

Linguistic Theory

D. Terence Langendoen

University of Arizona

Prepublication version. Final version published in Bechtel, William, and Graham, George, eds.: *A Companion to Cognitive Science* (Oxford: Blackwell), pp. 235-244, 1998..

1. Goals of Linguistic Theory

The goals of linguistic theory are to answer such questions as ‘What is language?’ and ‘What properties must something (an organism or a machine) have in order for it to learn and use language?’ Different theories provide different answers to these questions, and there is at present no general consensus as to what theory gives the best answers. Moreover, most linguists, when pressed, would say that these questions have not yet been satisfactorily answered by any theory.

In order to try to answer these questions, one strategy, originally employed by Joseph Greenberg (1961), is to undertake a comprehensive study of the languages of the world, to determine what properties they have in common and what distinguishes them from things that everyone agrees are not languages. Another, advocated by Noam Chomsky (1980), is to examine a few particular languages in depth to determine which of the intricate details that are found in one language turn up in all the others. As each of these approaches is extended, they merge into one another, and can be expected, ultimately, to converge on the same answer.

2. Expression and Meaning

Although we do not yet know enough to provide a definitive answer to the question ‘What is language?’, what we do know enables us to say with certainty that every language is a system with sufficient resources for communicating its speakers’ intentions, desires, and beliefs, no matter how complex and unusual they may be. Let us call the spoken, signed, or written vehicle of communication **EXPRESSION**, and what is communicated **MEANING**. For example, an American English speaker can communicate the desire to find out what the people he or she is talking to talked about on a particular occasion in the past by saying [w̄l̄dʒɪðltʰɔk.əb̄w̄tʰ], which is a transcription using the International Phonetic Alphabet (IPA) of what would ordinarily be written *What did you all talk about?* In this case, [w̄l̄dʒɪðltʰɔk.əb̄w̄tʰ] is the expression, and the desire to find out what the people one is talking to talked about on a particular occasion in the past is the meaning.

An expression, when spoken, can be analyzed as a sequence of **SYLLABLES**, each said with a particular degree of loudness (or stress) and pitch (or intonation). For example, the expression [w̄l̄dʒɪðltʰɔk.əb̄w̄tʰ] consists of five syllables, the third of which has strongest stress and the fourth the weakest. This stress pattern is indicated by the sequence of marks [, ' .], in which ['] indicates the strongest stress, [.] the weakest stress, and [] an intermediate stress. The highest pitch also falls on the third syllable, the lowest pitch on the second, fourth and fifth syllables, and the first syllable has an intermediate pitch. This intonation pattern is indicated by the marks [^ ` ` `], in which [^] indicates the highest pitch, [^] the lowest pitch, and [] an intermediate pitch. The stress and intonation pattern of an expression helps convey part of the meaning of that expression, as discussed further below.

A syllable, in turn, consists of a nucleus, usually a vowel, possibly flanked by consonants fore and aft. For example, the syllable [w̄λ] contains the vowel [λ] preceded by the consonant [w], but with no consonant following, whereas the syllable [ə̀] contains the vowel [ə] alone, and the syllable [tʰɔ̄k] contains the vowel [ɔ] which is both preceded and followed by a consonant. Consonants and vowels can be further analyzed as bundles of phonetic features, specifying the movement, position or activity of articulators, such as the lips, tongue, and vocal cords, or their acoustic effects. See Ladefoged and Maddieson 1996 for discussion of phonetic analysis and notation.

A meaning can also be analyzed into component parts, though there is much less agreement about semantic structure (the structure of meaning) than there is about phonological structure (the structure of spoken expressions). Whatever representation is chosen for meaning, it must meet certain criteria of adequacy, including the following. First, it must provide a way to determine what things it may be used to talk about, for example, situations in a world of the speaker's and hearers' experience or imagination. Second, it must provide a way to determine the logical properties of meaning, including what it implies and what it is implied by. Third, it must indicate what act the speaker is performing when expressing it (e.g. making a statement, asking a question, issuing a command). Fortunately, for our purposes, it is not necessary to formulate meanings precisely, using a notation that meets these (and other) criteria of adequacy. Except as needed, we represent the meaning of an expression by enclosing its ordinary spelling in single quotes; for example, we represent the meaning of the expression [w̄λ,dʒɪə̀ltʰɔ̄k.ə̀bət̄] as 'What did you all talk about?'. See Saeed (1997) and Larson & Segal (1995) for discussion of semantic analysis and notation.

Given that a language provides a means of expressing meaning, we may add to the goals of linguistic theory that it answer two additional questions, which we call the question of language PERCEPTION and the question of language PRODUCTION. The question of language perception is: 'How does one determine a meaning for an expression one has heard?'. The question of language production is: 'How does one determine an expression for a meaning one intends to convey?'.

3. Morphs and Morphemes

The simplest expressions of a language are those that cannot be divided into meaningful parts, other than the entire sequence of syllables that makes up each such expression and its stress and intonation contour. For example, the expressions [n̄o:] 'No?' and [n̄o:] 'No!' are among the simplest expressions of English, since their only meaningful parts are the syllable [no:] itself and the stress and intonation contours [ˆ] (rising) and [˘] (falling). The instances of the consonant [n] and vowel [o:] that combine to form the syllable [no:] are not meaningful, even though in other expressions, that consonant by itself, and that vowel by itself, are meaningful (e.g. in [ō:s̄ɪs.tʰə̀z.ɪ̀brʌ̀ð.ə̀z] 'Oh sisters and brothers'). The fact that [no:] is meaningful only in its entirety is the basis of the challenge "What part of 'no' don't you understand?" emblazoned on T-shirts and bumper stickers throughout the English-speaking world.

The syllable [no:] with the associated meaning 'no' in English is a theoretical construct known as a MORPH. A morph is a specific pronunciation associated with a specific meaning such that the pronunciation cannot be broken down into meaningful parts whose meanings combine to form the meaning of the whole. Behind the morph is an even more abstract theoretical construct known as a MORPHEME. A morpheme is an association of pronunciation and meaning such that the pronunciations and meanings of an entire class of morphs can be determined from it. In the case of [no:] 'no', there is

no distinction between the morph and the morpheme, since there is no other determinable pronunciation with the meaning ‘no’, and no other determinable meaning associated with the pronunciation [no:]. However in many other cases the distinction is quite sharp.

The syllable [no:] with the associated meaning ‘no’ in English is a theoretical construct known as a MORPH. A morph is a specific pronunciation associated with a specific meaning such that the pronunciation cannot be broken down into meaningful parts whose meanings combine to form the meaning of the whole. Behind the morph is an even more abstract theoretical construct known as a MORPHEME. A morpheme is an association of pronunciation and meaning such that the pronunciations and meanings of an entire class of morphs can be determined from it. In the case of [no:] ‘no’, there is no distinction between the morph and the morpheme, since there is no other determinable pronunciation with the meaning ‘no’, and no other determinable meaning associated with the pronunciation [no:]. However other morphemes differ phonologically or semantically from one or more of the morphs which are derivable from them. For example, the morpheme /ju:/ ‘you’ underlies a dozen or more morphs including [ju:] ‘you’, [ju:] ‘you (sg)’, [ju:] ‘you (pl)’, [jə] ‘you’, [jə] ‘you (sg)’, [jə] ‘you (pl)’, [j] ‘you’, [j] ‘you (sg)’, [j] ‘you (pl)’, [ɪ] ‘you’, [ɪ] ‘you (sg)’, and [ɪ] ‘you (pl)’. In the expression [jù:kʰɔ̃ld] ‘Did you call?’, the morph [ju:] ‘you’ represents /ju:/ ‘you’, just as [no:] represents /no:/. However, in [jəʰĩŋkʰsɔ:] ‘Do you think so?’, the morph [jə] ‘you’ represents /ju:/ ‘you’; in [w̃l̃dʒjə̀l̃tʰɔ̃k.ə̀bàʷt̃] ‘What did you all talk about?’, the morph [j] ‘you (pl)’ represents the morpheme /ju:/ ‘you’. Finally, in [hēlp.jə̀sēlf] ‘You (sg) should take what you (sg) want’, the morph [ɪ] ‘you (sg)’ (occurring at the very beginning of the expression) represents /ju:/ ‘you’.

In describing the relation between morphs and morphemes, we have used the terms ‘underlie’ and ‘derivable from’ to emphasize the fact that that relation is systematic both phonologically and semantically. Given the phonological form of the morpheme /ju:/ ‘you’, the various phonological forms of the morphs derivable from it can be determined by well-understood processes of vocalic weakening (from [u:] to [ə]) and deletion, and consequent consonantal weakening (from [j] to [j̃]) and deletion. Given the semantic form of the morpheme /ju:/ ‘you’, the various semantic forms of the morphs derivable from it can be determined by similarly well-understood processes of contextual delimitation (in the expression [w̃l̃dʒjə̀l̃tʰɔ̃k.ə̀bàʷt̃], the interpretation ‘you (pl)’ is required for consistency with the cooccurring morpheme /ɔl/ ‘all’, whereas in the expression [hēlp.jə̀sēlf], the interpretation ‘you (sg)’ is required for consistency with the cooccurring word *yourself*).

On the other hand, even though the morph [ju:] ‘ewe’ has the same phonological form as the morpheme /ju:/ ‘you’, it is not derivable from that morpheme, because the relation between ‘ewe’ and ‘you’ is not systematic semantically. Similarly, even though the morph [ðɑʷ] ‘you (sg)’ has the same semantic form (in those dialects in which that morph occurs) as the morph [ju:] ‘you (sg)’, it is not derivable from the morpheme underlying the latter morph, because the relation between [thou] and /ju:/ is not systematic phonologically. We conclude that /ju:/ ‘you’, /ju:/ ‘ewe’, and /ðɑʷ/ ‘you (sg)’ are distinct morphemes in English. Henceforth, whenever neither the exact phonological nor the exact semantic form of a morpheme is at issue, we represent it by its ordinary spelling in italics, for example *no* for [no:] ‘no’, *you* for /ju:/ ‘you’, *ewe* for /ju:/ ‘ewe’, and *thou* for ‘you (sg)’.

4. The Lexicon

The particular pairings of expression and meaning represented by individual morphemes have to be learned individually. The totality of all the pairings in a language that must be individually learned is known as its LEXICON, and its individual members are called LEXEMES (or LEXICAL ITEMS). The lexemes of a language consists of all of its morphemes together with those combinations of lexemes whose meaning or expression cannot be systematically determined from the lexemes of which it is comprised. For example, the meanings of the word *unusual* and of the phrase *touch base* cannot be systematically determined from the meanings of their constituent lexemes; hence those combinations are also English lexemes. Similarly, the word *went* is an English lexeme, even if it is analyzed as containing the two lexemes /go:/ ‘go’ and /d/ ‘in the past’; although its semantic form can be predicted from that combination, its phonological form cannot be. (Compare the word *planned*, consisting of the lexemes /plæn/ ‘plan’ and /d/ ‘in the past’, which is not an English lexeme, since both its phonological and semantic forms are derivable from those of its component lexemes.)

5. Morphology and Syntax

The vast majority of the pairings of expression and meaning represented by combinations of lexemes, whether these pairings are words, phrases, or sentences, do not have to be learned, because they can be systematically determined from the lexemes of which they are composed and the way they are combined and arranged. For example, the expression and meaning of the sentence *What did you all talk about?* can be determined from the expression and meaning of the individual lexemes *about*, *all*, *did*, *talk*, *what*, and *you*, and the way they are combined and arranged. The importance of how the component lexemes are combined and arranged can be seen from the fact that when they enter into other combinations or are rearranged, the result is always a different expression, which may have an entirely different meaning, or no meaning at all. For example, the sentences *What all did you talk about?* and *What did you talk all about?* consist of the same lexemes, but differently combined and arranged, and have different meanings from the original. The sentence *About what did you all talk?* also has a different arrangement, but the same meaning as the original. Finally, the arrangement in *You what talk did about all* is meaningless. Linguists generally call the expressions which are meaningless in a language UNGRAMMATICAL, and indicate that status by prefixing an asterisk to the expression, as in **You what talk did about all*.

The study of how lexemes combine to form words is called MORPHOLOGY (see Spencer 1991), and of how lexemes (typically, but not necessarily words) combine to form phrases and sentences is called SYNTAX (see Culicover 1997). The boundary between morphology and syntax varies widely from language to language; what can be expressed in a word in one language requires a phrase in another. For example, the meaning ‘from our hands’ can only expressed by a phrase made up of at least three words and four lexemes in English (*from*, *hand-s*, and *our*; we use a hyphen to separate lexemes within a word), but can be expressed by a single word made up of five lexemes in Turkish (*el-ler-im-iz-den*).

6. Recursion

The combination of lexicon, morphology, and syntax gives every language its expressive power, its ability to express any desired meaning. That power is, as far as linguists have been able to determine,

the same for all languages. If a fluent speaker of a language lacks a word or simple phrase to express a particular meaning, he or she can do so by means of a more elaborate phrase. Moreover, if a particular meaning which can only be expressed in a complicated way by the members of a community becomes important to them, they will come up with simpler expressions for that meaning.

Since lexemes must be learned individually, no language can have more than a finite number of them, and a relatively small number at that. (No language has been observed to have more than 10^6 lexemes, though the problem of deciding exactly how to individuate lexemes makes estimating a more exact upper bound extremely difficult.) Hence in every language there must be meanings which can only be expressed by words, phrases, and sentences which are not single lexemes. Moreover, it also appears to be the case for every language, that there are meanings which can only be expressed by phrases or sentences which are not single words. That is, the full expressive power of every language appears ultimately to depend on its syntax.

How this task is accomplished is most easily explained by means of examples. First, the syntax of English permits us to form two-word phrases such as *these cats*, *these dogs*, and *these hamsters*, as well as five-word phrases in which these two-word phrases are joined by the lexeme *and*, such as *these cats and these dogs*, *these dogs and these hamsters*, and (allowing for repetition of the two-word phrases) *these cats and these cats*. Let us call the two-word phrases ‘simple’ and the five-word ones ‘coordinate’. In addition, the syntax of English permits us to form longer coordinate phrases by joining a simple phrase to a coordinate one with a short intonation break in between, such as *these hamsters*, *these cats and these dogs*. Then since the latter phrase is itself coordinate, it can be joined with another simple phrase, as in *these cats*, *these hamsters*, *these cats and these dogs*, and so on without limit. By this means, we can form an infinite number of coordinate phrases in English, each of which is distinct both phonologically and semantically from the others. This syntactic device of coordinate-phrase formation does not by itself provide a means for expressing all possible meanings in English, but it’s a start.

Second, the syntax of English permits us to form simple sentences such as *I could fly*, as well as ‘complex’ sentences in which a sentence is subordinated to a larger one, by the addition of the structure *I thought that* or *You thought that* at the beginning, as in *I thought that I could fly* and *You thought that I could fly*. Then since any sentence, not just simple ones, can be subordinated to a larger one, the syntax of English also permits us to form longer complex sentences in which complex sentences are subordinated, such as *You thought that I thought that I could fly* and *I thought that you thought that I thought that I could fly*, and so on without limit. Again this syntactic device of complex sentence formation does not by itself provide a means for expressing all possible meanings in English, but now we’re on the road.

Our two examples illustrate RECURSION, the formation of phrases of a certain type (we assume from this point on that a sentence is simply a certain kind of phrase) out of phrases of exactly the same type. Each illustration starts with BASE CASES: phrases of a given type which do not contain any phrase of that type within it. In the coordination illustration, *these cats and these dogs* is a coordinate phrase which does not contain any coordinate phrase within it. In the subordination illustration, *I could fly* is a sentence which does not contain any sentence within it (i.e., a simple sentence). It then proceeds to a RECURSIVE STEP, according to which a larger phrase of a given type can be constructed out of parts which include a smaller phrase of the same type. In the coordination illustration, the recursive step

consists of adjoining a simple phrase to a coordinate phrase to form a larger coordinate phrase. In the subordination illustration, the recursive step consists of subordinating a sentence to a larger sentence by adjoining the structure *I thought that* or *You thought that* to the original sentence.

The expressive power of language depends on the existence of many different recursive devices in its syntax, and their ability to freely combine. For example, the coordination and subordination processes just illustrated can be combined to permit the formation of coordinate complex sentences such as *I thought that I could fly, you thought that I thought that I could fly and I thought that you thought that I thought that I could fly* (coordination of complex sentences) and *I thought that you could navigate, she could steer and he could make dinner* (subordination of coordinate sentences). Each of these sentences expresses a meaning not expressible by coordination or subordination alone.

7. Movement and Deletion

Languages employ various syntactic devices to prevent expressions for complex meanings from becoming inordinately long. Two devices which appear in the grammars of all languages are known as MOVEMENT and DELETION. We have already given an example which illustrates movement, namely the question *What did you all talk about?*, in which the lexeme *what* is displaced from its 'normal' position following *about*, as in *You all talked about what?*. In this case, the movement of *what* serves the purpose of focusing or highlighting what kind of answer the speaker is expecting (the name of a thing rather than of a person, for example). In more complex sentences such as *What did she tell him that you all talked about?* and *Did she tell him what you all talked about?*, it makes a difference semantically where the lexeme is moved to. By the same token, it also makes a difference semantically where the lexeme originates; compare *What did you all put the baskets in?* (which is equivalent to *You all put the baskets in what?*) and *What did you all put in the baskets?* (which is equivalent to *You all put what in the baskets?*).

Deletion may be employed in many situations in which the repetition of phrases can be 'reconstructed', as in the coordinate sentence *You thought that I could fly, but I didn't*, which has two meanings depending on what is reconstructed, either *think that I could fly*, resulting in the meaning 'You thought that I could fly, but I didn't think that I could fly', or simply *fly*, resulting in the meaning 'You thought that I could fly, but I didn't fly'. If we exchange the second occurrence of *I* with *you* in the original sentence, yielding *I thought that I could fly, but you didn't*, the result has three meanings: 'I thought that I could fly, but you didn't think that I could fly'; 'I thought that I could fly, but you didn't think that you could fly'; and 'I thought that I could fly, but you didn't fly'. The additional meaning results from the fact that the second occurrence of the lexeme *I* in *I thought that I could fly* can DEPEND on the first. If this dependency is reconstructed in determining the meaning of *but you didn't*, the result is 'but you didn't think that you could fly'. See Fiengo & May (1995) for analysis of dependency and its interaction with deletion.

8. Universal Grammar

A complete analysis of the lexicon, morphology and syntax of a language is called its GRAMMAR. The theory of grammar, which is a significant part of linguistic theory as a whole, has as one of its goals the answer to the question 'What is the class of all possible grammars?' The properties of that class is

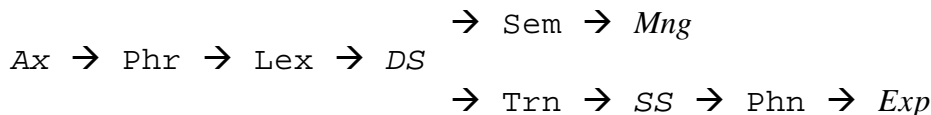
called UNIVERSAL GRAMMAR. Related to the goal of understanding universal grammar is the solution to the problem of language acquisition: ‘What enables a child upon limited exposure to a language to learn the grammar of that language?’ One widely held assumption is that people are innately endowed with knowledge of universal grammar, so that the task of language acquisition is really one of selecting the best grammars for the languages of one’s experience.

9. Generative Grammar

The first complete statement of the theory of grammar in the form presented here was the ‘standard theory’ of GENERATIVE GRAMMAR presented in Chomsky (1965), henceforth ST. (Chomsky’s 1957 presentation of the theory of grammar, which is widely recognized as having launched the modern enterprise of linguistic theory, was less well developed inasmuch as it neither attempted to account for the meaning of expressions, nor dealt with language acquisition.) According to ST, a grammar consists of a number of interacting components including a lexicon, two syntactic components, a semantics, and a phonology. For each meaningful expression, the grammar provides a DERIVATION, which starts with a member of a set of AXIOMS such as #S# (for ‘Sentence’) and terminates with a pair <Mng, Exp>, where ‘Mng’ is its semantic structure (representation of meaning) and ‘Exp’ is its phonological structure (representation of expression).

The derivation of a meaningful expression in ST begins in one of its syntactic components called PHRASE STRUCTURE, which constructs a hierarchical representation of the underlying syntactic structure of the expression. The phrase-structure component is responsible for, among other things, recursion. The output of phrase structure is the input to the lexicon, which inserts lexical items into the underlying syntactic structure. Chomsky called the result of that operation DEEP STRUCTURE. The deep structure of an expression is the input both to the semantics and to the second of the syntactic components, known as the TRANSFORMATIONAL STRUCTURE. The semantics is responsible for constructing the meaning of the expression, whereas transformational structure is responsible for, among other things, movement and deletion. Finally, the output of the transformational structure, called SURFACE STRUCTURE, is the input to the phonology, which determines the form of the expression proper, including its stress and intonational contours. The overall structure of ST is outlined in Figure (1).

(1) Outline of the ‘standard theory’ of generative grammar (Chomsky 1965)



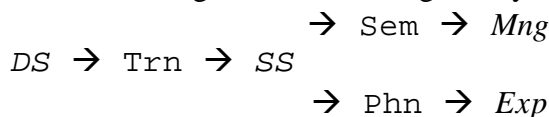
Legend: *Ax* = axiom, *Phr* = phrase structure, *Lex* = lexicon, *DS* = deep structure, *Sem* = semantics, *Trn* = transformational structure, *Mng* = semantic structure (meaning), *SS* = surface structure, *Phn* = phonology, *Exp* = phonetic structure (expression). Inputs and outputs are italicized.

ST does not attempt to answer the questions of language perception and production posed at the end of section 2. Rather than directly relating meaning and expression, it relates them indirectly, through deep structure. Thus, given an expression, the only way to determine its meaning according to ST is first to recover its deep structure, and then to compute its meaning, using semantics. However, the recovery of deep structure from expression is not an operation which is well defined within ST. The operations of the transformational and phonological components of ST map deep structure onto

expression, but are not capable of mapping expression onto deep structure. Similarly, given a meaning, the only way to determine its expression according to ST is again to recover its deep structure. However, just as the operations which map deep structure onto expression are not reversible, neither are the operations that map deep structure onto meaning. Chomsky justifies his decision to limit linguistic theory to merely providing a means of relating meaning and expression, rather than to providing a means of determining one from the other, by maintaining that the first a matter of linguistic COMPETENCE (what people know about language), and hence is properly within the scope of linguistic theory, whereas the second is a matter of linguistic PERFORMANCE (how people use language), and hence lies outside its scope. Not everyone agrees with Chomsky on this point, and in any event a total theory of language (whatever it is called) would have to encompass both linguistic competence and linguistic performance.

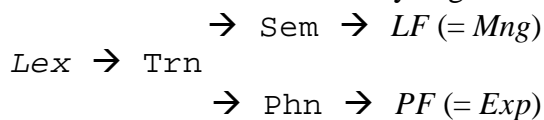
The theory of generative grammar has evolved considerably over the past thirty years, but continues to retain its ‘forked’ structure, in which meaning and expression are related indirectly through an intermediate construct. For example, the version of generative grammar known as ‘government and binding’ theory (Chomsky 1981) treats deep structure (renamed ‘D-structure’) as the starting point of a derivation, and surface structure (renamed ‘S-structure’) as the intermediate construct from which both meaning and expression are determined, as in Figure 2.

(2) Outline of the ‘government-binding’ theory of generative grammar (Chomsky 1981)



Finally, the ‘minimalist program’ of generative grammar (Chomsky 1995) treats the lexical items which contribute to both meaning and expression as the starting point of the derivation, eliminating both D-structure and S-structure entirely. Nevertheless, following application of transformational rules of ‘merge’, ‘move’ and ‘check’, derivations are still branched, with strictly phonological rules (now called ‘spellout’) applying on the branch leading to phonological representation (now called ‘phonetic form’ or ‘PF’), and strictly semantic rules applying on the branch leading to semantic representation (now called ‘logical form’ or ‘LF’), as in Figure (3).

(3) Outline of the ‘minimalist’ theory of generative grammar (Chomsky 1995)



It is of course not a necessary feature of the theory of generative grammar that it fail to provide answers to the questions of linguistic perception and production. One theory that maps meaning to expression in the grammar, and hence attempts to answer the question of linguistic production, is ‘generative semantics’, which originated in the 1960s as an alternative to ST; see Huck & Goldsmith (1995). As diagrammed in Figure (4), the mapping from meaning to surface structure is carried out by transformational rules, including rules which replace semantic substructures by lexical items represented in terms of their underlying phonological properties, and the mapping from surface structure to expression is carried out by phonological rules.

(4) Outline of the ‘generative semantics’ theory of generative grammar



10. Optimality Theory

However, only very recently has a theory of generative grammar been proposed that attempts to answer both the question of linguistic perception and of linguistic production, namely OPTIMALITY THEORY (Archangeli & Langendoen 1997; Prince & Smolensky 1997, forthcoming). Optimality theory assumes that the universal classes of expressions and meanings (that is, the class of all expressions of all possible languages and the class of all meanings) can each be defined by a GENERATOR, which works rather like the phrase-structure component of ST, or the rules for forming well-formed formulas in a system of logic. Then, given a particular meaning, one determines its expression in a particular language by evaluating the members of the universal class of expressions against a universal set of CONSTRAINTS (henceforth Con). Similarly, given a particular expression, one determines its meaning (if any) in a particular language by evaluating the members of the universal class of meanings against Con. That is, the problems of language production and language perception are considered problems of selection, just like the problem of language acquisition as described above in section 8. Figure (5) provides an outline of optimality theory.

(5) Outline of the 'optimality' theory of generative grammar

a. $Mng \rightarrow Con \rightarrow Exp$

b. $Exp \rightarrow Con \rightarrow Mng$

If, as optimality theory proposes, the classes of meanings, expressions and constraints are universal, how do languages differ? The answer is in the RANKING of the constraints; with each language corresponding to a possible ranking of the members of Con; for numerous illustrations of how this works, see Archangeli & Langendoen (1997). Presumably included among the members of Con is the universal class of lexical items, so that the determination of which lexical items belong to which languages is also a matter of constraint ranking.

Optimality theory has had its greatest success so far in accounting for the relation between lexical items and their expression, and is only now beginning to deal with the major phenomena of syntax, including recursion, movement, deletion, and dependency, so whether it will succeed in extending the scope of linguistic theory to the narrow concerns of linguistic competence to the broad concerns of linguistic performance remains to be seen.

Bibliography

- Archangeli, Diana, and Langendoen, D. Terence, eds.: *Optimality Theory: An Overview* (Oxford: Blackwell, 1997). [collection of articles which introduce optimality theory]
- Chomsky, Noam: *Syntactic Structures* (The Hague: Mouton, 1957). [the book that launched the enterprise of generative grammar]
- Chomsky, Noam: *Aspects of the Theory of Syntax* (Cambridge, MA: MIT Press, 1965). [presents the standard theory of generative grammar]
- Chomsky, Noam: *Rules and Representations* (New York: Columbia University Press, 1980).
- Chomsky, Noam: *Lectures on Government and Binding* (Dordrecht: Foris, 1981).
- Chomsky, Noam: *The Minimalist Program* (Cambridge, MA: MIT Press, 1995). [represents Chomsky's current thinking about linguistic theory]
- Culicover, Peter: *Principles and Parameters: An Introduction to Syntactic Theory* (Oxford: Oxford University Press, 1997).

- Greenberg, Joseph, ed.: *Universals of Language* (Cambridge, MA: MIT Press, 1961). [the article by Greenberg in this collection continues to be of interest]
- Fiengo, Robert, and May, Robert: *Indices and Identity* (Cambridge, MA: MIT Press, 1995).
- Huck, Geoffrey, and Goldsmith, John: *Ideology and Linguistic Theory: The Deep Structure Debates* (London: Routledge, 1995).
- Ladefoged, Peter, and Maddieson, Ian: *The Sounds of the World's Languages* (Oxford: Blackwell, 1996).
- Larson, Richard, and Segal, Gabriel: *Knowledge of Meaning* (Cambridge, MA: MIT Press, 1995).
- Prince, Alan, and Smolensky, Paul: 'Optimality: From neural networks to universal grammar', *Science* 275 (1997), 1604-1610.
- Prince, Alan, and Smolensky, Paul: *Optimality Theory: Constraint Interaction in Generative Grammar* (Cambridge, MA: MIT Press, forthcoming). [technical introduction to optimality theory]
- Saeed, John I.: *Semantics* (Oxford: Blackwell, 1997).
- Spencer, Andrew: *Morphological Theory* (Oxford: Blackwell, 1991).