Linguistics: the science you think you know

Sami Amer

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1 Introduction

Like riding a bike without being able to describe the mechanics of a wheel, linguistics is something all of us use in our day-to-day lives, but only a select few understand the magic behind it. If I were to ask you to order a list of adjective, you would probably do it without missing a beat. However, when asked to explain your thought process, or describe the criteria you used, you might be at a loss! To rectify this, linguists derive rules and structures to explain not only *how* things are said, but also *why* they are said that way. Through this essay, I would like to take you into the world of linguistics, focusing on syntax, and help you tap into your own brain and elucidate the rules you follow every day.

To understand what linguistics is, it sometimes helps to understand what linguistics *isn't*. Namely, a linguist is not someone that knows many languages (although they are definitely equipped to analyze them). Furthermore, "linguist" is a fairly broad term; the field of linguistics has many critical and equally important sub-fields, like semantics (meaning of words), morphology (formation of words), phonetics (sound of words), syntax (order of words, and our focus for today), and more. While most linguists specialize, it helps to have a healthy understanding of all of the sub-fields as they influence each other often.

To ease you into it, let me begin by demonstrating one of the beauties of linguistics and language as a whole: the subconscious understanding. While linguistics can be a very difficult subject, I want to highlight that you, the reader, are more capable than you think! To start, look at these two examples:

- (1) The big, red, young dog.
- (2) * The young, red, big dog.

Let's start with the question I know you can answer: which of these is correct? At this point, you may be unenthusiastically saying to yourself "The first one, obviously. Is this guy going to teach me anything? *The New York Times* is 25 bucks and I sure didn't get it for the political writing". Fret not, I promise to save you from Thomas Friedman with this next question: *why* do you know that the second sentence is incorrect? In fact, how were you able to so confidently answer in the first place? Can you name any rule or train of thought other than "it sounded better"? This gap

between innate knowledge and conscious explanation that you are experiencing right now is the essence of linguistics, and understanding how to bridge it, bit-by-bit, brings the larger picture into focus.

Before we dive in, let us get some basics out of the way. Please keep in mind two things: some of these will be oversimplifications, and some things we will learn as we go, so don't worry if not everything makes sense at the onset. While most of the field is not set in stone, it is still possible to get a good sense of what is going on without considering the cutting edge. So, without further ado...

2 The Basics

2.1 Building A Sentence

Starting off small, let's take a look at what makes up the sentences we read and write every day.

(3) The man pet the dog.

If asked to break this sentence up into components, the most natural answer would be to decompose the sentence into a subject, a verb, and an object. This breakdown is intuitive because it is easy to derive from meaning alone: the action (verb) is petting, the man (subject) is the one carrying out the action, and the dog (object) is the one being pet. What might be a little less intuitive, is how the different parts of the sentence interact with each other. Your first thought would be to say that they are sequential, like so (note that the subscript denotes the component in the brackets e.g. [s]encloses a subject. You might see this notation again later.)

(4) $[_{S}$ The man $][_{V}$ pet $][_{O}$ the dog]

However, sequentiality doesn't imply order. This would mean that we can change the order around, and get sentences like

(5) $*[_S \text{The man}][_O \text{the dog}][_V \text{pet}]$

Which is not necessarily ungrammatical, but also is not a complete sentence. What if we tried to enforce Subject-Verb-Object order? That would ensure that we don't get sentences like in (5), and would still allow us to construct example (3). When we start testing this hypothesis, however, we see that we can find exceptions without straying too far from our original sentence.

(6) $[_O \text{The dog}][_V \text{was pet}][_S \text{by the man}]$

While maintaining the original meaning, we are able to completely flip the order of the subject, verb and object. Additionally, we have no idea where the word "by" should go; is it part of the subject because it tells us who carried out the action, or part of the verb because it is adding more detail to the action?

We could deal with this by adding another rule that allowed for this specific construction, but then we would have to add another rule for the construction after that, and the one after that. Take a second to try and come up with some sort of comprehensive rule set for the connection of subjects, verbs and objects. Notice that, no matter how many rules you find, you can always find a contrary example. Lucky for you, I majored in espionage tactics and was able to sneak into an MIT linguistics class and steal the answers we are looking for. (If you are less keen on climbing buildings and entering through skylights, the classes are available on Open CourseWare.)

Our salvation comes in two forms: first, we need to ditch the concept of subjects, verbs, and objects (don't worry, they come back a little later, albeit also a little more Greek) and instead use phrases, like verb phrases, noun phrases, preposition phrases, inflectional phrases and so on; second, we need to stop trying to add things in sequence, and instead start nesting them. That way, our final result is just one big phrase, with a bunch of smaller phrases inside! As you will see once we get to trees, these two concepts together allow for a wide range of expression that better captures how sentences are structured. Before we get back to our adorable dog and our friendly man, let's explore these two concepts in more detail.

2.2 Phrases

Initially, phrases seem very simple: verb phrases start with verbs, noun phrases with nouns, and so on and so forth. Like we discovered above, however, it is trivial to find sentences with "unconventional" ordering that still sound just fine, so saying they START with a verb is incorrect. That being said, the verb in a verb phrase, the noun in a noun phrase, etc are still critical to the phrase; after all, they give the phrase their name. To maintain the special role of these words while still allowing freedom of movement, we call them *heads*, and while we can expect them to often be at the start of the phrase (at least in English), that is not always the case. While this may seem very simple, get your hands dirty by identifying the heads in the following phrases. Often the best study technique is practice!

- (i) hit the dog
- (ii) the man
- (iii) by the seashore
- (iv) I ate the pie.

In order: "hit" is the head of the verb phrase "hit the dog", "man" is the head of the noun phrase "the man" (this is a classic example of the head not coming first), "by" is the head of the prepositional phrase, and... the last one was a trick a question. I understand the disappointment you entrusted me with your linguistical future, and I purposely deceive you for my own pleasure. Look on the bright side though: this was a great way to introduce inflectional phrases. I hope this pedagogical feat is enough for you to start trusting me again!

Notice that the last phrase is the only one that is a complete sentence. Because of this, it is hard to tell what kind of phrase we are looking for. While some of this difficulty is due to the complexity of the phrase (relative to the other phrases), you were able to identify the phrase and head very easily for (i) and (iii), both of which are actually two phrases - "the dog" and "the seashore"

are noun phrases nested inside of the verb phrase and the prepositional phrase, respectively. For those two examples, you intuitively looked for the head of the largest phrase, but what do we do when the largest phrase is a complete sentence? By definition, we know that it has to be made up of multiple phrases, but it isn't very clear which phrase is "dominating" the others. This dilemma is solved by realizing that we are missing a very important, but invisible, component to our sentences: tense.

Inflectional phrases (IPs) are what we think of as independent clauses, since they are able to stand on their own as a sentence, but can also be embedded or joined into larger sentences which we call complementizer phrases (this is a gross simplification, but I find it to be the easiest way to start off the concept). These IPs are headed by tense, which describes the perspective (first, second, or third-person), the time (past, present, or future), and the scope (singular or plural). In our trick question, the head of the IP is the tense first-person singular past. You may also hear these concepts described in the scope of "agreement", because the sentence has to "agree" with the head of the IP. To make sure you understand this, take a stab at identifying the head of a couple of these IPs.

- (i) I hit the dog.
- (ii) We ate the pie.
- (iii) They drove home.
- (iv) You will take a cab.

In order, the answers are:

- (i) 1ST.PAST.SINGULAR
- (ii) 1ST.PAST.PLURAL
- (iii) 3RD.PAST.PLURAL
- (iv) 2ND.FUTURE.SINGULAR

Now that we know phrases, we can start understanding how we can put them together using trees!

2.3 Trees

Let's go back to our first example, "The man pet the dog". To make things as easy as possible to understand, I will start by building an incomplete tree and slowly working our way up to a complete example. Before we start building, we need to cover some basic notation.

- **XP**, is an x-phrase (like a verb phrase, VP, or noun phrase, NP). This is the highest 'projection' of a phrase, meaning when we see VP in the tree, we know that the verb phrase is done.
- The head of the phrase, as we discussed before, is written as \mathbf{X}^0 .
- Now while these are the only two parts of the phrase with function, we have one more notation, **X'**, pronounced as "X-bar" (in fact, the name of the entire concept is "X-bar schema"!). "X-bar" does not refer to a word or phrase in the sentence; it is just filler in the tree.

Because the location of the head and the XP is important, we need a way to manipulate their positions. So X' is a kind of place holder, and we can add as many as we want between the XP and the X0 (head). To illustrate this, look at the two trees below, which are equivalent.



Why is it important to be able to control where certain parts of the tree end up? Different locations in the tree have different names and characteristics, so we use our "meaningless" X' to make sure that certain words end up in places like

- the **complement** of a phrase, which is the constituent (part of the tree) that is next to the head of the phrase. By "next to", we mean that both the head (X^0) and the other constituent both have the same parent, and are on the same horizontal level of the tree.
- the **specifier** of a phrase, which is the constituent that is next to the highest X' of the phrase. This is a little confusing, but often this is just the first constituent under the XP. This is also often abbreviated to "Spec-XP" (pronounced like "speck").
- an **adjunct** of a phrase, which is anything that is not the specifier or the complement. While there can only be one specifier or complement for each phrase, there can be multiple adjuncts.

This is not the easiest concept to follow, so I drew a little tree for a more visual explanation. Note that A, B, and C in this tree do not stand for anything, and are just there to differentiate between phrases.



AP does not have a complement, because the head, A^0 , has nothing next to it. The complement of BP is CP, because CP is right next to the head B^0 . Like AP, CP does not have a complement.

The specifier of AP (Spec-AP) is BP, because BP is next to the highest (and in this case only) A'.

Notice how, without the A', the BP would have been the complement of AP (because it would have been right next to the head A^0), but with A', it is instead the specifier.

Now that we know how to read a tree, let's learn how to construct one! We will do this backwards with the sentence "The man pet the dog" so that we can work with smaller pieces. Our first phrase is the noun phrase "the dog", headed by the noun "dog". The article "the" is actually its own phrase, called a determiner phrase, and is by default also the head of that phrase.



Notice again how we used N'; the determiner phrase is supposed to be the specifier of the noun phrase (the Spec-NP position), so we make sure that is the case by adding an N'. Test yourself a little: what position (complement or specifier) would the DetP be in if we had not added the N'? (Hint: if we remove the N', then the determiner phrase (DetP) is right next to N⁰. What does that make it?)

Next, we move on to the verb phrase "pet the dog", which is headed by the verb "pet"



This is the tricky part, where we bring in the tense we talked about earlier. The tense, in this case third-singular-past, is the head of the inflectional phrase (I^0). The inflectional phrase has the verb phrase as its complement, and the noun phrase "The man" as its specifier.



And just like that, we have drawn our first tree! Before we move onto a more advanced concept, let us welcome back our old friends, subject and object. In linguistics, this concept still exists, but as something called theta-roles (I hope my Greek joke makes sense now). Theta-roles are used to describe the "agent" and "theme" of a sentence, which correspond with the subject and object, respectively. Theta-roles do not show up on syntax trees directly, but do inform some decisions in how trees should be drawn (for an example, you can look up the Verb Phrase Internal Subject Hypothesis). These theta-roles are used instead of subjects and objects because they allow for more rich descriptions and better explanations.

2.3.1 Heads or Tails?

With our current understanding of syntax trees under our belt, I can quickly share one of my favorite facts about syntax: head directionality. Notice how the head (X^0) tends to be at the start of a phrase? This is called being "head-initial", and some languages are instead "head-final", where the head comes at the end. English has mixed directionality, but leans towards being head-initial. This phenomenon is why other languages, when translated word for word, give results like "He sandwich ate" - the heads are flipped!

3 IT'S ALIVE! (an introduction to movement)

3.1 Questions

Like real-life trees, syntax trees start from some root and branch out. Unlike real-life trees, syntax trees move (or at least, things *within* the tree move). The best way to illustrate this is through questions, or more specifically, turning statements into questions. As is the case in a lot of syntax, you can probably do this pretty intuitively: for instance, how would you ask a question that has the answer "Mary hates Luke"?

(7) Who does Mary hate?

It was probably pretty natural for you to come up with that, but there are actually rules in place that "move" the theme (object) to the front, while the agent (subject) ends up towards the end. This movement is named A'-movement or Wh-movement, after the Wh-words (who, what, when, etc) that start most questions. We start off the process of describing this movement by writing the statement version of the sentence, with our wh-word replacing the answer, like so: "Mary hates who".



The first thing you will notice is that there are no empty spots, so we cannot move "who" or insert "does" without breaking the structure of the tree. This is where the aforementioned complementizer phrase comes in. To allow for some movements, we put the inflectional phrase next to the C^0 to make it the complement of the CP, like so



Now that we have two empty spots, namely the head of the CP, C⁰, and the specifier of the CP, Spec-

CP, we can take a look at how phrases move around. From our final question, "Who does Mary hate?", it is clear that we need to move the noun phrase "who" to one of the two spots, and because we know that there needs to be "does" after "who", it makes sense to move it to the Spec-CP spot. When we do this, we leave behind a *trace*, represented by t_k . This trace only serves to tell us that something *used* to occupy that spot. The matching k subscript in the NP and trace tells us that the noun phrase is what used to be there.



Okay, that was pretty straightforward, but where do we get "does" from? This is where things get interesting, and tense comes into play. Until now, all the I^0 (head of the inflectional phrase) has done was inform of us what the tense of the sentence was, something that is readily understandable. With a concept called "do-support", the head of the IP - the 3.SG.PRESENT tense - moves up to become the head of the CP and becomes the word "does", providing us with our complete question, "Who does Mary hate?"



This I^0 to C^0 movement is called "subject-verb inversion", and is also present in yes/no questions, such as

(8) Must he speak?

and "negative inversions", such as

(9) Never before have I seen such a mess!

This last sentence has another phenomenon called "verb second". We don't have time for it today, but it is the reason we say "Never before have I..." instead of "Never before I have..."

3.2 Case

A quick aside on case, and the Case Filter. Case refers to the function of a noun phrase in a sentence. In English, only pronouns show overt case. There are:

- Nominative pronouns like I, he, and she
- Accusative pronouns like me, him, her
- Genitive pronouns like mine, his, hers

These cases apply to all noun phrases, but only modify the form of pronouns (in some other languages, case is overt in both pronouns and non-pronouns)

The Case Filter states that all noun phrases must have some case (nominative, accusative, genitive), and sentences with case-less noun phrases are deemed to be incorrect. Because English, for the most part, does not exhibit overt case, explaining the concept is a little trickier, and would only serve to confuse you. However, we can show one of the consequences of the case filter, A-movement. (Not to be confused with A'-movement; Linguists do a bad job of making this stuff understandable

- "The Perfect" and "The Perfective" are two different linguistic concepts!). This movement is another important example of how sentences are constructed.

In some positions, noun phrases lack case, so they need to move to a position that supplies case. The most recognizable example of this is infinitival clauses, which are tenseless and thus cannot give case to the NP. Take for example the sentence, "Leo is certain to score". This sentence actually originates as "is certain [$_{IP}$ Leo to score]", but the infinitival phrase has no tense, and so the noun phrase "Leo" is violating the case filter. Thus, "Leo" will move to become the specifier of the inflectional phrase, and we get "Leo is certain to score". This movement looks like this:



3.2.1 Mr. Worldwide

While these concepts are mainly taught in English for ease of understanding, they are present in other languages. In fact, this similarity between languages is one of the most important aspects of linguistics. By formulating theories and testing them on a myriad of languages, we get a deeper understanding of the inner workings of human communication. Even more critically, understanding how language develops helps us in mapping out new languages, and potentially saving them from extinction. When the last native speaker of a language dies, so does the language, but if we can map out the language to a set of rules, then we can preserve it in some way or another.

Language is critical to the human identity, which is why many imperialist entities try their best to control the language of those they wish to rule. For instance, the English outlawed the speaking of Gaelic in Ireland and Scotland, even beating children into speaking English (note that there are slightly different versions of Gaelic, and not one unified language). Additionally, there are concentrated efforts to describe certain languages as "dialects", painting them as incorrect versions of the "pure" language. Two examples of this are African-American Vernacular English (AAVE) and Scots, where the languages are somewhat familiar to English speakers, but possess unique rules that must be adhered to. The speakers of these languages are not speaking incorrectly or aimlessly, but are speaking the languages that have developed due to racist policies like ghettos and redlining.

4 IT'S DEAD! (an introduction to movement, without all of that pesky movement)

4.1 Covert Movement

This topic will be our last, and also our most advanced. In the movements I showed before, there exist "islands", which are phrases out of which movement is *not* possible. Think of an island as a constraint on movement. Take for example our sentence in 3.2, "Leo is certain to score". In that sentence, the noun phrase ("Leo") starts out inside the lower inflectional phrase ("Leo to score"), but then moves outside to the higher inflectional phrase ("Leo is certain"). There exist situations in which this movement out of lower XPs is no longer possible, and in that case we would call this lower inflectional phrase an island.

There is a lot more depth to this concept, but the basic premise is that sometimes, movement that is normally correct becomes ungrammatical due to the way the sentence is structured. What is more interesting about this premise is that these constraints are adhered to even in languages where the words *don't* move, i.e. islands still make certain phrases ungrammatical even if there is no movement for them to "block". This suggests a theory of covert movement, where movement happens "behind the scenes" in the grammatical structure but does not appear in the pronunciation of the sentence.

An example of this is Chinese, which is what is called a "wh-in-situ" language. These languages do not move their wh-words when forming questions, so it would follow for the language to not exhibit islands, since islands and movement go hand-in-hand. Despite this, sentences in Chinese where the wh-words are placed in island environments are just as ungrammatical as those in English!

Another example, this time in English, is something called Quantifier Raising. Understanding this requires understanding several other concepts, namely Coordinate Structure Constraints, Weak Crossover Constraints, C-Command, and more. Despite our deficiencies in those subjects, we can still paint a picture with an example or two.

(10) Some dog loves every man

Here, the qualifiers are "Some" and "every", which describe "dog" and "man", respectively. This sentence, as it is, has some ambiguity to it - we do not know if there exists one dog that loves every man, or a dog per man. We can clear up this ambiguity fairly easily.

(11) Some dog likes every man and hates that fire hydrant.

It is no longer possible to understand this is as "for every man, there is a dog that loves him and also hates one specific fire hydrant". By adding the clause "and hates that fire hydrant", we removed the ambiguity and ensures the only valid reading is "there is one dog that likes every man and hates a specific hydrant". This is newfound clarity is due to the sentence now being "coordinated", and there is an island created by something called the Coordinate Structure Constraint. While nothing is overtly moving in this sentence, the introduction of an island removes a possible reading, proving that there exists some movement that we are not seeing.

4.1.1 Mr. Vice and Mrs. Versa

Previously, we discussed how Chinese is a "wh-in-situ" language, meaning that wh-words do not move when forming questions. Despite this, Chinese adheres to wh-movement constraints, and sentences that violate those constraints are ungrammatical, even though there is no movement to be "blocked". We take this to mean that there is movement in the underlying structure of the sentence, but not in the actual words you say out loud.

This phenomenon also happens in the opposite direction, with the underlying structure remaining the same and the words you say changing. A common example of this is the change of "want to" to "wanna". Despite the pronunciation changing, "wanna" still function as "want to" in the tree structure, and only affects how we *say* the sentence, but now how we understand it.

5 Why is this important?

To some, linguistics may seems frivolous, theory for theory's sake. "We can speak these languages just fine, why do we need to go and explain them?" you ponder. The thing is, linguistics is more than just the words that come out of our mouth or onto the page. It is the study of the essence of human communication, the tool that brought us to where we are today. All of these seemingly unrelated languages, often with no common ancestor, exhibit strikingly similar behaviors to one another, over and over. By understanding how a question is formed, and applying that understanding across different languages, we are slowly but surely drawing links between all of the people in the world, validating those who are looked down upon for their differing speech, and hopefully saving a language or two from going extinct. Plus, it really is just plain cool.

5.0.1 "Ok, I forgot what this is in English but..."

Growing up in Palestine, I was taught Arabic as a native student, albeit at a level a little lower than my grade (I had missed some fundamental years due to being in the US). In Arabic class, a big component was something called *i'rab*... I don't think its possible for me to convey the Arabic word for it through English text, so let's just butcher it and call it i'rab. This was a critical part of everyone's understanding of the written Arabic language (which differs from the spoken, where each country has its own version), and at its root was the task of explaining every word in the sentence, its function, and what vowels it has due to its location in the sentence.

While not as hardcore as trees, the ideas of sentence construction were taught to everyone at very young age, and unlike in English teaching (at least in my experience), it never went away. Instead, as you got older, it got harder and more complex, covering vast swatches of classic Arabic poetry and writing. While not being linguistics per se, I think learning linguistics-adjacent concepts and ideas is critical to teaching kids better self-expression, and as teaching changes and evolves, it would serve the future generations good if we snuck a little bit of linguistics in.