What is *language*?
And why (oh why) do we need *grammars*?

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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.!) 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. *Semanticity*:
   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 — has three words and then stops.

    However, we also get sentences that embed other sentences:

    b) *I think that [$_S$Bob is sleeping]* — is a sentence that *contains* another sentence.

    Consider the possibility of *repeating* the embedding here:

    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 another sentence. So we can start over:

d) *Fred denies that [$_S$ Mary cannot believe that [$_S$I think that [$_S$ Bob is sleeping]]]*

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

- Therefore, an *extensional* characterization (a complete *listing*) of all the possible sentences 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 [$_{VP}$ [$_{VP}$ [$_{VP}$ 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 sentence 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*. Repeat 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 lang.'s grammar)*

[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.

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'an *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 sentences 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:

[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 Chomsky'an 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 francais, comme l'esprit est forcé de les considerer [...] notre langue sera celle de la vérité, 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[3]:

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

  $a_1\ a_2\ a_3...a_n\ ...\ b_1\ b_2\ b_3...b_n$ *(= Let n-many phrases of type a be followed by the <u>same</u> number of type b phrases)*

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

19. People$_a$ [love hamburgers]$_b$ *(A subject is followed by a predicate)*
*People$_a$ [love hamburgers]$_b$ [love hamburgers]$_b$ *(too many predicates bad!)*

[The People]$_a$ [people$_a$ like$_b$] love$_b$ hamburgers *(two subjects, followed by two verbs)*
*[The People]$_a$ [people$_a$ like$_b$] hamburgers *(too few predicates bad!)*

[The People]$_a$ [people$_a$ [dogs$_a$ follow$_b$] like$_b$] love$_b$ hamburgers *(and so on)*

Note: Despite their *performance* issues, these sentences should be *possible*, cf.:

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)*

[3] The same argument holds for German words, too, for example *jemals*.

23. Consider some phrase structure rules that could underlie these examples:

a) S → N_1 *verbs* Det N_2 *(...These two rules do not*
b) S → N_2 *is verbed by* N_1 *refer to each other!)*

- Therefore, generative grammar started out from the assumption that some rules of the type *If S_1, then also S_2* were necessary:

24. N_1 *verbs* Det N_2 → N_2 *is verbed by* N_1 *(If the structure on the left side of the arrow is possible, then so is the sentence on the right)*

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 systems *made* (!) by intelligent human beings to solve their communicative problems. Language is a (man-made) *tool* for communication:

- "...a language is (...) used with the intention of establishing communicative relationships" (Dik 1997: 3).

- "Language is a hammer" (Van Valin)

  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).

To consider the sentence pair 21a/22a:

- 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_{3Sg}, *bláck bird*...)

- A word, along with its grammatical properties for combining with other words:

25. "kick" = {verb, combines in template: "$X_{DP\ subject}$ $kick_{+affix}$ $Y_{concrete\ object}$"

- 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[4]) and the point of view of generative grammars in the narrow sense (only grammatical *structures* are worth investigating, templatic 'constructions' exist, but they are peripheral and uninteresting). In summary:

Grammars can be...	primarily formal or...	...also functional
mostly analytic or...	*generative grammar in the narrow sense (cf. Chomsky)*	*functionalist grammars (cf., e.g., Dik)*
... somewhat holistic	*Simpler Syntax (Jackendoff et al)*	*Construction Grammar (cf., e.g. Fried, Goldberg)*

References: **Chomsky**, Noam 1965: *Aspects of the Theory of Syntax*. MIT Press. **Dik**, Simon 1997: *The Theory of Functional Grammar: Complex and derived constructions*. Mouton de Gruyter, Berlin. **Fried**, Mirjam & Jan-Ola **Östman** 2004: "Construction Grammar: a thumbnail sketch." In: *Construction Grammar in a cross-language perspective*. John Benjamins, Amsterdam, pp. 11-86. **Hopper**, Paul 1987: "Emergent Grammar". In: *Proceedings of the Thirteenth Annual Meeting of the Berkeley Linguistics Society*, pp. 139-157. **Wasow**, Thomas 2001: "Generative Grammar". In: Mark Aronoff & Janie Rees-Miller (eds.): *The Handbook of Linguistics*. Blackwell, Oxford, pp. 295-318.

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