

Steinberg 1993:
Introduction to Psycholinguistics

Longman Group UK Limited,
Longman House, Burnt Mill,
Harlow, Essex CM20 2JF, England
and Associated Companies throughout the world.

Published in the United States of America
by Longman Publishing, New York

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First published 1993

ISBN 0-582 05982-8 PPR

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library

Library of Congress Cataloguing-in-Publication Data

Steinberg, Danny D.

Introduction to psycholinguistics/Danny D. Steinberg.
p. cm.

Includes bibliographical references and index.
1. Psycholinguistics. I. Title.

P37.S77 1993.
401'.9—dc20

92-38645
CIP

set in Linotron Bembo 11/12pt by 8U
Printed in Hong Kong
WP/01

CHAPTER 5

Mental grammar

5.1 Grammar and psycholinguistics

5.1.1 How do speakers produce and understand sentences?

How do we produce and understand sentences? What role does a mental grammar, the grammar we have in our minds, have in such essential communicative processes? These questions lie at the heart of psycholinguistics and some understanding of them is essential, despite the high degree of complexity and abstractness which the subject matter presents.

In this regard linguists have long puzzled over what the main goal of linguistics should be. Is it to describe a language? Or, is it to describe what speakers know about a language? There is a distinction here, one that has important implications for psycholinguists.

5.1.2 Linguistics as psychology

In the first half of the twentieth century, linguists were divided on the issue. Some linguists, like Bloomfield, argued for the psychological validity of the descriptions they were writing. They held that what they wrote about was not only a description of language but it was also a description of what people had learned. Such theorists regarded themselves as dealing with a psychological product, human learning. Others, however, such as Twardell, rejected such a goal for linguistics. They considered the description of language, not the psychological aspects of people, to be their goal. Further, theoretical entities like the

phoneme were regarded simply as convenient fictions, useful for the notational purposes of description but nothing else. They denied that speakers learned or used such notions. Still other linguists, perhaps a majority, simply avoided the dispute altogether and kept on doing whatever it was that they were doing (making descriptions of various aspects of language) and leaving it to others to worry about the ultimate psychological nature of their formulations.

In the 1960s Chomsky came down heavily on the side of psychological linguistics. His thesis, that linguistics is a branch of cognitive psychology, has become so widely held that few linguists today oppose such a view. Even many of Chomsky's staunchest linguistic critics are in accord on the goal of linguistics as involving the description of knowledge that people have about language.

5.2 Chomsky's competence and performance distinction

In addition to using the term 'grammar' to indicate a certain kind of language knowledge, Chomsky uses the term *competence* with this same sense. Competence is the knowledge that people have of the grammar of their language and, as such, it is the goal of linguistics to describe this competence. A linguist will be successful to the extent that his or her formulations are true descriptions of the knowledge that is in people's minds.

Now, if the specification of competence is the primary goal of linguistics, what then should be the goal of psycholinguistics? In Chomsky's view, psycholinguistics has two major goals: (1) to specify how people use competence so that they are able to produce and understand sentences; and (2) to specify how people acquire competence (grammatical knowledge). It is the first of these goals, the use of a grammar for the production and understanding of sentences, that will be of concern to us here. The second is considered in other chapters of this book.

For Chomsky, the activities involved in producing and understanding sentences are *performance* processes. Competence (mental grammar) is just one part, albeit an essential part, of these two crucial performance functions. A theory

of performance should explain sentence production, i.e. how speakers take ideas and make them into sentences which are rendered into speech sounds. A theory of performance also should explain sentence comprehension, i.e. how speakers, on receiving speech sounds, recover ideas from those sounds. In both of these performance processes, according to Chomsky, one grammar, i.e. competence, is used.

The relationship of competence to performance for Chomsky, therefore, is that of part to whole, with *competence* being a part or component of the whole, which is, *performance*. Competence is the knowledge that persons have of their grammar while performance involves knowledge for using competence so that the processes of sentence production and understanding can be realized.

5.3 Chomsky's grammatical conceptions

Before continuing with a discussion of mental grammar and performance, which will be presented in the next chapter, it is first necessary to consider various conceptions of mental grammar. In this regard, consideration of the ideas of Chomsky, who is the world's foremost grammatical theorist, is of the highest priority.

In 1957 Chomsky came out with his book, *Syntactic Structures* — a remarkable book that revolutionized linguistics and influenced a number of the social sciences, especially psychology and anthropology. With his notion of a *system of rules*, phenomena which hitherto could not be explained could now be dealt with. In particular, Chomsky demonstrated how such a system could be used to explain how speakers can, in principle, produce and understand an infinite number of grammatical sentences. (The first chapter of my 1982 psycholinguistics book provides a description of Chomsky's brilliant and powerful ideas.)

Since the advent of Chomsky, linguistics (and psycholinguistics) has never been the same. Over 35 years later, we find Chomsky still leading the field. With the help of able supporters he continues to solidify his revolution with new and challenging ideas. On the average, Chomsky shakes up his followers once per decade. Following Syntactic Struc-

tures' grammar in the 1950s, there was the Aspects' (Standard Theory) grammar in the 1960s. Then there was the Extended Standard Theory grammar in the 1970s followed by the Government/Binding grammar in the 1980s. Now, in the 1990s, once again we hear rumblings, with Chomsky proposing to abandon D-structure, that deep level of structure the name of which has become familiar even to many outside of linguistics.

Still, despite far-reaching changes in the details of his grammars, Chomsky has continued to maintain one fundamental notion, which is that the syntax of the grammar is primary, with meaning (and sound) being secondary. (Abandonment of D-structure, as Chomsky now suggests, in no way implies that syntax would not continue to be primary.) This is to say that the meaning of a sentence is specified as a function of its syntactic form, and not vice versa. This relationship, which Chomsky claims to be innate and universal, is shown in Figure 5.1. This idea of how a grammar is to be organized, however, has the effect, as shall be argued later in this and the following chapter, of rendering Chomsky's essential grammatical theorizing as psychologically invalid. By his own criterion, the linguist's grammar must be psychologically valid.

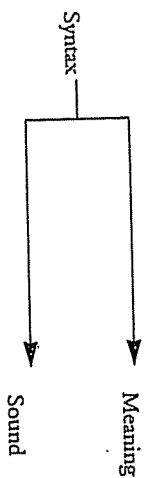


Figure 5.1 Relationship of syntax, meaning and sound

CHAPTER 6

Sentence processing and psychological reality

6.1 Meaning, sound and syntax relations in Chomsky's grammar

While over the past decades, Chomsky's theory of grammar has developed into one of increasing complexity and abstractness, at the same time certain essentials have not changed. The fundamental conception, as to how the three basic components of the grammar – meaning, sound, and syntax – are related to one another, remains the same. A schema of this relationship, as was discussed in the previous chapter, is shown in Figure 6.1.

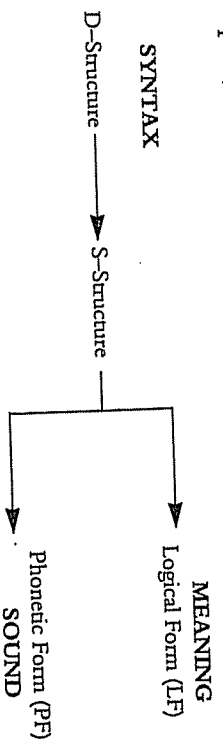


Figure 6.1 Chomsky's sound, meaning and syntax relations

Chomsky claims that the organization of his grammar is designed so as to account for the relationship of sound to meaning through the medium of syntax. What is striking here, though, is the way Chomsky relates sound and meaning. Chomsky does not begin with the meaning of the sentence nor the sound pattern of the sentence; he begins with the syntax of the sentence. In fact, he starts with the letter S, which, although one might be tempted to interpret it as meaning 'sentence', actually has no significance in Chomsky's scheme. The structures that represent the sound

or Phonetic Form (PF) and the meaning or Logical Form (LF) of a sentence are first generated from the syntax, which is activated by the vacuous S. ('Generate' is used here by Chomsky in an idiosyncratic way to mean 'define' and not 'produce'.) The meaning of the sentence does not determine syntax nor does the sound pattern of the sentence determine syntax. Rather, syntax functions independently ('autonomously') of meaning and sound. The meaning and sound pattern of a sentence is defined by the function of syntax. In this conception, only syntax is 'generative'. (An outline of Chomsky's grammar can be found in Chapter 5.)

6.2 Why Chomsky's grammar is not a performance model

Given how meaning, sound and syntax are related in Chomsky's grammar, it will become clear why that grammar could not possibly be a model of speaker performance either for the production or for the understanding of sentences. Let us first consider what the true process of speaker *production* must involve. Such a process must begin with the ideas of what a person wants to express, and, it must end with speech sounds. A speaker has some ideas he or she wishes to express and then uses speech sounds to try to communicate those ideas. In Chomsky's terminology, this process would begin with something like Logical Form (LF) and end with the Phonetic Form (PF).

For speaker *understanding* the true process would involve a reverse ordering. First we hear the speech sounds that someone utters and from those sounds we recover the meaning they represent. In Chomsky's terminology, the process would begin with the PF and end with the LF.

The essence of the production and understanding performance processes are as shown below. (The question mark (?) along with syntax is merely to indicate that other, unspecified, components are included.) The order in Chomsky's grammar is also presented for comparison purposes.

Sentence production performance order

Meaning (LF) → [Syntax + ?] → Sound (PF)

Sentence understanding performance order

Sound (PF) → [Syntax + ?] → Meaning (LF)

Chomsky grammar order

→ Sound (PF)
Syntax → Meaning (LF)

From this, it is clear that Chomsky's grammar could not be used directly as either a model of production or of understanding. Chomsky is aware of this and has long cautioned readers not to interpret his grammar as a kind of performance process. As Chomsky (1967, pp. 435-6) says:

It would be tempting but quite absurd, to regard it [the grammar] as a model of performance as well. Thus, we might propose that to produce a sentence, the speaker goes through the successive steps of constructing a base-derivation [D-structure] line by line from the initial symbol S, then inserting lexical items and applying transformations to form a surface structure, and finally applying the phonological rules in their given order. . . . There is not the slightest justification for any such assumption. In fact, in implying that the speaker selects the general properties of sentence structure before selecting lexical items (before deciding what he is going to talk about), such a proposal seems not only without justification but entirely counter to whatever vague intuitions one may have about the processes that underlie production.

Neither meaning nor sound is a starting point. Rather, meaning and sound are the products of syntax; they are not related to one another in any direct way.

Now, if Chomsky's grammar is not itself a performance process, then in what sense is it relevant to the production and understanding of sentences? Obviously Chomsky considers it relevant, otherwise he would not claim, as he does, that a mental grammar exists in people's minds. He is quite emphatic in this regard, having stated:

Hence, in the technical sense, linguistic theory is mentalistic, since it is concerned with discovering a mental reality underlying actual behavior.

(Chomsky, 1965, p. 4)

The linguist's grammar is a scientific theory, correct insofar as it corresponds to the internally represented grammar.

(Chomsky, 1980, p. 220)

Obviously every speaker of a language has mastered and internalized a generative grammar that expresses his knowledge of his language.

(Chomsky, 1965, p. 8)

In order to support his claim that his grammar is psychologically real, even though it is neither a model of production nor of understanding, Chomsky has made it an essential part of the performance process. He asserts that his grammar will be used in both the processes of sentence production and understanding. In this regard, the speaker must develop some sort of use rules, heuristics, or strategies so that the grammar can be used for such performance processes. The sort of model that Chomsky has in mind is discussed in the following section.

6.3 Types of performance models

Essentially, two basic performance conceptions are possible. The first conception takes what I call a *Resource Grammar* approach. (Formerly I have referred to this as a 'componential' model.) Here, the grammar is used as a sort of resource in order that a speaker may engage in the process of producing or understanding sentences. So that the knowledge embodied in the grammar can be tapped, certain strategies or heuristics are necessary. This approach is the one that Chomsky advocates.

The second conception takes, what I call, a *Process Grammar* approach. Here, a grammar (or grammars) is itself a process in the production or understanding of sentences. For example, since semantic-based grammars like Functional Grammar and Generative Semantics Grammar follow the Performance Production Order (shown above), such grammars could themselves be regarded as a performance model of sentence production. Grammar is itself a process.

6.3.1 Chomsky's resource grammar performance model

To understand Chomsky's conception, an analogy might be helpful here. Consider the solving of arithmetic problems such as multiplication and division. Essential to the solving of such problems is the multiplication table, a table which includes all products and combinations, e.g. a 10×10 table, where $1 \times 1 = 1$, $1 \times 2 = 2$, and so on to $10 \times 10 = 100$.

Such a table by itself, however, will not solve a problem like $468 \times 32 = \underline{\quad} \underline{\quad} \underline{\quad}$.

In order to solve this problem (by hand or mentally), we must know what digits are to be multiplied together and in what order, and we must know what numbers to record and which to hold in storage. Thus, we start with 2×8 (the rightmost digits of each of the two numbers) and follow this with 2×6 (moving one digit leftward on the longest number). How much is 2×8 and 2×6 ? Well, for these answers we dip into our memorized multiplication table where we find that $2 \times 8 = 16$, and $2 \times 6 = 12$. For the product of 16, we record the 6 and hold the 1 in storage. We use storage when the product consists of more than one digit. And so the process continues. We use resource knowledge, the multiplication table, and we use rules that enable us to access that knowledge. Thus, we may say that two types of knowledge are involved here, the multiplication table and a set of rules that uses that table for the purpose of solving multiplication problems.

The multiplication table is also an indispensable resource that we use when we want to do division, as in a problem like $483/9$. Here, we must apply a different set of use rules than those we apply for multiplication. For example, in solving this division problem (according to one method), we first take the leftmost digit of the number to be divided (4), and see if it is equal to or less than the number we are dividing by (9). Since 4 is less than 9, then we go on to the next digit to the right (8). We then divide 48 by 9. In order to carry out this division, however, we must use the multiplication table. There we search for a product where 9 times something is either equal to or less than 48, and select $9 \times 5 = 45$ (we reject $9 \times 6 = 54$ because it is more than 48). We record the 5, subtract 45 from 48, and continue on with the application of various rules until we arrive at an answer.

A model of arithmetic performance based on this discussion is shown in Figure 6.2. There we see that the multiplication table is used as a resource for the solving of multiplication and division problems. There is one set of Use rules for performance process of multiplication and another set for the performance process of division. Chomsky's view of the role of a grammar with respect

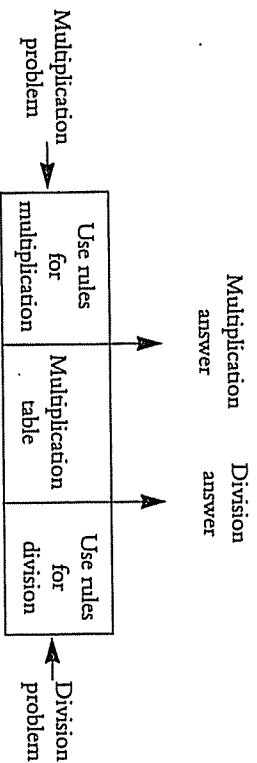


Figure 6.2 A resource model of arithmetic performance

to the production and understanding of sentences is like that of the multiplication table. One grammar serves as a resource for performance. Since there are two performance processes to be explained, two sets of Use rules are required: one set for production, the other for understanding. The schema shown in Figure 6.3 represents Chomsky's conception of a language performance model.

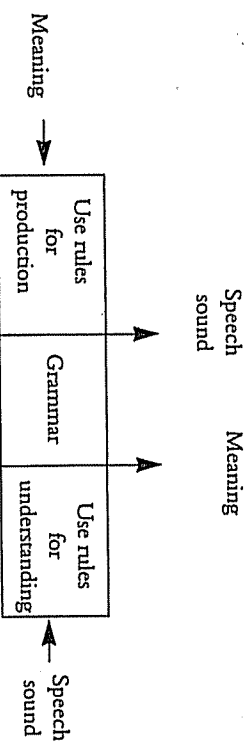


Figure 6.3 Chomsky's resource grammar performance model

Essentially, production performance involves meaning or ideas as input, and speech as output, while understanding involves speech as input and meaning as output. When given input, one of the sets of Use rules will interact with the grammar to provide an output.

Just what these Use rules might be has not been Chomsky's concern. That burden is one that he has assigned psycholinguists, an assignment based on a division of labour that he himself established. According to that division, it is for the linguist to describe grammar while it is for the psycholinguist to describe how that grammar is to be used

in performance. Many psycholinguists, particularly in the early revolutionary days of Chomsky's grammatical theorizing, have willingly accepted their given assignment.

6.3.2 A process grammar performance model

In contrast to Chomsky's resource grammar conception of performance, there are process type of grammars that are part of the process itself – for example, some of the grammars discussed in the previous chapter, such as the semantic-based grammars (Functional Grammar, mainly derived from Generative Semantics Grammar) and psychological process grammars (Cognitive Grammar). The semantic-based grammars could serve directly as models of sentence production since they take the meaning of the sentence as input and provide the sound pattern of the sentence as output. However, to suppose that a speaker would actually go step by step through such a grammar to produce a sentence is doubtful. This would be too time consuming a process. A speaker would take short-cuts by processing different levels at the same time. (See Section 6.4 below for further discussion on this point.)

That the production and comprehension processes are in some way interrelated must surely be the case. Both must share the same lexicon, for example, although how each process gains access to and uses the lexicon undoubtedly will be different. The same could be said for syntactic principles. Surely there must be a relationship, for example, between the knowledge needed to construct an interrogative form and the knowledge needed for identifying the same form. Such considerations, incidentally, would not lead to a grammar like Chomsky's because Chomsky's competence is not written with such problems in mind.

Any complete model of speaker performance, moreover, must take into account more than simple meaning. The sentences we utter are uttered for a purpose, to flatter, to insult, to praise, etc. Then, too, politeness, along with other interpersonal variables, also serves to determine the form and content of a sentence. ('Open the window' and 'Would you please be so kind as to open the window?' may have the same purpose but they differ greatly in politeness level.) Such pragmatic aspects of language are clearly

essential to any model of speaker performance. As Leech (1983) persuasively argues, these are best conceived of as a set of variables which operate to determine the form of the initial semantic structure and are not included in the grammar itself.

6.3.3 No workable performance model yet with Chomsky's grammar

Although it has been more than 25 years since Chomsky first proposed his competence-performance distinction and the model of performance it entails, as yet no workable performance model using his grammar has been formulated. Even some of Chomsky's most ardent and brilliant psycholinguistic supporters, e.g. McNeill, Bever, Mehler and Garrett, have not succeeded in the task. One cannot help but wonder, therefore, why this is the case. Two distinct possibilities come to my mind. Either psycholinguists are not smart enough to create a workable model, or, there is something wrong with Chomsky's conception of grammar such that a performance model cannot be devised. I believe the latter to be the case, not only because I am a psycholinguist looking for a face-saving device but because there are strong reasons for doubting the psychological validity of Chomsky's grammatical theorizing. Before dealing with this issue (Section 6.5 below), I would first like to consider in more detail the performance processes of production and understanding.

Phonological and Semantic rules are likewise written so as to account for certain levels of structure; from S-structure to LF and PF. *The content of the rules of grammar are thus determined by the directional relationship which Chomsky postulates with respect to the levels of his grammar.*

But, what does Chomsky say about this directional relationship in his grammar? He declares, and rightly so, that it would be 'absurd' to propose that in producing a sentence a speaker would start from the initial letter S, construct a D-structure line by line, then insert lexical items and apply transformations to form a S-structure, etc. As he emphasizes in the quotation cited earlier in this chapter, . . . such a proposal seems not only without justification but entirely counter to whatever vague intuitions one may have about the processes that underlie production.'

Thus, Chomsky asserts, the process of generating a linguistic derivation is not a process that a speaker would ever employ in producing a sentence. The same, of course, would be true for the understanding of sentences — a performance process that must begin with sound and not the letter S and a variety of syntactic principles. This being the case, it is clear that *the directional order of structure construction in Chomsky's grammar is a psychological fiction having no basis in actual speaker performance.*

Now, since the direction order in Chomsky's grammar is psychologically unreal, and since the content of his grammatical principles and parameters are determined by this directional order, we can only conclude that *Chomsky's principles and parameters are as psychologically unreal as the psychologically unreal order on which they were based.* (For more details on this argument, see Steinberg, 1976 and 1982, pp. 77-80.)

Given such a psychological self-contradiction, it is clear that Chomsky's grammatical theorizing is completely flawed psychologically. It remains the same sort of formalistic non-psychological theory of grammar that he originally proposed in the 1950s.

6.5 The psychological unreality of Chomsky's grammar

6.5.1 The psychological contradiction in Chomsky's theorizing

Chomsky claims that the principles and rules of his grammar are psychologically real. I do not believe that this is logically possible due to an essential contradiction in Chomsky's theorizing.

When we look at the content of the principles and parameters which Chomsky writes, we find that they are necessarily based on what he conceives to be the relationship of meaning, sound and syntax. This could not be otherwise since the specific rules of a grammar cannot be written independently of the postulated relationship of syntax to meaning and sound, i.e. the directional relationship obtaining among the levels of D-structure, S-structure, Logical Form and Phonetic Form. Thus, for example, syntactic principles are written with the purpose of converting D-structures to S-structures. Phrase Structure rules are written with the purpose of converting the letter S to a D-structure.