

LINGUISTICS AND PSYCHOLOGY*

1. GOALS

Since the early sixties, the received view among generative grammarians has been that linguistics is a branch of cognitive psychology. On this view, grammars constructed by linguists are hypotheses about psychologically real rules which are responsible for speakers' linguistic abilities and which are causally involved in the production of (some significant portion of) their linguistic behavior. Universal grammar (linguistic theory) is taken to be a theory of the role of innate linguistic knowledge in first language acquisition.

I will argue for a different conception in which theories in linguistics are not psychological in this way. It is important to emphasize, however, that my critique of the received view is not an attack on mentalistic accounts of linguistic behavior, nor on cognitive psychology in general. Thus, one must distinguish the following claims:

- (1) Complex, unconscious, computational states and processes underlie language acquisition and mastery.
- (2) Theories in linguistics are theories of (at least some of) these states and processes.

Many philosophical critics of the received view have attacked (1) on the grounds that positing unconscious mental states and processes is either incoherent or unscientific.¹ My own view is that such attacks have been inconclusive and that (1) is a plausible empirical hypothesis with considerable support.² Thus, my quarrel is not with (1), but with (2).

In arguing against (2), I will try to show that linguistic theories are *conceptually distinct* and *empirically divergent* from psychological theories of language acquisition and linguistic competence. In arguing that these two kinds of theories are *conceptually distinct*, I will try to show that they are concerned with different domains, make different claims, and are established by different means. In maintaining that they are *empirically divergent* I will argue that the formal structures utilized by optimal linguistic theories are not likely to be isomorphic to the internal representations posited by theories in cognitive psychology.

The differences between *conceptual distinctness* and *empirical divergence* can be illustrated by comparing mathematical formalizations of

elementary number theory with psychological theories of the cognitive processes underlying ordinary arithmetical reasoning. These two kinds of theories make claims which are about different domains and established by different means. They are, therefore, *conceptually distinct*.

It is important to recognize, however, that *conceptual distinctness* is compatible with any degree of *empirical convergence* or *divergence*. For example, suppose one's formalized number theory consisted of a standard first order language L , a specified set of arithmetical axioms A , plus some proof procedure P . Suppose also that the correct cognitive theory of arithmetical reasoning turned out to be one which claimed that reasoners unconsciously translated arithmetical sentences of natural language into L and applied A and P . This would be a miraculous instance of complete *convergence* between the structures utilized by a mathematical theory of natural numbers and the structures posited by a cognitive theory of ordinary arithmetical reasoning.

Although this imagined convergence would presumably justify the claim that the mathematician's formalization was *psychologically real*, it would not change the fact that the mathematical enterprise of constructing a theory of the natural numbers is *conceptually distinct* from the psychological enterprise of constructing a theory of the arithmetical reasoning of certain organisms. The formalization, considered as a mathematical theory, would still make non-psychological claims and would still be established by non-psychological means. Thus, even if complete convergence were established, it would be incorrect to claim that formalizations of elementary number theory are simply psychological theories, or that the task of constructing a theory of the natural numbers is a branch of cognitive psychology.

Of course, the imagined convergence is itself a fantasy. In reality, we expect mathematical theories of the natural numbers and psychological theories or arithmetical reasoning to be empirically divergent as well as conceptually distinct. (We don't expect mathematicians' axiomatizations to be found in the cognitive systems of ordinary humans). Nevertheless, it is worth remembering that the empirical divergence of mathematics and psychology is a point over and above their conceptual independence.³ I will argue that a similar empirical divergence and conceptual independence holds between linguistic theories of natural language and psychological theories of the mental states and processes underlying language acquisition and mastery.

This does not mean that linguistics is psychologically unimportant. On the contrary, linguistics constrains cognitive psychology in ways in which mathematics does not. For example, if P_1 and P_2 are populations whose

languages differ regarding which sentences are grammatical, then it is reasonable to hold that cognitive structures of members of the two populations will also differ. Although grammars of the languages do not pinpoint exactly how these structures differ, they require psychological theories to identify cognitive states and processes sufficient to produce (or explain) the observed differences in the two languages. Thus, linguistic grammars constrain psychological theories of linguistic competence. Universal Grammar, which attempts to characterize the class of humanly possible natural languages, constrains theories of language acquisition. Any such characterization implicitly specifies the scope of the human cognitive capacity to learn languages, without speculating about the causal mechanisms that implement this capacity. Thus, even though theories in linguistics are conceptually and empirically different from theories of language acquisition and linguistic competence, they are highly relevant to such theories.

It should be emphasized that the issues raised by the theses of conceptual distinctness and empirical divergence are substantive and cannot be resolved by arbitrary verbal stipulations. My point is not that certain people should be allowed to call their work 'linguistics', whereas others must content themselves with the label 'cognitive psychology'. Rather, I claim the following:

- (i) There is a theoretically sound, empirically significant conception of linguistics in which its subject matter is the structure of natural language, considered in abstraction from the cognitive mechanisms causally responsible for language acquisition and mastery.
- (ii) This conception of linguistics fits the ways in which practising linguists formulate, defend, and criticize their theories better than the received view does.

If these claims are correct, then the conclusion that linguistics does not yield computational and representational theories in cognitive psychology is a substantive one.

On my view, the divergence between linguistics and cognitive psychology does not diminish the importance of the former. Too often it has been assumed that if generative grammar were to lose the psychological status accorded it by the received view, it would lose its importance and, perhaps, its reason for being. I will argue that this is not so. Linguistics aims at providing theories of natural languages; cognitive psychology aims at providing theories of natural language users. Although there are

important relations between the two, neither need be assimilated by the other.

2. THE LINGUISTIC ENTERPRISE

2.1. *Leading Questions*

A useful way of investigating the nature of a field is to study the central questions that work in the field tries to answer. The most fundamental of these may be called 'Leading Questions' of the field. These are questions which define its basic nature and which are logically responsible for initiating and guiding the theoretical enterprise. Typically, such questions are relatively free of theoretical presuppositions and, hence, can be understood and accepted as genuine by researchers of different persuasions, as well as by those with little or no theoretical background.⁴

Among the most important Leading Questions of linguistics are instances of (Q_1 – Q_3).

- (Q_1) In what ways are . . . alike and in what ways do they differ from one another?

Instances are obtained by filling in the blank with a list or description of some (or all) natural languages e.g.,

In what ways are $\left. \begin{array}{l} \text{(a) English and Italian} \\ \text{(b) the Romance languages} \\ \text{(c) all Indo-European languages} \\ \text{(d) all natural languages} \end{array} \right\}$

alike and in what ways do they differ from one another?

- (Q_2) What (if anything) distinguishes natural languages from . . . ?

Instances are obtained by filling in the blank with a description of some set of artificial languages – e. g., 'finite state languages' – or animal communication systems – e.g., 'bee language'.

- (Q_3) In what ways have (has) . . . changed and in what ways have (has) . . . remained the same?

Here, instances are obtained by filling in both blanks by the same description (or list) of one or more natural languages.

What makes these Leading Questions is the relative paucity of their theoretical presuppositions, as well as their centrality in guiding the development of a broad spectrum of linguistic theories. In emphasizing the relative paucity of their presuppositions, I am not claiming that they are entirely free of presuppositions. On the contrary, two things are needed to

give them the content they need to play the role of Leading Questions for linguistics. One is a reasonably clear, pre-theoretic conception of what constitutes a language, as opposed to various aspects of speakers' behavior. The other is some conception of how languages are to be described so they can be studied and compared.

2.2 *Linguistically Significant Properties and Relations*

We do, I believe, have the kind of pre-theoretic grasp of what constitutes a language that is needed to give the Leading Questions content. This manifests itself in our pre-theoretic conception of linguistically significant properties and relations like grammaticality, ambiguity, synonymy, entailment, analyticity, contradiction, and so on. These properties and relations are characteristics which define languages and serve to identify or distinguish them.

For example, let *X* and *Y* be two groups of language users whose utterances have been partitioned into expression types (as opposed to tokens). Imagine that what we want to know is whether the *Xs'* language is the same as the *Ys'* language and, if not, how they differ. Certain facts about the utterance types of *Xs* and *Ys* will be *directly* relevant to answering this question and certain facts will not.

Among the facts that are not directly relevant are those of the following kinds:

- (3) *Xs* process sentences of type *A* faster than they process sentences of type *B*; whereas *Ys* process *Bs* faster than *As*.
- (4) *Xs* make fewer mistakes comprehending *As* than they do comprehending *Bs*, whereas *Ys* make fewer mistakes with *Bs* than *As*.
- (5) *Xs* learn *A*-constructions as children before they learn *B*-constructions, whereas *Ys* learn them in reverse order.

From facts like these, nothing logically follows about whether the *Xs'* language (or dialect) and the *Ys'* language (or dialect) are the same or different.⁵ In contrast, if some sentence (type) is grammatical, ambiguous, or contradictory in the *Xs'* language, but not in the *Ys'* language, then it does follow that their languages (or dialects) are different.

More generally, linguistically significant properties and relations constitute individually sufficient and disjunctively necessary conditions for individuating the languages (or dialects) of different speakers. Thus, the *X*-language is identical with the *Y*-language if and only if there is no difference between them regarding grammaticality, ambiguity, synonymy,

truth conditions, and so on. Since answering the Leading Questions involves describing and comparing different languages (or different historical states of the same language), a theory responding to these questions must be concerned with such facts. However, once the linguistically significant facts have been accounted for, there is no need for the theory to be concerned with psycholinguistic data involving reaction times, error rates, or developmental aspects of the learning process.

It should be noted that in distinguishing linguistically significant properties and relations from other characteristics of expressions (and their users), I have left many important philosophical questions open. For example; What is it about speakers and utterances in virtue of which certain utterance types are grammatical, ambiguous, or contradictory in the language of the speaker? To ask this is to ask for a philosophical analysis of these properties plus a specification of the evidence upon which attributions of them are made. Although providing such an analysis is important, its outcome does not affect the point at issue. No matter how grammaticality and other linguistically significant properties and relations are ultimately analyzed, facts involving these properties and relations are defining characteristics of languages, whereas facts like (3)–(5) are not.⁶

Undoubtedly, data which are not themselves linguistically significant often provide evidence for attributions of properties and relations which are. This is typically the case with speakers' intuitions, or judgments, of grammaticality, ambiguity, entailment, and the like.⁷ Nor is the point limited to speakers' intuitions. For example, results involving reaction times and error rates of users in various aspects of sentence processing can, in difficult cases, provide evidence that is helpful in deciding whether or not a sentence is grammatical. However, the relevance of such psycholinguistic data to theories in linguistics is limited to this indirect role. When they do not bear on attributions of linguistically significant properties and relations, they play no role in answering the Leading Questions of linguistics. Even when they do bear on such attributions, they need not be predicted by linguistic theories, so long as the theories correctly account for all linguistically significant facts.

The Leading Questions, then, play an important role in fixing the domain of facts that are properly linguistic, and in separating them from data which at most provide evidence for such facts. They do this by focusing on languages rather than acts of utterance or other aspects of speaker behavior. This concern with languages presupposes a large degree of abstraction from ordinary contexts of language use. In particular, it presupposes a grasp, albeit imperfect and subject to revision, of the properties and relations that are constitutive of languages and that serve to

identify and distinguish them. It is this pre-theoretic grasp of what constitutes a language that allows one to use the Leading Questions of linguistics to define a coherent, non-arbitrary domain of study.⁸

2.3. *Answering the Questions*

Once the domain of study has been delineated, the next issue is that of specifying how languages are to be described so that they can be studied and compared. The Leading Questions listed above do not specify how this is to be done. Thus, there is room for theorists of different persuasions to adopt different methodological constraints on systems of description.

Three methodological principles that have been adhered to by generative grammarians since their presentation in Chomsky (1955, 1975a) are:

- (P_1) The way to describe languages is to formulate grammars that generate them and correctly characterize their linguistically significant properties and relations.
- (P_2) Such grammars can be regarded as scientific theories of natural languages that make testable predictions about them.
- (P_3) Construction of these theories is guided by methodological constraints analogous to those found in normal scientific theory construction. These include:
 - (a) Coverage of data – correctness and completeness of predictions
 - (b) Simplicity and generality.⁹

On this approach, languages are compared by comparing grammars that are constructed in accordance with (P_1 – P_3). For example, languages may be alike in having grammars that share the same rules, types of rules, or principles of organization. The ways that grammars differ from one another constitute ways in which languages differ. Common aspects of the grammars provided by the theory for all natural languages are linguistic universals.¹⁰

This methodological approach can be defended on the grounds that it provides more complete and informative answers to the Leading Questions of linguistics than other (e.g., ‘taxonomic’) approaches do.¹¹ Since much of the early work in transformational grammar can be seen as showing this, I won’t attempt to reconstruct the demonstration here. For present purposes, it is enough to note that

- (i) in articulating a principled basis for distinguishing linguistically significant facts from other characteristics of utterances (and

their users), and

- (ii) in adopting a general methodological approach for describing and comparing languages,

we have sufficiently specified the content of the Leading Questions so that they define a coherent theoretical enterprise.¹² The next task is to distinguish this enterprise from psychological theories of the mental states and processes underlying language acquisition and mastery.

3. NON-MENTALISTIC LINGUISTICS AND NON-LINGUISTIC PSYCHOLOGY

3.1. *Two Claims*

The distinction between linguistics and mentalistic psychology is based on the observation that the domains of facts relevant to theories in the two fields are not the same. They differ in two respects:

- (6) There are linguistic facts which are not psychological in nature. These include semantic facts about the truth conditions of sentences.
- (7) There are psychological facts which are non-linguistic. These include chronometric data about reaction time, error rates, and developmental aspects of the learning process. Such facts are relevant to psychological theories of language acquisition and mastery in ways in which they are not germane to theories in linguistics.

My first task will be to explain these points and use them to establish the conceptual distinctness of two domains of theorizing about language. I will then move on to a consideration of the empirical divergence of theories in these domains.

3.2 *Truth Conditions*¹³

There is widespread (though not universal) agreement among theorists that a complete grammar of language *L* must include a semantics, which, among other things, provides an account of the truth conditions of sentences of *L*. This agreement reflects the recognition that languages may differ not only with respect to syntactic and phonological properties, but also with respect to semantic properties involving truth conditions. A linguistic theory that failed to account for truth conditions would miss these differences and, in extreme cases, would fail to distinguish different

languages (i.e., languages with the same syntax and phonology, but different assignments of truth conditions to sentences).¹⁴ Since the job of a linguistic theory is to specify the similarities and differences among (possible) languages, such a theory must be sensitive to truth conditions (or elements that determine them).

This conclusion has a direct bearing on the relationship between linguistics and psychology. If linguists' grammars were simply psychological theories, then claims about truth conditions would themselves be psychological. Since these claims are not (purely) psychological, it follows that grammars are not wholly psychological in nature and that linguistics is not merely a branch of psychology.

The basic argument is simple. Psychological theories are theories of the states and processes mediating sensory inputs and behavioral outputs. For mentalistic theories, the important states and processes are those occurring in the head (as opposed to the environment). The facts about which these theories make claims have to do with what these mental states and processes are, and how they mediate input and output.

Facts about truth conditions are not of this kind. To give the truth conditions of sentences is to specify the non-linguistic conditions that would make them true. Even if the sentences to be evaluated are taken to be internal representations, and hence, within the domain of mentalistic theories, a complete specification of the non-linguistic conditions under which they are true will not follow from a specification of mental states and processes, or a description of the relationship between sensory input and behavioral output.¹⁵ Consequently, claims about the truth conditions of sentences are not (purely) psychological and linguistic semantics must be distinguished from theories of the mental states and processes underlying semantic competence.

It should be noted that this argument is independent of a wide range of options regarding the way in which truth conditions are specified. For example, it doesn't matter whether a theory of truth conditions takes the form of a Tarski-Davidson truth definition, a possible world semantics, a situation semantics, an assignment of structured, Russellian propositions to sentences, or some other form. All the argument requires is that the semantics make use of extra-psychological notions. Since this is typical of semantic theories, it follows that linguistic semantics is *conceptually distinct* from psychological models of semantic competence.

3.3. *Non-Linguistic Psychology*

3.3.1. *Psycholinguistic Data*

The distinctness of linguistics from mental models of language users can

also be established by considering thesis (7). Not only are there non-psychological facts that linguistic theories must account for, there are also non-linguistic facts that psychological theories must accommodate. These include psycholinguistic data about reaction time, error rates, and developmental aspects of learning.

What makes data of this type non-linguistic is that they are not constitutive of languages. If *X* and *Y* are two groups of language users whose expressions correspond completely regarding linguistically significant properties and relations,¹⁶ then *Xs* and *Ys* speak the same language no matter how much they may differ psycholinguistically. For example, they may speak the same language even if they differ in each of the following respects:

- (3) *Xs* process sentences of type *A* faster than they process sentences of type *B*; whereas *Ys* process *Bs* faster than *As*.
- (4) *Xs* make fewer mistakes comprehending *As* than they do comprehending *Bs*; whereas *Ys* make fewer mistakes with *Bs* than *As*.
- (5) *Xs* learn *A*-constructions as children before they learn *B*-constructions; whereas *Ys* learn them in reverse order.

If these differences are pervasive enough, they may provide evidence that *Xs* and *Ys* have internalized different rules, and, hence, have different systems of underlying psychological competence.¹⁷ However, so long as this is not accompanied by differences in the linguistically significant properties and relations of *X*- and *Y*-expressions, the psycholinguistic differences between *Xs* and *Ys* are irrelevant to the description of the common language that both speak. Linguists, being concerned with language, can ignore them. Psychologists, being concerned with language users, cannot. The fact that mental models of language users are responsive to, and responsible for, facts that linguistic theories are not constitutes a further argument for the *conceptual distinctness* of these two types of theories.

3.3.2. *Competence and Performance*

It is important to note that this argument shows that linguistics is conceptually distinct not only from theories of performance, but also from psychological theories of competence. This result is not vitiated by the fact that familiar theories of competence do not make predictions about psycholinguistic data of the type illustrated by (3)–(5). What makes such

data relevant to theories of competence is the role of these theories in more performance-oriented models.

Roughly speaking, performance models and competence models can be thought of as occupying different regions along a continuum of positions that theories in psychology can occupy. At the pure performance end, theories of linguistic behavior abstract away from very little; the aim is to account for virtually all aspects of speaker judgment, sentence production, and sentence comprehension. This includes not only the nature and operation of internalized linguistic rules and strategies, but also the influence on linguistic behavior of non-linguistic cognitive systems such as those involving attention, perception, memory, and the general ability to reason.

An intermediate position on the continuum is occupied by theories which abstract away from non-linguistic cognitive systems in order to focus on those aspects of the subject's cognitive capacities that are solely, or primarily, involved in the mastery and use of natural language. Theories occupying this position can be characterized as *theories of linguistic competence, broadly construed*. Their subject matter includes the speaker-hearer's internalized linguistic rules, plus any processing or heuristic procedures whose sole or primary applications are restricted to internal structures representing linguistic material. If one thinks of the human mind as a system of 'black boxes' representing relatively well-discriminated cognitive capacities, *theories of linguistic competence, broadly construed*, are theories of the box representing the speaker-hearer's command of his native language.

At the extreme end of the continuum are *theories of linguistic competence, narrowly construed*. These are theories of the speaker-hearer's internalized linguistic rules, minus any claims about the processing techniques or heuristics that determine how they are used.¹⁸ The nature of these theories can be illuminated by considering an analogous, non-linguistic example.

Let M be a machine for proving theorems and deriving consequences of sentences of first order logic. In attempting to describe M 's internal structure, one might hypothesize that M used Frege's axioms and rules of inference for first order sentences, without specifying the particular theorem proving format M employed. Such a hypothesis would be a theory of M 's theorem-proving competence, narrowly construed. This theory, together with the assumption that M 's theorem-proving format uses the full power of its internalized axioms and rules of inference, would allow one to predict which theorems M was capable of generating.¹⁹

The difficulty with this narrow theory of competence lies not in making

sense of its claims about the rules employed by *M*, nor in verifying which theorems *M* can prove, but rather in justifying the attribution to *M* of one set of rules rather than another. So long as one looks only at information regarding which theorems *M* can prove, one has no more reason for attributing the Fregean axiomatic system to *M* than one has of attributing to *M* Mates' system of natural deduction, Jeffrey's tree method, or any number of logically equivalent, but computationally distinct, alternatives. In order to justify the selection of one of these as providing the correct narrow theory of competence for *M*, one must look not only at *which* theorems *M* can prove, but also at *how* *M* proves them. Data bearing on this might be gathered from a variety of sources, including the time it takes *M* to derive various conclusions, the order in which it computes different logical consequences of a sentence, and the nature of any of its mistakes or malfunctions.

Bringing this expanded data base to bear on the choice at hand would require incorporating alternative narrow competence models into broader competence theories by adding explicit hypotheses about *M*'s theorem-proving format and heuristic strategies. Predictions could then be made about the relative complexity of *M*'s derivations of different sentences and other aspects of *M*'s performance. If *M* could do more than prove theorems, and if the internal mechanisms responsible for *M*'s non-logical capacities interacted with its theorem-proving mechanism in a way that affected *M*'s actual performance, then even more encompassing performance models might be constructed to account for all available performance data. The result would be a series of ever larger theories, facing progressively richer classes of data.

(8)	<i>Theory Type</i>	<i>Claims</i>	<i>Primary Data</i>
	(a) Narrow competence	- internalized rules	- theorems provable by <i>M</i>
	(b) Broad competence	- (a) plus theorem-proving format and heuristics	- (a) plus data bearing on computational complexity
	(c) Performance	- (b) plus other internal systems	- (b) plus all behavioral data

The role of narrow theories of competence as components of broader psychological models explains how data about which narrow theories make no predictions when taken in isolation can nevertheless be crucial in testing such theories. For example, if a broad theory of competence makes incorrect predictions about data bearing on the relative complexity of various of *M*'s derivations, one will be faced with the choice of revising either the theorem proving heuristics or the system of inter-

nalized rules attributed to *M*. In some cases, the correct choice may be to modify the heuristics; in others, a revision in the narrow theory of competence may be called for.

The situation is analogous for psychological theories of linguistic competence and performance. A narrow theory of competence makes claims about the internalized rules employed by competent speakers. These claims (together with the assumption that the system responsible for speakers' grammatical judgments makes use of the full power of their internalized rules) predict which judgments idealized speakers will make about various linguistically significant properties and relations.

However, narrow theories must also be incorporated into broad competence models and, ultimately, into explicit theories of performance.²⁰ As components of these broader theories, narrow theories of competence face possible confirmation or disconfirmation by all of the kinds of data that the larger theories are responsible for. In particular, psycholinguistic data involving reaction times, error rates, and developmental aspects of learning can be as important in determining which rules have been internalized as judgments about linguistically significant properties and relations are. In short, these types of data are directly relevant to psychological theories of competence in a manner that goes well beyond their role in determining the extensions of linguistically significant properties and relations.²¹ Since they are not directly relevant to linguists' grammars in this way, psychological theories of linguistic competence and linguistic theories of natural languages cannot be identified.

There are, then two different distinctions that must be kept separate.

- (*D*₁) Narrow theories of psychological competence vs. more performance-oriented models.
- (*D*₂) Linguistic theories of particular languages (i.e., grammars) vs. Narrow theories of psychological competence.

*D*₁ is a distinction within cognitive psychology. *D*₂ is a distinction between cognitive psychology and linguistics.

If these distinctions are run together, there will be a tendency to regard linguists' grammars as

- (i) psychological hypotheses about the internalized rules of competent speakers

which are nevertheless

- (ii) independent of theories of performance

and

- (iii) insulated from disconfirmation by psycholinguistic data.

I have argued that no theory is capable of satisfying (i)–(iii). Linguistic theories of particular languages (i.e., grammars) satisfy (ii) and (iii), but not (i). Theories of competence satisfy (i), but not (ii) and (iii).²²

Which type of theory on constructs will depend on what one is trying to do. If one's goal is to answer the Leading Questions of linguistics, one will abstract away from psycholinguistic data that are not constitutive of languages. If one's goal is to uncover mental structure, one must account for such data by embedding narrow competence theories into broader, more performance-based models.

4. THE DIVERGENCE OF PSYCHOLOGICAL AND LINGUISTIC STRUCTURES

4.1. *Different Structures from Different Facts*

So far, I have argued that the claims made by linguistic theories of particular languages (i.e., grammars) are not the same as the claims made by psychological theories of linguistic competence. The former include claims about the truth conditions of sentences that the latter do not; the latter are subject to confirmation or disconfirmation by psycholinguistic data in ways in which the former are not. Thus, linguistics is *conceptually distinct* from mentalistic psychology.

Nevertheless, it is conceivable that *the structures* posited by linguists might turn out to be isomorphic to those posited by cognitive psychologists – i.e., it is conceivable that the mental structures posited by a correct theory of competence for speakers of *L* might correspond exactly with the structures in an optimal grammar of *L*. What I want to argue is that although this imagined isomorphism is a possibility, it is one that is unlikely to be borne out by empirical investigation.

Again, the crucial consideration arises from the observation that theories in the two domains are responsive to different sets of facts. We may assume, for the sake of argument, that there is a close correspondence between some of the facts relevant to the two theories. For example, let us imagine that all and only grammatical sentences (or syntactically ambiguous sentences) would be judged by speakers (under appropriate conditions) to be grammatical (or syntactically ambiguous).

- | | |
|-----------------------------|-------------------------------|
| (9) <i>Linguistic Facts</i> | <i>Psychological Facts</i> |
| grammaticality | ↔ judgments of grammaticality |

syntactic ambiguity ↔ judgments of syntactic ambiguity

However, in addition to the facts represented by (9), there are also facts which are directly relevant to one type of theory that have no close analogue in the other. For example, nothing in the linguist's grammar is responsive to psycholinguistic data in the way that a psychologist's theory of competence is. It is also not clear that anything in the theory of competence will correspond closely with the full range of truth conditions, and logical properties and relations, that must be accounted for by a complete grammar.²³

(10)	<i>Linguistic Facts</i>	<i>Psychological Facts</i>
	Truth conditions	
	and logical	
	properties	?
	and relations	

Roughly speaking, we can think of the linguist's task as that of constructing the simplest and most general account of the facts on the lefthand side of (9) and (10), and the psycholinguist's task as that of constructing a similarly optimal account of the facts on the right. To suppose that the two tasks will result in perfectly isomorphic structures is to suppose that psycholinguistic data, and facts about the full range of truth conditions and logical properties and relations, will be epistemologically dispensable in constructing the two types of theory. I see no reason to believe that this will be so.

To single out such data as being dispensable in this way would be as arbitrary as to ignore data involving notions like syntactic ambiguity, synonymy, and focus and intonation. It is, of course, conceptually possible that the simplest, most general account of facts excluding these notions might, surprisingly, turn out to provide the structures needed for the simplest, most general account of an expanded class of facts including all instances of the notions in question. However, no theorist would assume in advance that things would turn out this way. Since there is no more reason to assume it in the case of psycholinguistic and semantic facts, it should not be assumed that linguists' grammars will be isomorphic to the competence models of psychologists.

A more specific point can be made by focusing on the role of psycholinguistic data in psychological theories. One function of this data is to provide evidence about the computational complexity of the mental operations underlying speakers' linguistic abilities. A concern for this

kind of complexity is typically absent from grammar construction in linguistics.²⁴ The linguist's concern with simplicity and generality results from his attempt to maximize linguistic generalizations by economizing on the rules and conditions needed to generate natural languages. However, economy of generating principles may well lead, as it often does in logic and mathematics, to extra length and complexity of derivations. For example, the derivations of arithmetical equations from an optimally simple set of axioms for elementary number theory are much longer and more laborious than derivations using heuristics that most of us follow. Although this in no way detracts from the mathematician's axiomatizations, it does suggest that they are not psychologically real.

The situation is analogous in linguistics. Neither mathematicians nor linguists are concerned with the amount of scratch paper needed to write out the derivations characterized by their elegant formal systems. However, psychologists must be concerned with the amount of computational space an organism has at its disposal. To insist that speakers have internalized the simplest, most general grammar of their language, regardless of the complexity of its derivations, is to suggest that their cognitive systems are so cramped for long-term memory space in which to store grammatical principles, and so rich in computational space in which to process sentences, that economies in grammatical principles will be pursued regardless of computational costs.²⁵ Unless this can be established independently, there is little reason to postulate an isomorphism between linguists' grammars and psychologists' models of linguistic competence.

4.2. *The Dilemma*

If what I have argued is correct, those linguists who have accepted 'the received view' face a dilemma. In practice, they have tried to maximize linguistic generalizations by showing how apparently diverse linguistic data can be accounted for with a minimum of generative rules and principles. However, in explaining the significance of their grammars, they have characterized them as psychological models of linguistic competence. I have argued that one should not expect any theory to satisfy both the demands of linguistic practice and the desire for psychological reality. If this is right, then proponents of 'the received view' should either stop requiring their theories to maximize linguistic generalizations or stop taking them to represent adequate psychological theories of linguistic competence. Although neither alternative may be attractive to the most psychologically-minded linguist, on my view both are legitimate. Which alternative one chooses will depend on whether one wants to do linguistics

or mentalistic psychology.

5. LEVELS OF INVESTIGATION

The reasons for pursuing these alternative can be illustrated by considering three different types of theories that provide three different levels of investigation.

Level 3: Linguistic theories

Level 2: Psychological or computational theories

Level 1: Physical or engineering theories

Engineering theories are theories of the physical construction of various language-using beings. Computational theories are theories of the internal 'mental' representations and processes of language users. Linguistic theories are theories of the languages spoken by different groups.

Theories at the higher levels do not determine unique theories at the lower levels. For example, suppose that the collection of language users included not only humans, but also computers whose programs exactly mimicked the computational routines of human English speakers. In such a situation, there would be a correct level 2 theory that attributed the same computational states and processes to all English speakers, human and non-human alike. However, since the physical characteristics of humans and computers are different, there would be no level 1 engineering theory that correctly attributed the same physical design to all of these speakers.

The same sort of example can be constructed for levels 2 and 3. This time, imagine that the group of English speakers included not only humans, but also Martians, whose internal mental states and processes differed greatly from those of human beings. In this case, there would be a single grammar that correctly described the common language that both groups speak. However, the level 2 computational theories characterizing the two groups would be quite different.

What these examples show is that one can construct and accept theories at higher levels without committing oneself to specific theories at lower levels. Of course, one might wonder why one should bother working on higher level theories in the first place. A pragmatic reason is that higher level theories are often easier to come by than lower level theories. One doesn't have to wait for the development of neuro-physiology to construct a theory of internal computational states and processes. Similarly, one doesn't have to wait for the development of cognitive psychology to construct a theory of language.

Higher level theories can also be useful in guiding the development of, and placing constraints on, lower level theories. For example, the lin-

guistic characterization of the class of natural human languages poses the problem of specifying the psychological mechanisms in virtue of which children are able to learn them.²⁶ In addition, theories in linguistics provide a rich source of hypotheses for psychological theories of competence. Nor is the psychological interest in these hypotheses limited to only those structures that turn out to be psychologically real. Points of divergence between linguists' grammars and psychologically real systems may well provide the basis for posing precise and fruitful questions about the psychological and biological functions fulfilled by deviations from optimal linguistic simplicity and generality.

Finally, there is also an intrinsic interest in constructing higher level theories. These theories specify a core of commonality among potentially differing systems on lower levels. Computational theories abstract away from what may be widely differing physical systems in order to concentrate on the functional relationships these systems share. Theories in linguistics abstract away from potential differences in the internal representations and computational routines of various mental systems in order to concentrate on the structure of the common output they all produce.

NOTES

* Early versions of this article were presented to the Cognitive Science Groups at Stanford University and the University of California at Irvine in May of 1979, and to the Philosophy Department of the State University of New York, Albany, in December 1979. I would like to thank the participants in those sessions, and also Noam Chomsky, Robin Cooper, Jerry Fodor, Robert Harnish, Jeff Poland, Thomas Wasaw, and Barbara von Eckardt for their useful comments on various versions of the manuscript. The work was originally intended as part of a longer, book-length project on the foundations of linguistics. However, other commitments have intervened, preventing completion of that work. In the meantime, the manuscript has been widely circulated (together with a companion piece on semantics) and reaction to it has begun to appear – Higgenbotham (1983). As a result, I have decided to publish the manuscript in close to its circulated form, putting off until another time a more extended treatment and defense of the general picture presented here, as well as consideration of various possible objections.

This work was supported by a Fellowship for Independent Study and Research from the National Endowment for the Humanities (1978–9). Facilities provided by the Syntax Research Center of the University of California, Santa Cruz, were used to put the manuscript in final form (1983).

¹ Such attacks are presented in: David Cooper (1975), Steven Davis (1976), Gilbert Harman (1967) and (1969), W. V. O. Quine (1972), and Stephen Stich (1971) and (1972).

² Defenses of (1) against various philosophical criticisms can be found in: Noam Chomsky (1969a), (1969b), (1975b); Noam Chomsky and Jerrold J. Katz (1974); Jerry A. Fodor (1968), (1975); and Scott Soames (1980). Psycholinguistic support for (1), over and above that which is implicit in the linguistic literature itself, can be found in Fodor, Bever, and Garrett (1974).

³ What makes this divergence *empirical* is the fact it is an empirical matter what principles of

reasoning people normally employ. Thus, even if mathematics itself is non-empirical, the degree to which its principles correspond to those employed in ordinary mathematical reasoning is an empirical question.

⁴ Answering the Leading Questions requires theory. However, once enough theory has been developed to begin answering them, the theory itself can be seen to give rise to further, more specific, theory-laden questions. Thus, the Leading Questions are not the only questions that theories attempt to answer. However, they are central questions that theorists of different persuasions must address.

For more detailed discussion of the view of scientific theories as responses to questions, see Bromberger (1963), (1965), (1966).

⁵ This claim is a generalization of the commonplace observation that differences in the speed with which people speak, differences in their powers of comprehension, the presence or absence of speech impediments, variations in their linguistic history, and so on, do not, by themselves, signal differences in the languages (or dialects) spoken. In other words, our pre-theoretic conception of a language (or a dialect) abstracts away from these features of the behavior of speakers.

⁶ Another intuitively clear notion which is the proper subject of further analysis is that of a *linguistically significant property or relation*. I have said such properties and relations individuate languages, and they do; but so – in a broad sense – do many properties of, and relations between, expressions. For example, let P be the property of being part of a language spoken by more than a million people. If X utterances have P , but Y utterances do not, it follows that the X language \neq the Y language. But P is not linguistically significant, and is rightly ignored by grammars.

There is, of course, an important difference between P , on the one hand, and properties like grammaticality, ambiguity, and analyticity on the other. It is both a priori and metaphysically necessary that if languages A and B differ regarding P , then they must also differ regarding grammaticality, or ambiguity, or analyticity, etc. However, the converse is not true. This suggests that we might characterize the set of linguistically significant properties and relations as the smallest set S such that for any conceivable languages A and B , it is both a priori and metaphysically necessary that if $A \neq B$, then A and B differ regarding some member of S . This characterization excludes not only P , but also the properties truth and falsity, provided that properties like that of having such and such *truth conditions* can be taken to be members of S . (Grammars don't have to tell us which sentences of a language are true.)

Although I think that something along these lines is correct, I am not certain about the precise form of the final definition. What does seem clear is that the usual properties singled out by linguists (grammaticality, ambiguity, etc.) constitute defining characteristics of languages in a far stronger sense than properties like P , truth, or falsity do. Facts involving these defining characteristics are linguistically significant, and must be predicted by linguists' grammars. Facts like (3)–(5) are not themselves defining features of languages, but rather bear indirectly on the individuation of languages spoken by populations only in so far as they are relevant to determining the extensions of linguistically significant properties and relations.

⁷ Facts involving grammaticality, ambiguity, entailment, and so on are linguistically significant. Speakers' judgments of grammaticality, ambiguity, and entailment are not, but rather are evidence for linguistically significant facts. Although these judgements are generally reliable, they can be mistaken. For example, two speakers might differ in that one, but not the other, failed to notice a certain ambiguity or entailment that is present in his language. If this were the only relevant difference between them, the speakers might speak the same language (dialect) even though their intuitions about it differed. See Soames (1984) for further discussion.

⁸ The argument in this section was stimulated by a prepublication version of J. A. Fodor's 'A Note on What Linguistics is About'. In that paper, Fodor admits that a non-mentalistic

conception of linguistics is coherent, but claims that such an enterprise is necessarily arbitrary (and hence uninteresting). The source of the alleged arbitrariness lies in a supposedly unprincipled exclusion of psycholinguistic facts from the domain of linguistics. The argument in this section is intended to undercut Fodor's criticism by showing how a principled distinction between linguistically significant facts and psycholinguistic data can be drawn.

It should be noted that Fodor's target in the article was a view that differs from mine in certain respects. In particular, Fodor took himself to be objecting to a view that included intuitions of grammaticality as data for theories in linguistics, but excluded other psycholinguistic facts. (His criticism seems to me to be a good objection to the view called 'competencism' in Katz (1977), but an inaccurate characterization of what Katz calls 'Platonism'. See in particular pp. 256–258 of Katz in the Block volume.) It must be emphasized that as Fodor used the term 'data' in the article, data are what theories make claims or predictions about. As I indicated above, in that sense even intuitions of grammaticality are not data for theories in linguistics; whereas facts about grammaticality are. Of course, intuitions and other psychological facts are epistemological sources one uses to discover what the grammatical facts are; they may even be nomologically constitutive of such facts. As such they are relevant to the evaluation of linguistic theories. Since there are no a priori restrictions on what sources might be epistemologically relevant, or nomologically constitutive, much of Fodor's criticism of a priori restrictions on science does not apply to the conception of linguistics I advocate. What I have tried to show is that there is a non-arbitrary and theoretically sound conception of linguistics in which the predictions made by grammars are logically constitutive of natural languages in the manner discussed above; and that psycholinguistic, neurological, and other considerations are relevant to evaluating grammars only insofar as they bear on the correctness of those predictions.

⁹ The status of simplicity in the theory and practice of generative grammar has sometimes been clouded by vacillation between formal and psychological notions. In practice, generative grammarians, like other scientists, have followed their pre-theoretic sense of simplicity in selecting among alternative grammatical analyses, and in projecting beyond restricted classes of data to more inclusive sets. This practice is roughly in keeping with the treatment of simplicity discussed by Chomsky in *The Logical Structure of Linguistic Theory* (LSLT). However, in later works, where the psychological interpretation of linguistics is emphasized, the 'simplicity metric' is said to represent a psychological hypothesis about language acquisition. On this view, a correct simplicity metric incorporates the criteria used by language learners in projecting beyond utterances encountered in the learning process to sentences they have never heard before.

Clearly, the task of explicating scientists' (e.g., linguists') notion of simplicity is conceptually distinct from the task of discovering children's projection methods. Moreover, there seems to be little reason to expect the two tasks to converge on the same principles for choosing among grammars. (See, however, Note 25.) Thus, there is a prima facie conflict between the practice of many linguists (selecting grammars in accord with their pretheoretic sense of simplicity) and the psychological interpretation of linguistics (which says that the sense of simplicity applicable to linguists' grammars is that used by children in projection). The sense of simplicity I am adopting in P_3 is the formal sense corresponding to linguists' intuitions as scientists.

In this connection, a word should be said about Chomsky's treatment of simplicity in LSLT. The discussion of simplicity takes place in the framework of what Chomsky has called "the methodological interpretation of the fundamental problem of linguistics" – namely, the selection and justification of a grammar of a language on the basis of a corpus of data drawn from the language. (Introduction to Chomsky 1975a p. 36) In this framework, simplicity is used to justify grammars in terms of the degree of linguistically significant generalization they achieve, as well as their success in projecting beyond available corpora.

The purpose of a 'simplicity metric' in this framework was not, explicitly, to provide a

psychological theory of language acquisition, but rather to ensure that theoretical notions of linguistic theory could be given operational definitions. For example, the definition of 'morpheme' was thought to fit roughly the following pattern:

- (i) *m* is a morpheme of the language *L* of a corpus *C* (of some appropriate size and type) iff *m* is assigned a certain kind of representation (at a fixed level of structure) in the simplest grammar (provided by general linguistic theory) that is compatible with the analysis of *C* in terms of the primitives of linguistic theory.

The primitives of linguistic theory were supposed to consist of pre-theoretic notions in terms of which the corpus could be analyzed so as to yield the basic linguistic data against which grammars could be tested. Theoretical notions, like 'constituent', 'morpheme', and so on, were to be defined using these primitives, plus simplicity, and the general schematism provided by linguistic theory. In order for these definitions to satisfy the standards of rigor envisioned in LSLT, the sense of simplicity relevant to linguistics had to be formalized within linguistic theory. Hence, the concern with devising notations in which formal considerations (like length) reflect "real simplicity and generalization".

Granting the need for formalization within this framework, one might still wonder exactly what was being formalized. Here, one is pulled in two directions. On the one hand, Chomsky assumed in LSLT that, as scientists, linguists have a "partially understood pre-systematic sense" of simplicity which allows them to recognize clear instances of the notion, and which is roughly correlated with economy of generating principles. (Chomsky 1955 and 1975a, Section 26) Time after time, Chomsky appeals to this sense of simplicity, in the absence of data about language learning, to motivate one linguistic analysis over another. This suggests that the notion of simplicity to be formalized is a special case, applying to linguistics, of the general scientific notion (a suggestion supported by several references to Quine and Goodman on the nature and importance of simplicity in science).

On the other hand, the centrality of projection on the methodological and operationalist interpretation has an obvious psychological analogue, as Chomsky has indicated. Just as operationalism requires projecting beyond linguists' corpora of some appropriate finite sort, so a psychological model of language acquisition must explain how children acquire knowledge of an infinite language on the basis of exposure to a relatively small amount of linguistic information. It seems clear that Chomsky had this analogy very much in mind. With it in mind, one can see how the 'simplicity metric' might come to be viewed as embodying an explicitly psychological hypothesis about language learning.

Thus, one natural way of modifying and extending the general framework of LSLT is to adopt a psychological interpretation of linguistics (being careful when doing linguistic work to rely on data about language learning, rather than linguists' intuitions about simplicity and generality). However, another modification and extension is also possible – namely, to drop operationalism, while retaining the notion of simplicity in its scientific, as opposed to psychological, sense. On this conception, linguistic theory is charged with characterizing the class of possible natural languages and providing this class with grammars which, on the whole, are as simple and general as possible. This, in rough outline, is the sort of approach I advocate.

¹⁰ Note, linguistic universals are not elements common to all grammars of natural languages, but rather are elements common to all grammars of natural languages that are made available by general linguistic theory (Universal Grammar). In order for such a theory to be adequate it must provide an optimal grammar for each possible natural language. However, it is not required to provide for each natural language all of the (infinitely many) possible grammars that are capable of generating it. See Stich (1972) and Chomsky and Katz (1974) for discussions of this point.

¹¹ By 'taxonomic' approaches I have in mind the theories of the American Structuralists who preceded Chomsky. In general, these theories

- (i) limited grammatical descriptions and comparisons of language to regularities that could be stated at the level of surface structure; and
- (ii) conceived of linguistic theory as a set of procedures for analyzing utterances and constructing 'taxonomic' grammars from observed corpora.

¹² The fact that one can articulate a principled, pre-theoretic basis for picking out a domain (and a set of methodological constraints for studying it) does not guarantee that the domain will be appropriate for systematic theorizing. It is conceivable that in order to obtain a systematic, non ad hoc theory, one might have to expand or contract one's pre-theoretically specified subject matter.

In the case of linguistics this means that our ability to pre-theoretically characterize linguistically significant properties and relations as being constitutive of languages does not in itself guarantee that the domain they define will be a theoretically interesting or fruitful one. If there turned out to be no systematic, non ad hoc formalizations of this domain (or reasonably adjusted versions thereof), then there would be no interesting theories of language in my sense. Fortunately, the substantial progress made by generative grammarians in the past two decades provides ample grounds for believing that there are such theories.

¹³ The idea of using semantic facts as one means of distinguishing linguistics from psychological models of mental structure was suggested to me by an early draft of what eventually became Katz (1981). However, my basic strategy for achieving this result differs fundamentally from his. For a comparison, see Katz (1981) and Soames (1984).

¹⁴ Let L_1 and L_2 be such that

- (i) For all sentences S , S is grammatical in L_1 iff S is grammatical in L_2 ; but
- (ii) For all sentences S , the truth conditions of S in $L_1 \neq$ the truth conditions of S in L_2 .

Then, although L_1 and L_2 are different languages, they may be indistinguishable to a theory that is insensitive to truth conditions (or elements that determine truth conditions).

¹⁵ This claim depends on the contention that there is a subset of lexical items (in languages of various populations) whose central semantic properties are not (wholly) determined by psychological facts. By contrast, semantic facts corresponding to recursive aspects of the specification of truth conditions may be psychologically determined. However, even in this case there are reasons to believe that the formal mechanisms used by a semantic theory to represent these semantic facts are not 'psychologically real'.

The first of these points, about lexical semantics, shows that the content of semantic claims like (i) and (ii) cannot be (wholly) psychological.

- (i) Expression α in the language of population P refers (relative to an index i) to ... (expresses the information content ...)
- (ii) Sentence S in the language of population P is true (relative to an index i) iff ... (expresses the information content ...)

The second point, about recursive aspects of semantics, shows that even though semantic facts like

- (iii) S_1 entails S_2 in the language of population P

may have some broadly psychological content, semantic theories do not specify, and are not isomorphic to, the mental states and processes underlying semantic competence. See Soames (1984) for extended discussion.

¹⁶ i.e., the set of grammatical X -sentences = the set of grammatical Y -sentences, the set of n -tuples of synonymous X -sentences = the set of n -tuples of synonymous Y -sentences, the set of X -sentences that are analytic = the set of Y -sentences that are, and similarly for all other linguistically significant properties and relations.

¹⁷ I am here using *competence* in roughly Chomsky's technical sense. In this sense a speaker's competence is the system of linguistic rules that he has internalized. Since different systems of rules may characterize the same output, speakers may have different competences, in the technical sense, even though they share the same ability to speak and understand their common language.

¹⁸ Proponents of the received view have generally regarded linguists' grammars as theories of competence in this narrow sense. "A grammar of a language purports to be a description of the ideal speaker-hearer's intrinsic competence". Chomsky (1965), p. 4.

"To avoid what has been a continuing misunderstanding, it is perhaps worthwhile to reiterate that a generative grammar is not a model for a speaker or a hearer. It attempts to characterize in the most neutral possible terms the knowledge of the language that provides the basis for actual use of language by a speaker-hearer. When we speak of a grammar as generating a sentence with a certain structural description, we mean simply that the grammar assigns this structural description to the sentence. When we say that a sentence has a certain derivation with respect to a particular generative grammar, we say nothing about how the speaker or hearer might proceed, in some practical or efficient way, to construct such a derivation. These questions belong to the theory of language use – the theory of 'performance'. No doubt, a reasonable model of language use will incorporate, as a basic component, the generative grammar that expresses the speaker-hearer's knowledge of the language; but this generative grammar does not, in itself, prescribe the character or functioning of a perceptual model or a model of speech production." Chomsky (1965), p. 9.

¹⁹ The assumption that *M*'s theorem-proving format uses the full power of its internalized axioms and rules of inference is an expository convenience. It allows one to use the narrow theory of competence to characterize the class of theorems *M* is capable of proving, without specifying the precise theorem-proving format that *M* employs. (There are many such formats that use the full power of the axioms and rules of inference.)

An analogous assumption in the case of theories of linguistic competence is that the systems underlying speakers' judgments of grammaticality utilize the full power of their internalized syntactic rules. If this assumption is correct, then speaker-hearers can, in principle (if not in practice), recognize all syntactically well-formed sentences that their internal grammars abstractly characterize. This (as far as I know, unargued) view seems to underlie the commonly held thesis that what I am calling 'theories of linguistic competence, narrowly construed' are theories of the grammatical judgments of idealized speaker-hearers. (For some special difficulties involving semantic judgments, see Soames (1984)).

²⁰ If the rules attributed to speakers by a narrow theory of competence take the form of a grammar, then this internalized grammar must be a component of some performance system – e.g., the system responsible for sentence production, sentence comprehension, grammatical judgments, or a 'fail-safe' system that can be invoked as a check on some on-line process. Although there has been considerable speculation that an internalized grammar is a component of the system underlying speaker judgment, it is an open question whether this is the relevant performance system. What is not an open question is that the rules posited by a correct narrow competence theory must be parts of some performance system. If they weren't, then they would not guide any aspects of speaker behavior and no justification could be given to the claim that they are psychologically real.

²¹ Essentially this point is made by Jerry A. Fodor (1981) and by Thomas Wasow (ms.).

²² Linguists often seem to have run together distinctions *D*₁ and *D*₂. However, in some places Chomsky and Katz have made one of the points about theories of competence that I have made here – namely, that, in principle, they do not satisfy (ii) and (iii).

“Thus, suppose it were discovered, say, by neurophysiological investigation or by psycholinguistic study, that all the linguist’s data (and more) can be better explained by assuming that the organism has a system of perceptual strategies not involving the principles of generative grammar in any manner . . . Linguists who take the realist position, claiming that a dag (descriptively adequate grammar) actually describes the speech mechanism at work, might well abandon their formerly held comprehensive performance theory, with its idealized components and its specific principles and properties.” Chomsky and Katz (1974)

This seems to me to be exactly right regarding theories of competence, but not linguists’ grammars in my sense.

Although Chomsky has recognized that psycholinguistic evidence might, in principle, reveal that speakers’ internalized rules are not optimally simple linguistically, in practice he has tended to minimize the importance of available psycholinguistic results (for theories of competence) and to emphasize the difficulty of obtaining significant and reliable psycholinguistic data. This negative assessment of the status of present-day psycholinguistics is a controversial one which I do not propose to discuss here.

²³ There are two distinct points here. One involves the non-psychological nature of certain claims about truth conditions. The other involves the possibility that competent speakers may be inherently incapable of recognizing the full range of instances of logical properties and relations in their language. These points are discussed in detail in Soames (1984).

²⁴ See Bresnan (1982) for an apparent exception to this generalization. Note, by *linguistics* I mean the discipline defined by the Leading Questions discussed earlier and practiced today by generative grammarians. For expository purposes, I am not using the term to cover the field known as *computational linguistics*.

²⁵ This argument assumes that theories of competence which posit internalized grammatical rules must be incorporated into some performance system. (See Note 20.) The argument is also subject to two qualifications.

First, it is probably best not to require linguistic theory to provide a maximally simple and general grammar for each natural language, but rather to require the theory to characterize the class of possible natural languages, providing this class with grammars that are, *on the whole*, optimally simple and general. Local deviation from maximal simplicity and generality in the case of an individual language might be tolerated, if it purchased increased simplicity and generality elsewhere.

Second, although simplicity of generating principles may make for computational complexity, it is not entirely without psychological virtues. There seems to be at least a rough correlation between simplicity and generality of theoretical principles, on the one hand, and the informativeness of conclusions drawn from these principles on the basis of small amounts of data, on the other. (See Sober, 1975) Roughly speaking, advances in simplicity increase the amount of information that can be extracted from observed data about unobserved cases. This feature of simplicity might well find some use in a language acquisition device.

Nevertheless, it seems to me that the basic argument still stands. Psychological systems face a variety of constraints, including derivational complexity, that linguistic systems do not. Because of these constraints, there is little reason to assume that there will be an isomorphism of structure between optimal theories in linguistics and psychology. How much or how little divergence there really is can be settled only by further empirical work.

²⁶ Wasow (1978) stresses this point.

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