0. Introduction: Linguistics is the study of languages (as they are)

Modern linguistics is not about proclaiming rules for speakers to follow. It is about discovering the rules that speakers already follow, albeit tacitly. Therefore, we are not involved in a pedagogical enterprise and we are not interested in dictating language behavior:

"The norms of prescriptive grammar are to linguistics as the American Kennel Club's breeding standards are to biology" (Wasow 2001: 295f.).

So, when we say that linguists try to find a grammar for a language, say English, we mean to say that they are describing the knowledge a speaker actually possesses:

- Which chains of words qualify as sentences in the language according to the speaker's knowledge of the language? Which chains of words are gibberish, 'don't sound right' or could be described as 'odd' in some other way according to the speakers' intuitions?

- For every sentence of the language, we want to describe:

  What meaning does the sentence have?
  What meanings can not be expressed via this sentence?
  Which possible pronunciations does the sentence have?
  What pronunciations are not possible for this sentence?

- Given its meaning, how (for which communicative aims) could the sentence be used?

As we will see, this seemingly straightforward task of describing the sentences of a language is actually endlessly complex. Complexity, creativity and open-endedness in language are reasons we need a 'generative' type of grammar (cf. below: in a 'wide sense').

Ultimately, the aim is not to define a grammar for any particular language, but to be able to describe the uniquely human ability to acquire any and every language – any languages to which we are exposed as children.

But are human languages not endlessly variable, completely culture-specific communication systems? As it turns out, there are many commonalities between different languages. Some (but not all) linguists go so far as to say that universal principles exist which define how all human languages work – even all possible or potential human languages:

- They compose complex structures (sentences, etc.) from stored simplex elements (morphemes, etc.)...
- ... in a highly systematic way (not arbitrarily) implementing predictable structures...
- ... so that every complex structure's meaning can be computed from the meaning of the simplex items and the ways in which they are systematically combined.

For now, let us begin and start out from observations which general properties human language (Sg.l) has. Hockett defines a set of design features that all human languages share. To present only a few, consider:

1. **Physical channels:**
   Spoken language is produced in the vocal tract and transmitted/heard as sound, whereas sign language is produced with the hands and transmitted/seen as light.

2. **Rapid fading:**
   The sound made by speech diminishes almost instantaneously after being released. Gestures can only be seen while they are being produced.

3. **Semantics:**
   Speech sounds/signs can be linked to specific meanings.

4. **Arbitrariness:**
   There is no direct connection between the signal and its meaning.

5. **Discreteness:**
   Each unit of communication can be separated and, once recognized, is unmistakable.

6. **Displacement:**
   The ability to talk about things that are not physically present.

7. **Productivity:**
   The ability to create new messages by combining already-existing signs.

8. **Traditional transmission:**
   The learning of language occurs in social groups.

9. **Duality of patterning:**
   Meaningful signs (words) are made of—and distinguished from one another by—meaningless parts (sounds, letters). A finite number of meaningless parts are combined to make a potentially infinite number of meaningful utterances.

The human language faculty is characterized by all of these properties. Therefore it is not sufficient for some communication system (e.g. animal call system, human-made non-linguistic codes, etc.) to display some of these properties in order to be considered the equivalent of human language. This statement is necessary to delineate precisely what can (and cannot) be considered a 'human language':

- Not 'every communication system' (human-made or not) counts as 'a language', but
- all human languages share these basic design properties (abstract commonalities).

1. "Generative grammar" in a wide sense

   The central problem of language descriptions is productivity, i.e. the fact that for every language ever encountered, that language's 'output', the set of its sentences, is infinite:

   10. For example, call S a sentence in English. All actual sentences are finite in length:

       a) Bob is sleeping
       b) I think that [SBob is sleeping] is a sentence that contains another sentence.
       c) Mary cannot believe that [S I think that [S Bob is sleeping]]
The result of of embedding yet another sentence within our sentence yields – yet an-
other sentence. So we can start over:

d) Fred denies that [is Mary cannot believe that [is think that [is Bob is sleeping]]]

You get the gist: The embedding can be repeated indefinitely. We therefore get an un-
limited number of sentences already by only adding more matrix clauses.

• Therefore, an extensional characterization (a complete listing) of all the possible sen-
tences in English) could never be a list of sorts: The list would be infinitely long!

11. This open-endedness cannot only be demonstrated by embedding sentences:

Noun phrases can embed infinitely many other noun phrases:

a) the [NP big [NP fat [NP grumpy [NP old ... cat]]]]

Verb phrases can contain infinitely many modified verb phrases:

b) He was [VP [VP slowly [VP noiselessly [VP... digging]] in the garden] at night] ...

If there infinitely many sentences, how does a speaker ever learn them?

Consider this comparison: How could you ever determine whether a given number is a
natural number? Since there is infinitely many natural numbers, you cannot look them up
on a list! The answer to both problems is the same. We need an algorithm, that computes
intensionally (by definition), what is or is not a natural number, or what is or is not a sen-
tence of a language:

12. a) Let 1 be a natural number

b) For every x, x a natural number: x+1 is a natural number, too.

13. Therefore: 1 is a natural number (by rule a)

1+1= 2 is a natural number (2 is a natural number by rule b)

2+1= 3 is a natural number (3 is a natural number by rule b)

3+1= 4 is a natural number (4 is a natural number by rule b)

... and so on

As you can see, rule b can be applied again and again (and again and ...) infinitely. Re-
peat it a million times, and you will know that 1,000,001 is a natural number.1

Back to language: Assume we have an algorithm (= grammar) that defines sentences:

14. a) (Bob, is, sleeping, green, ideas, calmly, ...) are possible parts of English sentences. (This is the language’s lexicon)

b) Possible parts (a) can be combined according to certain grammatical rules and restrictions. (This is the language’s grammar)

If we knew the rules and restrictions in clause b), our language would be attractive:

• It operates over a finite set of items to be learned (speakers know a finite number of
words/ morphemes/...).

• It operates on the basis of a finite set of rules. The hope is that these rules can be
learned somehow, since they are a) finite in number, and b) detectable somehow.

Additionally, to approximate the competence of a speaker, the grammar needs to state:

• Given any sentence (out of infinitely many), what is the meaning of this sentence?

• Given any sentence (out of infinitely many), what is its pronunciation?

Grammars that are able to handle these problems are called generative grammars. We
define generative grammar in a wide sense as:

• A grammar that has a finite set of simplex elements at its disposal,

• and a finite set of rules to combine simplex elements into complex structures,

• to yield an output of infinitely many complex form+function pairs (aka “sentences”).

Under this wide definition, virtually all contemporary grammars (Chomsky’s Minimalism,
Systemic Functional Grammar, Lexical Functional Grammar, etc.) are all generative
grammars (in the wide sense).

Non-generative alternatives are rare (but see, e.g. Hopper’s 1987 Emergent Grammar).
Out of the generative grammars in the wide sense, some are also generative grammars in
the narrow sense of the word.

2. Generative Grammar in the narrow sense

The term generative grammar is often used to refer specifically to theories that ultimately
go back to Noam Chomsky’s works. Under this narrow definition, generative grammar:

• is a model of the competence of an ideal speaker: The knowledge of a speaker who is
unconstrained by practical problems such as lapses of memory, distraction, etc.,
who knows the language perfectly and commits no mistakes.2

• What is not (!) at issue is the performance of an actual speaker: How do we build sen-
tences in our heads, in real-time? When do we use which sentences and why? Etc. ...

• The grammar is an explicit expression of everything that the ideal speaker knows and
leaves nothing of this knowledge unclear, i.e. nothing is undefined.

• Before Chomsky started this enterprise, grammars were completely different animals:
They described individual constructions, odd grammatical quirks or inexplicable gaps –
but they never even attempted to describe a language in its entirety:

1 This is certainly not what you are actually doing when you make the decision: If you are like me, you look
for a comma, or a fraction bar. If I find nothing that says ‘not a natural number’, I say ‘natural number’. Please
don’t tell my colleagues from the math department.

2 Chomsky does not deny that speakers exist that have less than perfect knowledge, and he does know that
speaker under normal circumstances exhibit practical problems of various kinds. However, he argues, these
practical issues belong to the theory of performance, not the competence he is after.
"no traditional or structuralist grammar goes beyond classification of particular examples to the stage of the formulation of generative rules on any significant scale" (Chomsky 1965: 5).

• Generative grammars in the Chomskyan sense, however, strive for generalizations that are universally true for all constructions of a language, or even for all constructions in all languages! Chomsky aims for a universal grammar (UG).

• This grammar is "mentalistic, since it is concerned with discovering a mental reality underlying actual behaviour" (ibid.: 4).

• However, the grammar is not concerned with actual mental operations by actual speakers in actual situations: "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" (Chomsky 1965: 9).

Under the narrow definition, not all of the grammars above qualify (or even only want to be considered as) generative grammars: many of them reject Chomsky's assumptions.

2.2. How do we do this? Defining generative grammars is difficult

In the history of linguistics and language philosophy, many authors have had surprisingly simple explanations for how sentences come into existence: "Nous disons les choses en si jamais elle revient sur la terre" (Diderot).

Speakers of languages other than French may want to disagree here. So how can we define the rules that describe the make-up of sentences?

• Grammar that operate in a linear fashion can only refer to relations such as:

  Word X precedes or follows (= is in the same sentence) as word Y.
  Word X neither precedes nor follows (= is not in the same sentence) as word Y.
  Word X precedes word Y (but does not follow it).
  Word X follows word Y (but does not precede it).

Since a linear string only has elements in a 'one-dimensional' order (a sequence), it cannot define other relations. School-type grammars often try to make do with linear relations.

If we find that the occurrence of words is rule-governed (not arbitrary), but cannot be defined by the linear relations, we have proof positive that grammars must involve more (and other) relations than just linear ones. Indeed, it turns out that linear relations are demonstrably insufficient to capture needed generalizations even virtually every language.

(And yes, you guess right: This entails that linear school-type grammars are often insufficient in principle to describe languages properly – they cannot capture the real rules).

Consider the use of any in English:

15. a) I don't see anybody.  Assumption 1: For anybody (=X) to be used in a sentence, a negation (= Y) must co-occur.
   b) *I see anybody.*

16. a) Nobody saw anybody.  Assumption 2: For anybody to be used, some negative polarity item (negation or nobody, none of them...) must be present.
   b) *Anybody saw nobody.* Assumption 2: For anybody to be used, it must be preceded by (i.e. anybody must follow) a negative polarity item.

18. a) [That nobody left] worried Bob.
   b) *[That nobody left] worried anybody. ... no possible linear description left!*

• So-called finite state grammars can generate all the sentences of all languages – but they fail to capture certain kinds of restrictions that occur in natural languages. For example, a finite state grammar cannot express a rule of the following kind:

\[ a_1 a_2 a_3 ... a_n b_1 b_2 b_3 ... b_m \]

(= Let n-many phrases of type a be followed by the same number of type b phrases)

However, human languages use rules of this type – and reject violations of the rule:

19. People[love hamburgers],
   a) *People[love hamburgers]*
   b) [The People], [people, like], love, hamburgers
   c) [The People], [people, like], hamburgers

(A subject is followed by a predicate)
   (two subjects, followed by two verbs)
   (too few predicates bad!)

20. Those people love hamburgers who some other people like who, in turn, are followed by dogs.

As we can see, some types of grammars are not able to capture generalizations that occur in natural languages. Therefore, generative grammars cannot be of those types!

• Likewise, some more powerful types grammars (phrase structure grammars) are incapable of expressing properties of human languages that every speaker recognizes:

21. a) John eats [a cake]  (Ok: Object of eat is edible)
   b) ??John eats [a housing bubble]  (Odd: object of eat is abstract)

22. a) [A cake] was eaten by John.  (Ok: subject of be eaten is edible)
   b) [A housing bubble] was eaten by John.  (Odd: subject of be eaten is abstract)

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The same argument holds for German words, too, for example emals.
23. Consider some phrase structure rules that could underlie these examples:

a) \( S \rightarrow N_1 \text{ verbs Det } N_2 \)

b) \( S \rightarrow N_2 \text{ is verbed by } N_1 \)

Therefore, generative grammar started out from the assumption that some rules of the type \( S_1 \rightarrow S_2 \) were necessary:

24. \( N_1 \text{ verbs Det } N_2 \rightarrow N_2 \text{ is verbed by } N_1 \)

This type of rule (if \( S_1 \), then also \( S_2 \)) are called transformation rules. However, rules of this kind had to be stipulated in a huge number. How, one might ask, could the child learn all these rules? This question became central to generative grammar (narrow sense).

3. Functionalist explanations to language

Language, functionalist grammarians argue, is more than just a collection of structures. Rather, language is a communication system - and thus, does it meet the requirement of explicitness of grammars?)

To consider the sentence pair 21a/22a:

a) More is needed than "there is a piece of wood and a piece of metal" to describe a hammer (i.e., its function, and the way that handle and head allow for this function.

b) Likewise, more is needed than "there is a noun phrase and a verb phrase" to describe S: The sentence’s meaning/ uses, explain its form (functionalists claim).

These sentences are related in that they express the same situation.

This is the reason why certain parts look similar in both sentences.

However, they are different, in that they present the situation from different perspectives: 21a is a statement 'about' John, while 22a is a statement 'about' the cake.

This is the reason that the formal differences exist in the first place: to allow for the communicative differences to be 'encoded' or 'expressed'!

But formalist grammarians would ask: What is that mysterious 'perspective? Is it properly defined – and thus, does it meet the requirement of explicitness of grammars?)

Explanations of this kind are often interesting. Note, however, that they are not necessarily more efficient or more plausible than purely formal statements:

By alluding to communicative functions of expressions, functional grammars can formulate more kinds of statements about these expressions (the 'yield' of the theory).

However, on the other hand, if functional explanations are admitted in this way, this also increases the number of stipulated tools used in a grammar (the 'cost' of a theory).

- Also, who says that language exists only as a tool for communication? Could it not also be a tool for thinking? A vehicle for poetry? The human equivalent of a peacock's tail (functionally useless, but possibly a tool for courting attractive fellow humans)?

The jury is still out as to whether functional explanations are needed in the description of natural human languages.

5. Construction Grammar CxG

Assume that you have a set of constructions in a language. A construction in this technical sense can be almost anything (cf. Fried & Östman 2004 for an overview of CxG):

- A morpheme of any kind (house, -s, -es, black bird...)
- A word, along with its grammatical properties for combining with other words:

25. "kick" = (verb, combines in template: "X\(p\) \{subject +affix \} kick\(v\) +affix \} Y\(concrete\) object\}"

An idiom (bite the bullet, kick the bucket...) that appears to be made up from words, but fails to receive its meaning and/or grammatical properties from the constituent words (e.g., there is no actual bucket you need for kicking the bucket).

Assume further that every construction can detail for and by itself what it means, how it's pronounced, and which other types of constructions it would combine with, e.g.:

26. "\(X_{P} with the Y_{NP}\)"

"Down with the king!", "Off with their heads!"

"Out with the old – and in with the new!"

Obviously, given enough 'templates' of this type, language structures can be explained (in the extreme, they are just listed). What you get is a hybrid between a radically a-grammatical view of languages (only templates exist) and the point of view of generative grammars in the narrow sense (only grammatical structures are worth investigating, templatonic 'constructions' exist, but they are peripheral and uninteresting). In summary:

<table>
<thead>
<tr>
<th>Grammars can be...</th>
<th>primarily formal or...</th>
<th>also functional</th>
</tr>
</thead>
<tbody>
<tr>
<td>mostly analytic...</td>
<td>generative grammar in the narrow sense (cf. Chomsky)</td>
<td>functionalist grammars (cf., e.g., Dik)</td>
</tr>
<tr>
<td>...somewhat holistic</td>
<td>Simpler Syntax (Jackendoff et al)</td>
<td>Construction Grammar (cf., e.g. Fried, Goldberg)</td>
</tr>
</tbody>
</table>


4 This view is indeed taken by Emergent Grammar (Hopper 1987 et seq), but has not been taken up widely.