1982

14. Some implications of the nonspecific bases of language

T. G. Bever

Plato thought nature but a spume that plays
Upon a ghostly paradigm of things;
Solider Aristotle played the taws
Upon the bottom of a king of kings . . .

. . . O chestnut-tree, great-rooted blossomer,
Are you the leaf, the blossom or the bole?
O body swayed to music, O brightening glance,
How can we know the dancer from the dance?

Yeats, "Among School Children"

This essay explores some implications for the study of language acquisition of the view that the essential formal characteristics of language are not human in origin. According to this interpretation they are universal abstract objects whose properties are uncaused. The idea that linguistic universals are uncaused "Platonic" forms, in particular, has been recently suggested by J. Katz (1978, 1979, 1981), who argues that some essential features of language rest on necessary truths. This view attributes the structure of some linguistic universals to factors not uniquely intrinsic to humans. It would remove the explanation of linguistic universals from the strictly human biological or historical domain, by claiming that linguistic universals are purely formal. Accordingly, linguistics would be a nonempirical science, of the same sort as classical geometry or modern logic.

It is impossible to find direct empirical justification for such a Platonic interpretation of language, just as it is impossible by observation to prove that geometries are, or are not, abstract domains. We can, however, pursue the implications of such ideas for the way we study empirically related phenomena. In the case of language, the empirical domain that I shall consider is the psychology of language, with special emphasis on how children learn it.

The nonspecific view of the essence of language could resolve several puzzles in the interpretation of language evolution and psychology of

This speculative essay was stimulated in large part by discussions with Jerry Katz, Terry Langendoen, and my students. The reader interested in Platonic linguistics should consult Katz (1981), which presents the most definitive case to date. I am grateful to V. Valian, R. Gelman, C. Carrithers, P. Postal, and the editors for manuscript advice.

language. From this view, the stultifying conflict between radical nativism and radical empiricism becomes purely an empirical problem for psychologists, with no relation to linguistic investigations. The structure of the essence of language in the child is caused neither by the way it is inherited nor by the way it is learned: It is *discovered* (like atoms, planets, and America, or logic, geometry, and numbers). The origin of the essence of language in the species is no longer necessarily ascribed to purposeful evolutionary causation; rather, it could be the result of the emergence of sufficient complexity (mental or physical) for humans to become susceptible to the relevant forms of language.

This view would also explain why certain linguistically possible languages are unusable; linguistic structures do not overlap completely with cognitive capacities. Certain common cognitive processes never occur in language: Although usable by the human mind, such cognitive processes are not part of the extrinsically determined essence of language. Correspondingly, if the essential features of language are real, independent of humans, then they are not caused by mechanisms of human evolution or learning.

This view has implications for what we should expect to find in language acquisition. There may be special-purpose learning capacities that are adapted to linguistic structure. However, if these capacities do not themselves cause the structures, we may find instances in which children systematically generate false *kinds* of hypotheses about their native language.

14.1. Some puzzles if linguistic structure is caused

We start by distinguishing existing languages from humanly possible languages (Postal, forthcoming). It is clear that the potential varieties of human languages are not exhausted by the languages that happen to have existed. Each language family seems sufficiently distinct to suggest the possibility that an arbitrarily large number of such families could exist. This finding requires that the science of linguistics focus on the form of a possible language, taking existing languages as empirical instances. Such an approach has been the basis for the isolation of a set of universals of language (e.g., N. Chomsky, 1965). Each observed universal has two obvious possible sources: It is accidental, or it is characteristic of what a language in humans must be.

At first consideration, it might seem that all the observed universal characteristics constitute the essence of language, the subject matter of formal linguistic science. However, some of these universal properties are caused by the ways in which human beings learn and use language: Obvious candidates are such universals as the absence of languages with a word made up of ten stop consonants in a row; the absence of languages having neither inflections, function words, nor word-order constraints;

the absence of languages with no way of asking questions. Such linguistic lacunae are reviewed extensively elsewhere (see Bever, 1970; Bever, Katz, & Langendoen, 1976; G. Miller & Chomsky, 1963; Postal, 1980). Their significance for the present discussion is that they force a distinction between two kinds of constraints on humanly possible languages. Certain constraints, such as those just mentioned, are extrinsic to the form of language, and are purely human in origin. No special linguistic account is required of how these constraints are discovered by the child – they emerge as an automatic result of the way language is used.

The child's conformity with certain other universal constraints has no such obvious source: Accordingly, these are interpretable as intrinsic formal constraints. Examples of this may include a distinction between fixed units (e.g., words) and compositional entities that relate the fixed units in specific ways (e.g., sentences); a distinction between inner and outer form; or a semantic interpretation of the compositional entities that is a function of the fixed units and their interrelations.

Such intrinsic constraints are characteristic of the essence of language and provide an account of what is criterially linguistic. A correct account of how these linguistic features emerge in each language is typically interpreted as a psychobiological problem: Namely, what mechanisms allow human children to isolate and integrate these, and only these, features in their linguistic knowledge and behavior? In other words, how does the child extract language from the environment?

There is a startling degree of agreement on this question among the authors of chapters in this volume. Virtually every chapter assumes that the child imposes a rich structure on an impoverished environment and thereby is at least a sufficient cause of the essence of linguistic structures, responding to the varied and sparse linguistically relevant data he or she experiences. Though there are apparent disagreements about how the child proceeds, these are trivial compared with the agreement on the question of nativism. All these writers share the view that the essence of language is caused by humans, and each adheres to at least one of the following three positions (most appear to hold to the first):

1. There is a unique innate faculty of language, which sets criteria on a possible language and thereby determines what the child listens for and accepts in the surrounding language.
2. There is a unique, innate faculty of learning, which forces language to be of a certain form because no other language is learnable (Wexler, Chapter 10).
3. There is an independently emergent faculty of communication, which leads the child to construct language out of different cognitive skills in a specific way (Bates & MacWhinney, Chapter 6).[1]

Each of these somewhat distinct positions maintains implicitly that there

is a *genie d'enfant* that constrains a child to create the essence of language out of impoverished linguistic experiences. The difference in the positions lies primarily in how specialized the *genie* is. Willingly (positions [1] and [2]), or unwillingly (position [3]), each claim accepts the following syllogism, outlined in various instantiations by N. Chomsky, and rephrased by many others.

To be proven: Language is innate:

1. The essence of language has property P_i.
2. P_i cannot be learned by any (known) (conceivable) theory of learning.
3. Therefore P_i is innate.
4. Therefore the essence of language is innate (and caused thereby).

The crucial assumption in this proof is the negative statement (2). In most examples of this syllogism, some property P_i of great intricacy is described, rendering implausible any claim that it is extracted by an orderly inductive learning mechanism. Genetically transmitted behaviors such as upright walking or ethologically isolated patterns could be cited as examples of complex behavior patterns that can be transmitted genetically. These behaviors, however, are orders of magnitude less refined and articulate than language appears to be and do not set a convincing precedent.[2]

Therefore, the very intricacy of linguistic property P_i could be the crucial substantive step of a relatively *anti*nativist argument.

To be proven: Language is learned:

1. The essence of language has property P_i.
2. P_i cannot be transmitted by any (known) (conceivable) genetic mechanism.
3. Therefore P_i is learned.
4. Therefore the essence of language is learned (and caused by how it is learned).

There is a dilemma. We must rely either on as yet inconceivably complex genetic mechanisms of behavioral transmission or on an inconceivably delicate and sensitive inductive system of learning. As is often the case with dilemmas, one can blunt its horns by noting that each one presupposes an unnecessary claim, in this case the same claim:

The essence of language has a cause.

Each of the syllogisms offered presupposes that, whether innate or acquired, the essence of language is caused to be the way it is either by genetic or by social factors, by the biology of the human child or by historical accident. To put it contrastively, according to the commonly accepted view, language could have essential features incompatible with those currently proposed if humans were biologically different, or had a different history.

In this sense, the essence of language is claimed to be like color vision in humans. Color vision is a richly structured system, involving complementary colors and focal colors. No abstract property or law of physics forces color vision to operate that way; indeed, many animals are sensitive to different parts of the light-wave spectrum, and many do not differentiate "color" in the same way. Its essential features must be biologically caused by direct genetic transmission, or indirectly caused by interaction of historical accidents and mechanisms of learning. By either interpretation, the essential features of language are empirically, that is, physiologically and/or historically, caused.[3]

Each of the views outlined previously implies that the essence of language, though biologically or culturally caused, is a historical accident. "Language" could have taken an arbitrarily large number of forms: The form taken is explained by evolutionary or social history, in combination with any relevant physical laws governing complex systems such as the human brain. This brings us to the second empirical problem of linguistic nativism: the awesome precision of an accidental evolution of the essence of language. If the essence of language emerged gradually, what enlightened and ever-constant millennial entelechy could have guided it? If it emerged in a single cluster of developments, what mysterious instantaneous entelechy did the dirty deed?

If the essence of language is the way it is by virtue of factors extrinsic to humans, there is no need to explain its structure by reference to historical, social, or evolutionary facts that are true only of humans. If the essence of language is an abstract form, then its particular mastery by humans is not the cause of the form – indeed, the form has no cause. The nature of that linguistic structure would not have to be accounted for by human brains, history, or behavior. This would blunt the poignancy of the evolutionary dilemma. The controversy would no longer concern the explanation of what causes language to be the way it is, since its nature is uncaused.

Of course, how humans discover such basic forms may involve phenomena of a variety of kinds (biological, formal, physical). But the child's discovery procedure would not be an explanation of the structure of what is discovered. Neither evolution nor empiricism would be required to explain why language is the way it is; one has only to explain how language is discovered by individuals. That question is surely a totally empirical one, roughly on a par with such questions as how humans learn about integers or learn to walk. Investigations of this sort are important, especially for the human psychologist and physiologist, but they should not be confused with the view that we cause what we learn.

There is a third problem raised by the theory that language is caused

by humans: the mental segregation of linguistic processes within the mind. There are formally possible linguistic rules that do not occur in any known language, and there are cognitively possible processes that do not occur in any known language. That is, the matrix shown here is completely instantiated (notice that this matrix is the universal analogue of the distinction between "grammaticality" and "usability" in individual grammars; see Bever, Carrol, & Hurtig, 1975; Bever & Langendoen, 1973):

	Natural cognitive process	Unnatural cognitive process
Linguistic process	copying (I)	scrambling (II)
Nonlinguistic process	symmetry (III)	hyperbolic function (IV)

It is trivially true that there are types of rules of which we are linguistically and nonlinguistically capable (type I in the matrix), and also rules which are unnatural in behavior, both within and outside language (type IV). I have already noted that there are cases of rules that the essence of language would appear to allow, but that do not occur in any known language (type II). An example might be a total "scrambling" rule that reorders constituents freely (see Bever, 1970, 1975; Bever & Langendoen, 1973, for discussions of such cases). There seems to be no obvious intrinsic constraint against any such rule (within a transformational framework); yet it could lead to an unusable language, because every sentence would be profoundly ambiguous. Hence it may be a linguistically possible process but be nonexistent in humans for nonlinguistic mental reasons.

Such cases are problematic for an interpretation of linguistics as a discipline about actual human knowledge. If there are potential languages allowed by universal linguistic theory that cannot be learned, what is the mental or physiological implication of universal linguistic theory? If some well-formed grammars cannot be learned by humans, linguistic theory is not about the human mind. We must accept the implication of this argument about specific rule processes for the claim that there are linguistically possible languages that are cognitively impossible. That is, a language just like English except for a word-order scrambling rule is a possible "real" language, but not a possible human language (see J. Katz, 1980; Postal, 1980, for further discussion).

The distinction between possible mental process and possible linguistic rule leaves us with a notion of a mentally isolated *Festung Sprache* that is both of the mind and not of it. What could be meant is puzzling even at a physiological or modular level of interpretation. A possible model is that one "part" of the mind can learn language (regardless of usage constraints like those just discussed) while another "part" of the mind imposes usage constraints. By this view, we would have to accept the

strange picture of one piece of the mind's inchoately "knowing" something eternally private (all the potential languages) that cannot be used by any other piece of the mind.[4]

Even more telling is the fact that certain mentally natural rules do not appear in any language. The ability to process symmetrical reflections as a special intuitive category of experience is such an example. No language has a rule that allows any arbitrary sequence of constituents to be reversed (e.g., changing *The boy ate the sandwich* into *Sandwich the ate boy the*). Yet general symmetries are frequent in human behavior, ranging from visual sensation to abstract music. Why are there no productive symmetrical rules in language? (cf. N. Chomsky, 1965, for a different discussion of the significance of symmetries). If language is biologically or historically caused by an organism that is thoroughly capable of symmetrical processes, why do they not appear in language? At a formal level, symmetries are extremely easy to describe, with a simple context-free phrase-structure grammar – hence their absence cannot be a result of their formal complexity in languagelike systems (see Bever, Fodor, & Weksel, 1965b). In a transformational grammar framework one can "explain" their absence by noting that symmetrical rules are prohibitively complex to state with transformations over sequences of arbitrary length, and that transformations would have the effect of destroying any symmetries generated by the base structure.

This explanation, however, is parochially formal, and begs the question concerning the causation of the rules. The question is not why transformational grammar, in particular, blocks symmetrical rules, but why language of the symmetry-free form is describable by transformational grammar. If language is an "organ" of a mind that characteristically infects every intellectual adventure with symmetry, why is language itself immune? One cannot argue that a symmetrical rule would serve no communicative purpose. First, there are numerous properties of language that do not serve any obvious communicative purpose. Second, there is ample evidence that other variations in word order serve many linguistic and communicative purposes. One cannot argue that symmetries already exist in language, as exemplified by the canonical CVC form of syllables, or passive syntactic forms: These structures are not symmetries; rather, they converge onto symmetrical form with no systematic basis for it. One cannot argue that the ability to deal with symmetries would break down for long strings, because there are many grammatical constructions that exceed behavioral capacities in complex or long constructions. In short, there are no obvious potential behavioral explanations for the absence of symmetries in language alone. Symmetry simply is not a property of language.

The moral to be drawn from the fact that the matrix presented previously is fully instantiated is that the essence of language is independent

from cognition as a whole – the essence of language makes possible certain languages that cannot be used by the mind, and the mind makes possible certain kinds of rules that are not used in any language. It is not a literal contradiction to maintain, despite these facts, that the essence of language is caused by an organ of the mind. But it does present a picture of language as resulting from a capacity that is mentally isolated in sporadic ways. That is, many aspects of cognition as a whole are reflected in language use and structure; why are the specific exclusions the way they are?

None of these puzzles raised by the theory that humans cause language is a logical contradiction, but each is an otherwise unmotivated puzzle. There has been a conflation of the reasonable claim that humans must have some special capacity or history that makes it possible for them to transmit language and the further claim that the mechanisms of learning and transmission cause the structure to be the way it is.

Suppose one stipulated that the essence of language is not caused by humans. This would free psychology of the problems just reviewed. From this perspective, first, the essence of language is caused neither by the way its learnability is transmitted genetically nor by the way that it might be learned by general mechanisms (if such exist). The essential features are instead the result of extrinsic factors. Second, language itself did not evolve with humans; rather, humans evolved to a point of complexity at which learning language became relevant. Finally, the absence in language of an otherwise pervasive cognitive form is explained by its absence from language proper, rather than by its unique absence from a particular part of the mind.

The view that the essence of linguistic structure is nonhuman is consistent with all the facts that have been traditionally taken to indicate the opposite conclusion, that language must be a proper result of evolution (see Lenneberg, 1967). First, the occasion of an extrinsically structured language could still be species-specific, simply by virtue of the fact that only in humans has the required level of complexity been reached for language to be discovered. There might also be a unique, innate mechanism in human infants for the discovery of certain parts of language, both the essential and the peripheral. There could be general patterns in the order of language acquisition, paced either by a language-specific learning mechanism or by nonlinguistic developments. There could be "typical" patterns of brain representation, based on the most natural organization of the behavioral features of language use.[5] Finally, language learning could be largely independent of normal variations in intelligence; a person with a manifest IQ of 60 may already have a brain that is complex enough in relevant ways.

In brief, the view of language as an uncaused structure is entirely consistent with all the usual biopsychological facts pertaining to its human uniqueness. We now turn to the study of how such extrinsic structures might be discovered.

14.2. The discovery of extrinsic structures

It is obvious (to a nonskeptic) that certain structures have a reality outside human knowledge of them: For example, the fact that there are planets revolving around the sun (if this is a fact) is not caused by human cognition or astronomy. I mention such a noncontroversial banality to set the scene for a less obvious claim: The fact that triangles have angles totaling 180 degrees is not the result of human cognition; for example, just as Martians can know about planets, they can know about triangles. Furthermore, planets would exist and the properties of triangles would exist without any knowledge of them. Clearly, the fact that we know that triangles exist is attributable to human cognition; indeed, centuries of (incorrect) acceptance that Euclidean geometry is the only possible natural geometry might be attributed to properties of the human sensorimotor system. But that system does not cause the properties to exist, even if it can provide a partial explanation for the order in which we discover them.

One can argue that geometry does have an initial physical instantiation and that humans learn abstract geometry from that starting point. Whether explanatorily adequate or not, this line of reasoning cannot be extended to other domains of human knowledge, notably logic. Most humans master a degraded version of logic that they use for everyday reasoning. But they usually fail to master certain principles of any formal system without special training, for example, that anything follows from a contradiction or that in certain logics disjunction is best interpreted inclusively. The formal logical principles that human do and do not intuitively master are not physically instantiated in any way – yet the formal properties are necessary and would exist (insofar as they exist at all) with or without any specific knowledge of them by any species. In this sense logic is a necessary abstract form (see Husserl, 1970).

14.3. Implications for the psychology of language

Even if language were uncaused, we still would have to find out how adults use it and how children master it. Does it make any difference to researchers on language behavior like us what the "true" source of the essence of language is?[6]

The first answer to this query is dogmatic: The truth shall set ye free. We sometimes simply do not know how our studies are skewed by mistaken assumptions, until those assumptions are corrected. So if it is, or could be, true that the essence of language is uncaused, then we should consider this possibility and see where it leads. The formal analysis of

language structure is a practical and logical prerequisite to a science of language use. If the essence of language is not caused by humans, we must be aware of what its true nonhuman structure is in order to study how humans master it. Consider the following example of what the study of number psychology might be like if it was practiced without an independent theory of the nature of numbers.

Suppose that a psychologist, Dr. P, was studying the nature of discrete quantity terms as used in a primitive culture without explicit mathematics, and suppose that he was himself a member of the culture and unaware of any independent theory of integers (the example under discussion is also typical of children between the ages of 3 and 5: see Decroly, 1932; Descoeudres, 1916; Gelman & Gallistel, 1978). Dr. P might note that there are four quantities for which his subjects have different names, *A,B,C,D*. By experimenting with manipulations of these quantities (or referring to his own intuitions as a member of the culture), he would find that the combinatorial facts of discretely quantified groups of objects are as outlined here. The following combinations of the quantities always obtain:

$A \pm A,B,C,D = A,B,C,D$
(i.e., adding or removing A changes nothing)
$B + B = C$
$D + A,B,C,D = D$
(i.e., anything added to D results in D)

The following combinations sometimes are true:

$B + C = D \quad C - B = C \quad D - C = C$
$B + C = C \quad C + C = D \quad D - C = B$
$C - B = B \quad D - C = D \quad D - B = C$

The most baffling property of these facts is the presence of inconsistencies. For example, if $C + D = D$, how can $D - C$ ever equal anything other than D? Despite such problems, Dr. P could arrive at some conclusions: A is the smallest quantity; D is the largest. But what more could he conclude? Would he arrive at any internal theory of the quantity relations? Would he not reasonably conclude that relative quantities in humans are innate in origin and nature? That is, the array of partially inconsistent facts above has no extrahuman grounds that Dr. P can see, is learned with little or no instruction, and so on. Of course, we cannot know for sure that Dr. P would come to such a limited conclusion. He might hypothesize an abstract concept, "integer," and discover the true state of affairs underlying his informants' quantity behavior. Suppose he "invented" the positive integers and showed how the mapping functions onto the integers,

$A = 0; \quad B = 1; \quad C = 2\text{–}6; \quad D = 7+$

explain the properties of *A,B,C,D*. He might then claim that integers themselves are "innate." How else, he would ask, can we account for the acquisition of such abstract entities? But he would then be the victim of his culture-specific myopia. Lacking an abstract, or nonhuman, theory of integers, he finds it plausible to assume that they must be human in nature and origin. This claim confuses the manifest capacity of his subjects, which may well have innate components, with the correct structure of what his subjects actually have learned (regardless of the definition of *learned*).

Suppose integers are real. Then Dr. P's subjects are in the position of having discovered a quantity system that reflects certain properties of real entities. But that discovery does not prove that those entities are the way they are because they are innate. Quite the contrary: They are they way they are because they are real.[7]

Of course, Dr. P should be credited with an important discovery – namely, that his subjects' behavior is systematically related to a mapping of his invention "the integers." In fact, his invention would make it possible to study what is innate about discrete quantities. He could now contrast the regularities of the way quantities develop in children with their formal analysis. For example, he could ask what psychological mechanisms give a special status to the differences between 0 and 1, 1 and 2, and 6 and 7, but not to any other one-step difference. In this way, the formal theory of integers would be a critical scientific tool in studying the psychology of quantities in his subjects.

I think we must entertain the possibility that we have all been acting like Dr. P in our studies of language acquisition. We may have confused the fact that language acquisition proves that something is innate with the claim that what is innate must be the underlying theory, or a predisposition which always leads to that theory. Like Dr. P's subjects, the child may master a "language" that is mapped onto a formal theory of language in certain ways. But this mastery does not imply that the formal entities themselves are innate, only that something is innate which allows the child to behave in conformity with some of the laws those formal entities entail. Like Dr. P we need the formal theory, for it gives us an analysis of what the child might learn to contrast with what he or she actually learns. Indeed, a theory can clarify what might be innate to the learning mechanism by giving us a clear picture of what does not have to be innate in the formal structure. Like the structural theory of integers, linguistic theory provides the psychologist with the potential distinctions. It is the psychologist's task to study how and why these distinctions are mastered in some cases and systematically ignored in others.

This view has a number of practical implications for the study of language acquisition. First, it clarifies by contrast that we have not taken seriously enough the implications of the strong nativist position. For

example, if language is caused to be the way it is by human biology, we should find radically different kinds of languages appearing as mutants or as the result of organic developmental disorders; we might expect slight structural variations in language structure to run in families; we might expect familially heritable patterns of acquisition; we might expect identical twins to have language structures more similar in detail than fraternal twins; we might expect a correlation between certain linguistic features and otherwise defined racial groups; we might expect highly specific localization in the brain;[8] and so on. Such phenomena are typical of genetically transmitted and caused structures: Why are they not typical of language? The absence of such phenomena might just be a failure of observation. But it might be that they do not exist because the essence of language is not biologically caused.

A second implication for the psychologist is that it clarifies the distinction between *competence* and *performance* (see J. Katz, 1978, in particular). The common use of the term *competence* refers to what the speaker/hearer "knows" about his or her language. If this competence is also claimed to include an individual embodiment of the complete universal grammar, then we face the conceptual puzzles already reviewed. However, there is no such difficulty if an individual's competence refers only to his or her personal embodiment of the structures inherent in the particular language.

This personal knowledge system combines aspects of the history of the specific language, usage constraints, and uncaused essentials of language. In order to minimize confusion with previous uses of the term *competence*, I use the terms *human language* and *psychogrammar* to refer to an attested language and the individual mental representation of personal linguistic knowledge. I use *real language* and *real grammar* to refer to an uncaused possible language and its correct description.

The distinction between psychogrammars and real grammars raises an intriguing possibility about human languages: Some (or all) of the latter may not be well formed or complete real languages. This possibility would be analogous to the possibility that the human apprehension of space, logic, and numbers may not reflect a complete, or even consistent, formal system. For example, the concepts of the square root of a negative number or of an infinitely small nonzero quantity are not natural concepts in any indigenous number system. With respect to such kinds of knowledge, "there is no particular reason to suppose that . . . the mathematical abilities (of humans) permit them to conceive of theories approximating truth in every (or any) [*sic*] domain" (N. Chomsky, 1980, p. 252). That is, every humanly accessible theory of numbers may be wrong. Just so for language.

A third implication of viewing language as extrinsically determined is the unification of the acquisition of language with the acquisition of other

abstract formal skills. It is a startling fact that researchers in language acquisition, as generally represented in this handbook, take for granted that language learning (if it exists at all) is sui generis. It follows principles that are completely unique. So long as we adhered to the empiricist presumption that the human child must either cause linguistic structures or learn them, there was no alternative. However, if we now stipulate the linguistic essentials as uncaused, we can refer to a model of acquisition for other uncaused structures.

One class of models for the acquisition of such structures involves representational conflict resolution. For example, in Piaget's interpretation, formal structures are discovered by the child as resolutions of contradictions produced by emerging everyday habits of behavior. If language is an uncaused structure, then we can interpret its acquisition in the same way as the discovery of the intuitive concepts of number, geometry, or logic. Consider first a simple example of cognitive development as mental conflict resolution.[9]

We can start by investigating how the child categorizes small numbers; that is, we first play the experimental role of Dr. P. with children as our subjects. Various researchers have done this (see Decroly, 1932) and have found that 3-year-old children have roughly the same grouping of numbers as that outlined on p. 438. This gives us some insight into children's categorization of quantities, but it does not bear directly on their concept of number or quantity relations. To study this concept, one must ask children questions about the quantity relationships between one array and another, about how they change under various kinds of transformations. A child can be interpreted as having mastered an intuitive concept of certain properties of numerical quantities when he or she recognizes that it is invariant under all transformations except those that change the actual number of objects in an array. The 3-year-old, for example, may think that a row of dolls has more dolls in it after they are spread out. At the same time, the child will volunteer that a row has less if one of the dolls is taken away from it. Such simple cases illustrate different systems of representation of quantity – one perceptual, the other active. The child has a perceptual rule – "If it looks bigger, it has more" – and an action rule – "If you take some away it has less."

What does the child believe happens to a row if you both remove one element and spread the others out (see Bever, Fodor, & Garrett, 1968; Mehler & Bever, 1967). This tactic places the child in internal conflict: One processing system informs him that the row has more, the other that it has less. It is the ultimate discovery of the conceptual invariance of number that resolves such conflicts in behavioral systems. That is, the motivation for the discovery of number is to resolve these conflicts; the motivational role of the discovery of number is to resolve a conflict in mental representations of quantities. It is important to note that the child does not have to give up one of the behavioral systems he has developed.

For example, even in adults, number estimation can be based on array size under certain circumstances. An important fact about the discovery of intuitive formal systems is that they allow the conflicts in the behavioral systems to continue, but provide an underlying system for reconciling those conflicts when necessary. (The kinds of conflicts are by no means exhausted by these cases; other examples would be the conflict between relying on density and relying on overall area in judging numerosity, and the inconsistencies among the results of combining the four basic "quantities" outlined at the beginning of this section.)

In general, formal intuitive knowledge, such as the intuitive concepts of number, space, and logic, are arrived at as internal solutions to such conflicts in different behavior systems. That is, they are a set of "internal languages" that map one behavioral system onto another, and thereby detoxify the negative force of the superficial conflicts between those systems.

We can use such a model to explain why a child learns a psychogrammar at all. Several common explanations are implicit in most of the literature on language acquisition:

> He or she cannot help it (e.g., it is innate).
> It is a by-product of the urge to communicate.
> It simplifies what must be memorized.

Ordinarily we try not to make ourselves responsible for explaining why language is learned; we suggest only that it lies in the murk of infantile motivation or circular functionalism. Certainly the answers suggested here have these weaknesses. Each states in a somewhat different way that a grammar is learned because infants like to learn it.

The conflict-resolution model just outlined provides a theoretical rationale to explain *why* children learn the concept of number: It resolves representational conflicts among otherwise powerful and useful systems of quantity behavior. I think it is natural to extend the application of such a model to language: The psychogrammar is a level of representation that resolves conflicts between the representational powers of the system of speech perception and production. Of course, a special biological mechanism might be required for the discovery of such a formal system, but it might not necessarily be limited to the discovery of any particular system, such as language (see Bever, 1981, where such a model is presented more fully).

14.4. Implications for the study of language acquisition

The resolution model of language learning needs empirical support. The kind of data required – in particular, systematic comparisons of developments in the production rules, perceptual strategies, and other systems

of language use – are almost totally lacking. Cross-psycholinguistic studies of language behavior systems in the adult and child are also of great importance to the verification and expansion of this model (cf. Slobin, Chapter 5). My main point is to show that viewing the essence of language as nonhuman in origin has real consequences for what (I think) we should do in our practical research.

One might object that the conflict-resolution models of the acquisition of intuitive formal structures like number and language are inadequate, because they do not explain why the particular structures are the ones that are discovered. That argument, however, still presupposes that the psychologist must explain why the structures are the way they are. If the structures are nonhuman and real, then the problem of how we discover them is an instance of the problem of how we discover reality. To say that there must be some innate mechanisms that participate in this process is not tendentious. To say that the innate mechanisms themselves cause the structure of reality is to leap into the vat of skepticism.

According to the theory that the essence of language is caused by humans, the specification of the essential universals is exactly a description of what every child is prepared to learn. Accordingly, universal grammar exactly describes the set of possible theories of language acquisition. According to this view, the study of language acquisition and grammar are closely linked. This linkage is frequently reflected in Chomsky's observation that the study of grammar reveals what the learning psychologist must explain.

The complementary line of investigation has been developed by Wexler and his co-workers (see Chapter 10). They explore the extent to which a theory of learning constrains what could be a possible grammar. This is a direct return to the behaviorist dictum that what is known is caused to be that way by how it was learned. Though they are not constrained to operational methodology, nor to traditional empiricism, they embrace the view that the essence of language has a cause and the cause is the language-learning children. (If, however, one examines the constraints they impose on possible grammars, one realizes that they also represent a return to grammars that make deep-structural patterns available in their surface organization – certainly a move compatible with empiricism.)

The linguistic realist is not committed to this position, because to him or her the essence of language has no cause. The child's problem is to apply general intelligence or special capacities to construct a representation of language sufficient to serve human purposes.

It is possible that children never acquire a real language at all, just as they do not acquire a consistent logical system. But just as everyday human reason proceeds well enough with faulty logic, human communication could proceed with a faulty language. It is also likely that the range of learnable languages is smaller than the set of real languages

Short-term memory limits alone would account for a restriction in the range of many structural processes.

It might seem that the ontological status of the essence of language is not at issue when we are studying how children acquire it. In principle this may be true. But in our practice it makes an enormous difference in what we look for if a property of human language has an uncaused structure. What is at issue is the kinds of hypotheses the child tries out as he or she masters language. If the essence of language is caused by the human brain, it would be very odd if the child ever developed a grammatical hypothesis that contradicted some essential property. The nativist argument that the child acquires the right kind of grammar in the face of rarified data is incompatible with formation of impossible hypotheses; how would the impoverished data ever "correct" such hypotheses, once they were formed? Indeed, if the data were sufficient to correct false kinds of hypotheses, then the case for a language-specific innate acquisition device would be much weaker.

Yet the child does appear to come to the wrong kinds of hypotheses about such uncaused structures as number – for example, that integral operations are not reversible and that relations are not necessarily transitive, as implicit in the patterns in the preceding section. It is not clear how such false kinds of hypotheses would be generated if there were a specifically innate device for the acquisition of number that also caused integers to have the properties that they do. How could this device ever generate hypotheses that contradict essential properties of numbers?

If the essential properties of integers are uncaused, then this at least opens up the opportunity for further experience with numbers to provide crucial information that will lead to correcting the false hypotheses. It is totally mysterious how such correction takes place, just as it is mysterious how we incorporate any aspect of the world. But, at least if numbers are real, we do not have to invoke number-specific learning mechanisms to account for their real properties.

The same might be true of language. We might find that the child develops incorrect kinds of hypotheses about the nature of language. I am referring not to the possibility that the child might generate incorrect rules of a correct form, but rather to the possibility that he or she might generate hypotheses incompatible with an essential property of language. Consider the following example. J. Katz (1981) suggests that one of the uncaused properties of language is "effability," the principle that every sense has (at least) one sentence that corresponds to it. That is, a "language" that could not express some sense would not be a real language. He draws the conclusion from this that languages are recursive, a conclusion that is necessary if every sense is to be represented by a single sentence.

Suppose it is true that for every sense there is a sentence. If this property is intrinsic to the way humans organize languages, then the child should never conclude that some senses are not expressible in sentences. At least some child, for at least some sense, would never experience any data to falsify such a conclusion. Yet it seems possible that children (and perhaps adults) do believe that there are some senses without a sentence. (Remember that I am now pursuing the implications of effability for the study of language acquisition, without commenting on its correctness.) This can be the case only if effability is either false or an uncaused property of language. Surely this makes important the study of effability in children.

There are also false hypotheses that the child might entertain just because they are compatible with uncaused essentials of grammar, even though they are incompatible with any human language. Human beings come to every situation with extreme limits on their serial memory. This factor might exclude them entirely from capitalizing on the recursive character of real languages, because embedding complete sentences in others would quickly multiply the length of sequences. G. Miller and Chomsky (1963) suggest that the functional role of transformations is in fact to compress the information in a complexly embedded structure into a compact and linear form. That is, actual human languages reflect the recursive character of language by utilizing meaning-bearing propositions that are not sentences themselves and that are characteristically shorter (i.e., phrases).

This suggests another false kind of hypothesis that the child might entertain: Every proposition-bearing sequence is a sentence. This is definitely not true of any attested human language, since phrases can often be proposition-bearing sequences. I think that there are certain prima facie indications that children do pass through such a period, as evidenced in their so-called telegraphic utterances. Here too the status of such behavior is unclear, but it would be worth a great deal to know whether the child assigns such sequences a derivational history as a sentence, or goes through a phase of treating a multiphrase sentence as a "discourse."

14.5. Conclusion

I have outlined a number of problems linked to the assumption that the essence of language is caused by human beings. These problems would be resolved if one accepted the view that the essence of language is not caused.

What remains are two empirical questions: What is innate that makes the discovery of language necessary? What is innate that makes it possible? I have suggested that language structure is discovered by the child as a reconciliation of behavioral conflicts that arise among emerging separate systems of communication. By this view, the discovery of lan-

guage is made necessary by the existence of distinct behavioral systems that manipulate sequences of symbols. Accordingly, the ability to develop those independent systems must be innate. Such abilities are astounding, but not unprecedented in the animal kingdom. There are other species that communicate a variety of messages or rituals, sometimes with complex sequences.

We must also account for what makes the discovery of language possible. The crucial question is whether this capacity is an isolated and psychobiologically unique one, or whether it is an application of a general ability. This part of our investigation will depend crucially on a better understanding of what language is, independent of the subset of languages that humans are able to discover. I pointed out that Dr. P's investigation of the innate basis for the "numbers" *A,B,C,D* would be greatly aided by his discovery of how those numbers map onto real integers. We depend in the same way on understanding how the universal "psychogrammar" maps onto a real essence of grammar. If this research program is correct, we will find that certain features of the real grammar are not part of universal psychogrammar, and that certain features of psychogrammar are not part of the real grammar. These mismatches between the two systems will highlight what the nature of the learning mechanism must be. A theory of that mechanism will then be required to explain why humans fail to acquire real grammar as part of their intuitive formal knowledge, and it will become an empirical question if the mechanism of discovering language structure is like the mechanisms for the discovery of other uncaused structures.

Of course, we know very little about the properties of "real grammar." But we also know very little about universal biological properties that might account for many aspects of human languages. Certain formal constraints that seem unique to language actually may be the linguistic expression of general constraints on rule-governed serial behavior. For example, the "A over A" principle in syntax (and its inheritors) and "the longest environment first" principle in phonology might both be linguistic instances of a behavioral principle: Apply a process at the most general level possible. We do not need to speculate blindly about such a possibility. For example, we can search experimentally for a principle of this sort in the rule-governed serial behavior of nonhuman animals (see Bever, Straub, Terrace, & Townsend, 1980). Such investigations increase our arsenal of possible sources of properties of human languages. We then interpret each linguistic universal as having one of these origins:

1. It is biologically based in all rule-governed organized behavior.
2. It is psychologically based in how the human mind goes about discovering and using language.
3. It is a necessary feature of real grammar.

The hypothesis that the essence of language is uncaused by humans allows for a logically possible world in which we can make relatively modest claims about what evolved in the human species and is inborn to each child:

1. Mechanisms of productive and perceptual use of symbols
2. Mechanisms for processing sequences of symbols (e.g., large short-term memory)
3. Mechanisms for the discovery of real formal structures (e.g., number, logic, language) to resolve representational conflicts within domains like (1) and (2).

According to this interpretation the acquisition of language by a child rests on three presumed mechanisms, none of which is unique to language; there is no special innate language-learning mechanism, though there may well be an innate system that makes possible the discovery of a variety of formal structures.

The corresponding account of the biological basis of language can now be unified with that of the evolution of other capacities. The biological basis for each of the postulated mechanisms must be prodigiously complex, but the first two capacities are not without precedent. Indeed, if we differ at all from certain animals in these capacities, it may be only quantitatively. The ability to discover and intuitively utilize formal structures has less clear biological precedents.[10]

But there is no reason to be categorical about the capacity of our nonlinguistic brethren. Whatever the background for mechanism (3), its presence in humans is *ex hypothesi* a general ability, not one limited to language alone. This does not make its psychobiological basis trivial or uninteresting. But it does mean that the psychobiological basis of the ability to discover language may not involve the evolution of an isolated capacity, focused only on language.

Notes

1 I am giving Bates and MacWhinney the benefit of the doubt: They may wish to claim that a distinguishable faculty of language never emerges – only communication patterns that (benighted) linguists call "language." In that case, they may hold a unique position – that language has no real existence, neither in the child nor in physics nor among the set of universal forms – a curious kind of linguistically localized skepticism.

2 Certain innate body mechanisms appear to exhibit languagelike intricacy and flexibility. The most notable example is the immune system, once often cited by biologists as an exemplar of environment-sensitive "behavior" that is genetically transmitted. Chomsky (1980) discusses this as an example of how biologically transmitted behavior can appear to be creatively "instructive" while actually being "selective." The basic phenomenon is that the immune

system provides a different antibody for all distinguishable pathogens, including those that it has not yet encountered. This would seem to indicate either foreknowledge of all "possible" pathogens, or a kind of "grammar" that constructs each antibody when needed. However, the now commonly accepted view of this process is that the immune system generates a random "library" of antibodies shortly after birth, and periodically during life. If a pathogen happens to enter the system for which there is no antibody already in the library, the organism is not capable of generating specifically the needed antibody. Furthermore, the method by which the library is originally created is by random recombination of genetic material. It is hard to see how such random mechanistic phenomena provide much comfort for the linguistic nativist. The linguistic analogy would be that elementary mental components recombine randomly until an aggregate of them fits the environmental language. But because, by hypothesis, the environment greatly underdetermines the grammar, the recombinations cannot be random in the sense that they are in the formation of antigens. If they are, then the argument that language learning is based on highly constrained mechanisms would not hold.

3 Note that there could, however, be a nonbiological physical basis for the mechanisms that underlie the knowledge of language. If the essence of language is the result of a physical law that becomes relevant only when there are complex living systems like human brains, then the essential nature of language would be literally a law of the universe, not a law of the human brain or human history.

Lest the physical interpretation be sloughed off, consider an example of how a physical law might emerge only in human behavior, but not be caused to have its essential properties by that behavior. Consider upright walking in humans. Suppose there were no other examples (on earth) of self-propelled entities that rely on the mixture of gravity, forward momentum, and balance that walking requires. We could use the study of walking as an empirical territory to explore the interaction of these physical laws and relations. We could stipulate as well that walking in humans is "innate": It is learned with little specific training and involves (already partially known) innate brain mechanisms. But one would not conclude that the physical laws with which the brain mechanisms interact are also caused by those mechanisms. Rather, it would be argued that the physical laws have their particular properties because of the basic nature of matter, not because of the human brain. The human body and brain would be cited as organs of sufficient complexity for the physical laws to become relevant constraints. In this sense, the physical properties are discovered by virtue of their application to human walking.

One could make the parallel argument about the physical basis of language – the human brain may be physiologically adapted to learn language, but if language is the effect of physical laws, then the structure or behavior of the brain cannot explain why language is the way it is. Similar arguments apply to the claim that the essence of language is a nonphysical form. The brain may account for how and why humans discover that form, but the nature of the form itself is not caused by the brain to have the particular form it does.

4 Strange as this view now seems to me, it is exactly the view I once held (see Bever, 1970): it seemed (and seems) to me to be the only way to resolve the

contradictions raised by the combination of the competence–performance "distinction," the claim that "competence" is psychological, and the existence of unlearnable (i.e., unpsychological) well-formed rules. Of course, if "universal competence" (i.e., the essence of language) is not psychobiological in origin, then the contradiction disappears and the strange mental model of *Festung Sprache* is not required.

5 The only evidence of neurological specialization for language involves the claim that it is usually localized in areas of the left hemisphere. However, even the force of this is mitigated by the fact that there is a large variability of that location from individual to individual. It is also not clear that the localization – such as it is – does not result from a general difference in computational power between the hemispheres, rather than a language-specific predisposition of the left hemisphere. See Bever (1980) for a discussion of this.

6 In fact one could maintain that special-purpose causal mechanisms must exist that "harmonize" with the nonhuman linguistic essences, that is, that the essence of language is a synthetic *a priori*. But the view that language is an *a priori* of any kind makes possible nonsynthetic interpretations we can also consider.

7 I am aware that even the structure of integers may be argued by some to be caused by human cognition, in the so-called intuitionist interpretation of mathematical objects and relations. Intuitionism can be interpreted as a claim that mathematical entities and properties all start with those that are intuitively clear to humans. This places the burden on a constructivist mathematics to show that all of mathematics can be demonstrated, starting with just those intuitions. Notice, however, that even if constructivism can succeed as an investigative method in mathematics, its success would not support any particular ontological claim about what mathematical entities in fact are. Intuitionism would remain an unsupported doctrine.

8 See n. 5.

9 The literature on the acquisition of number is very large. My attempt here is to give a programmatic description of how such a phenomenon is interpreted on the mental conflict resolution model. The reader should consult Gelman and Gallistel (1979) for reviews of research paradigms and results in this area. I have also been greatly informed on this topic by the writings of Jonas Langer.

10 Notice that it makes no difference if the evolutionary entelechy is biological, physical, or cultural. That is, any suggestion that the complex brain became capable of creating human language because of the evolutionary operation of an as yet unknown "physical law" simply changes the mystery from one of biology to one of physics. Similarily, discovery by virtue of a "cultural" law presents an anthropological mystery.