combine a word with a phrase to make a larger phrase.

The overdeterminist version includes an explicit disjunction, whereas the underdeterminist version leaves order open, to be fixed by some kind of learning. But notice that there is nothing in (15) that implies that a language learner must settle on a fixed order. The nature of the speech stream implies that each token of a verb phrase that gets uttered must have the verb come before the object or after it. But why couldn't the order vary from verb phrase to verb phrase within a single language? One can imagine a language in which it was possible to say either *Mary ate spinach* or *Mary spinach ate*, depending on one's whim or stylistic considerations. One can also imagine a language in which some verbs are used with verb-object order and others are used with object-verb order, so that one consistently says *Mary ate spinach* but *Mary spinach cooked*. In fact there are no such languages. Order within the verb phrase varies from language to language, but not internally to the same language.³ This elementary fact is made mysterious by (15). It is not as mysterious in the overdetermined version in (14): one can imagine that the disjunction is really an exclusive *or*, accompanied by some kind of tag saying "learn which". But it makes little sense to append "learn which" to (15), since the options are not explicitly enumerated. This suggests that the human language capacity

³ There are languages with free word order, but these languages do not build phrases of the kind assumed by both (14) and (15) at all (Baker 1996). Languages that allow both *Mary ate spinach* and *Mary spinach ate* also allow *Spinach Mary ate* and *Ate Mary spinach*, in which the object and the verb do not constitute a phrase. A very different parameter is at work in such languages, which I do not consider here.

cares deeply about word order, and order is built into it from the beginning—like a word processor, not a mobile.

An underdeterminist might try to deflect this point by saying that people are such creatures of linguistic habit that they don't tolerate freedom. Even if a grammatical option exists in principle, we always settle into one routine or another in practice. But this is not true in other comparable domains. To see this, consider another feature of the Bantu languages. In all Bantu languages, direct objects ordinarily come after the verb, as in English, not before it as in Japanese. (16) shows this for Chichewa (spoken in Malawi) and Kinande.

- (16) a. Njuchi zi-na-luma alenje. (Chichewa)
 Bees AGR-past-bit hunters.
 'The bees stung the hunters.' (Not: **Njuchi alenje zi-na-luma.*)
- b. Omukali a-gula eritunda. (Kinande)
 woman AGR-bought fruit
 'The woman bought a fruit.' (Not: **Omukali eritunda a-gula.*)

Bantu languages also allow “object dislocation structures”, in which the object noun phrase appears at the edge of the sentence, and a pronoun is attached to the verb. (Colloquial English allows something similar, as in *That dress, I really like it.*) But there is a difference. Chichewa allows the dislocated object to appear either at the beginning of the sentence, or at the end:

- (17) a. *Alenje* njuchi zi-na-wa-luma (Chichewa)
 hunters bees AGR-past-them-bit.
 'The hunters, the bees stung them.'
- b. Njuchi zi-na-wa-lum-a *alenje*
 Bees AGR-past-them-bit hunters.
 'The bees stung them, the hunters.'

In contrast, Kinande only allows the dislocated object to appear at the beginning:

- (18) a. Eritunda, omukali a-ri-gula. (Kinande)
 fruit woman AGR-it-buy
 The fruit, the woman bought it.
- b. Impossible: *Omukali a-ri-gul-a eritunda.
 woman AGR-it-buy fruit
 The fruit, the woman bought it.

The Chichewa examples in (17) show that humans are not intrinsically adverse a degree of freedom being left open in language. The underdeterminist thus has no quick and easy answer as to why comparable freedom is not tolerated in the ordinary verb phrase structures formed by (15).

This point can be underscored in another way. The differences between Chichewa and Kinande imply that there is another parameter at work. This parameter can be stated in overdeterminist fashion as in (19).

(19) *The Dislocation Parameter:*

- (i) Dislocated noun phrases appear at the beginning of the clause *or*
- (ii) they appear at either edge of the clause.

Kinande adopts (19i) and Chichewa (19ii). Now (19) translates into the underdeterminist idiom roughly as (20).

(20) Dislocated noun phrases appear at the edge of the clause.

But (20) is no different in its basic structure than (15). How could children know that (20) does not need to be restricted down to a particular word order (see Chichewa), whereas (15) must be? Underdeterminists are on the horns of a dilemma. They must choose whether young humans have a general urge to fill out their general innate knowledge into more rigid and specific rules or not. If they do, then the dislocation pattern in Chichewa is mysterious. If they do not, then the fact that no language tolerates free word order inside verb phrases is mysterious. This dilemma does not arise within the overdeterminist view. That view is committed to explicitly spelling out the possible values for each parameter. Therefore, it is not at all surprising that two similar-looking

parameters might specify a different range of admissible choices—“beginning” or “end” in one case, and “beginning” or “either” in the other.

5 Is Overdetermination of Language Perplexing?

Finally, let us consider the third pillar of underdeterminist intuitions: that the existence of a super-rich innate endowment for language would be perplexing. To many people influenced by the “blank slate” model of human nature, the idea that the structure of a human language is built into our minds is hard to swallow. Given this predisposition, it is even harder to swallow the idea that the structure of *all* human languages is built in from the beginning. The overdeterminist seems to be saying that his infant knows not only the basic principles of English, but also (in a sense) the basic principles of Japanese, Yoruba, Mohawk, Ancient Akkadian, and whatever will be spoken on the lunar colony 1000 years from now. That seems absurd. The mature human actually speaks only one or two languages, not tens of thousands. It seems like there is no purpose to all this extra knowledge in the ultimate scheme of things. Thus it is perplexing to think we have it.

The crucial point to make here is that our perplexity depends on our notions of purpose. The degree to which something is perplexing is in proportion to the degree to which it has complexity that serves no purpose. Therefore, whether we find an overdetermined language faculty perplexing or not depends on what we think the purpose of human language is.

Most people who think in these terms at all take it to be self-evident what the purpose of human language is. It is some variation on the following (see, e.g., Pinker (1994: 367-69)):

- (21) The purpose of language is to permit the communication of complex propositional information.

This is accepted almost without argument by a wide range of language specialists. If this is the purpose of language, then I agree that it would be perplexing to find that we have an overdetermined UG. We can, it seems, communicate whatever propositions we want using only one or two languages (contra Nowack et al 2001), so why make explicit provision for more than that in our minds? There could be no evolutionary advantage to this capacity, given that we make little use of it in our on-going lives. At best it could be an evolutionary accident of some kind.

But (21) is not set in stone. It could be correct but incomplete, in ways that affect our judgments of perplexity. Suppose, for example, that we say that the purpose of human language is (22) instead.

- (22) The purpose of language is to permit the communication of complex propositional information *to your collaborators, while concealing the information from possible competitors.*

This is a rather minor variation on (21), falling within the same conceptual scheme.⁴ But it renders the existence of many potential linguistic systems unperplexing. Basically, it says that human language has the same purpose as those products of human engineering known as codes and ciphers. To be effective, such systems make explicit provision for variation, indeed for the setting of parameters. For example, the famous German Enigma machines of World War II could produce many different codes, depending on how certain “parameters” were set: which alphabet wheels were chosen, what their initial positions were, and how the cross-wiring was done. Perhaps the human capacity to learn languages that superficially look quite different can be understood in the same way.

This idea is made plausible by the fact that natural languages do make very effective ciphers in practice. The most famous example is the U.S. Marine Corps’ use of the Navajo Code Talkers in World War II. Navajo Indians speaking their native language to each other over the radio proved to be more efficient, more effective, and harder to decipher than the most sophisticated products of human engineering at the time.

From this perspective it might not matter if underdeterminist intuitions turn out to be correct and it is more costly to represent a language faculty with explicit parameters built in. The extra complexity might be justified by the advantages of having a better code, one that conceals strategic information better. This could be an instance of adaptive complexity, built into the account of the origins of the innate endowment of language from the beginning. Linguistic diversity would then not be an evolutionary accident or a residual imperfection, but part of the point of language in the first place.

⁴ A more radical version of this critique, brought up from time to time by Chomsky, is to deny that language has a purpose. Not everything in the natural world does have a purpose that explains its structure, after all. Rocks, for example, do not have an intrinsic purpose, even though we use them for a variety of purposes. Language could be like a rock in this respect.

According to Pinker and Bloom (1990), claims about adaptive complexity gain support if one can point to instances of biology replicating the strategies used by engineering to accomplish some goal. This seems possible in the case at hand. Just as vertebrate eyes are much like cameras, so the human language faculty is structured rather like artificial encryption systems (see, for example, Singh (1999)). This comparison can be pursued at two levels.

At the gross level, every code is factored into two parts: the general encryption algorithm and the specific key. The general algorithm is public information available to all; the key is some crucial piece of secret information that needs to be plugged into the algorithm before the message can be decoded. For example, the algorithm for the Caesar shift cipher (used by Julius Caesar in his campaigns) is to replace every letter in the message with the n^{th} subsequent letter in the alphabet. The secret key is the value for n —how far the alphabet is shifted. Choosing different values makes possible 25 different ciphers, giving the user flexibility for staying ahead of the enemy. Similarly, the RSA cipher, which is the basis for modern internet security, is based on the algorithm of translating one's message into a huge number using its ASCII code, and then calculating the new number $(\text{message})^k \pmod{n}$, where n is the product of two large prime numbers. Anyone can know this, but your messages are safe unless someone knows the prime factorization of n , which is the mathematical key for decoding. Since there are an infinite number of primes, there are an infinite number of ciphers in this family. I suggest that the distinction between the invariant principles of UG and the parameter values needed to define a particular language is analogous. The invariant principles are like the general encryption algorithm, which is available to all humans. The parameter settings are like the key; they are kept “secret” within a particular speech community, and can only be revealed to children and others who come into the community by a rather lengthy process of language acquisition.

The comparison between UG and cryptography is also interesting at a more detailed level. If one looks at the kinds of tricks that UG uses to create a diversity of languages, they match up rather well with the ciphers of the 16th century. 16th century espionage used steganography—the art of hiding messages—such as concealing a letter in the bottom of a barrel. Natural language does something similar by using different distinctive features in different languages. Each language contains certain distinctions between sounds that carry differences in meaning but that are virtually undetectable to speakers of other languages; examples include Hindi's difference between aspirated 't'

and unaspirated ‘t’, which is inaudible to the English ear, or English’s ‘r’ vs. ‘l’, which is mysterious to a Japanese speaker. 16th century spies used ciphers that replace the elements of a message letter by letter; similarly, natural languages use different inventories of sounds. 16th century spies also used codes, which replaced whole words with other words or symbols; natural language uses Saussurean arbitrariness, according to which domestic canines can be indicated with *dog*, *chien*, *perro*, *erhar*, or *ekita*. 16th century spies used homophones (different symbols that represent the same meaningful unit) and nulls (symbols that represent nothing) to throw off code-breaking by frequency analysis. Similarly, natural languages contain allophonic variation in sounds, synonymous words, idioms, and apparently meaningless words. 16th century spies removed the spaces between words in coded messages, so it would not be clear where one word stopped and another began; natural languages have rules of sound assimilation that have the same effect. Finally, 16th century spies made use of transposition, scrambling the elements of the message according to some regular procedure that a knowledgeable receiver could undo. Word order parameters such as the Head Directionality Parameter and the Dislocation Parameter can be seen as the analog in natural language. Overall, there are enough parallels to make one think that it is not an accident that the innate endowment for language is structured like a code—in which case, the existence of parameters is not perplexing after all.

This comparison between UG and espionage may not in the end be the most accurate one available. I am not wedded to the idea that (22) is the perfect statement of the purpose of language. Other views that attribute a concealing function to language as well as a revealing function would work just as well. For example, it could be that linguistic diversity has the desirable function of making it hard for a valuable member of your group to defect to a rival group, taking his resources and skills with him. He will not be as valuable to another group, because they cannot talk to him.⁵ Reversing the

⁵ I thank the participants in the Newark workshop, October 2001, for bringing up this possibility.

Evolutionary psychology is committed to a somewhat stronger position: something can be attributed to the innate endowment only if it would have been beneficial in the context of small bands of hunter-gatherers in the ancestral environment. It is not clear that (22) meets this additional condition. Not being an evolutionary psychologist, I do not consider this crucial to my interests. Even so, it is not obvious to me that linguistic diversity would not have had Code Talker-like advantages in traditional societies, albeit on a smaller scale. Warfare is an important feature of all such societies, where possible it is directed against other linguistic groups, and its

scenario, it could be that linguistic diversity has the desirable function of making it hard for a greedy or dangerous outsider to join your group and get access to your resources and skills. You are less vulnerable to manipulation or deception by a would-be exploiter who cannot communicate with you easily. It is not my purpose to choose which of these scenarios is the most promising; I simply want to take away the certainty that (21) is correct, thereby dispelling some of perplexity associated with an overdetermined innate endowment for language.

6 Conclusion

Linguistic practice often makes use of an overdetermined innate endowment, one that explicitly specifies grammatical options from which language learners are invited to choose on the basis of their environment. That the innate endowment should be “super-rich” in this way has been considered perplexing and unparsimonious by some researchers. They claim that the innate endowment should underdetermine language instead. In response, I have argued that this kind of underdetermined universal grammar may not be possible—that not all parameter values can be learned reliably by prelinguistic cognitive capacities. Second, I have argued that an underdetermined universal grammar is not necessarily more parsimonious than an overdetermined one; this depends on unknown details of the representation scheme. Third, I have argued that there are plausible purposes for an overdetermined universal grammar: it could make possible a form of communication that conceals information from some even as it reveals it to others. Overall, then, there is no compelling reason prior to detailed inquiry to think that the innate endowment must underdetermine the structures of particular human languages. This does not establish the super-rich, overdetermined view of the innate endowment for language. But it does mean that if the most successful theories of language typology and syntactic acquisition (continue to) make important use of

practice depends heavily on cooperation and treachery (see, e.g., Divale 1973). These are precisely the boundary conditions under which it is plausible that a code-like function for language might have evolved.

People have pointed out to me that multilingualism is extremely wide-spread in traditional societies, suggesting that natural languages are not very effective codes in practice. This might only mean that the natural code-breakers have gained the advantage on the natural code-makers in a kind of evolutionary arms race at this particular point in human development. (This was also true of cryptography in the 16th century (Singh 1999).)

overdetermination, we should feel free pursue them, not judging them out of bounds on evolutionary or methodological grounds.

This inquiry into one corner of the innate mind also means that we should be alert to parallel issues in other corners. For other mental modules too, it might make sense to consider the rarely-raised possibility that the innate structure might be more than is necessary to produce a certain result, rather than less. It could be that hyper-nativism is sometimes the right amount of nativism.

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