Expanding the Lexicon

LING 255
January 31, 2008

1. BEYOND VERBS

Last time we ended with:

(1) **The Rule of "Noun Verb" interpretation**
If we have a Sentence node, and its daughters are NP and VP, then

⟦NP VP⟧ = TRUE if ⟦VP⟧(⟦NP⟧)

⟦**snores**⟧ = the characteristic function of {*x* | *x* snores}, i.e., that function from individuals to truth values such that, given an individual, it returns TRUE if and only if that individual snores.

That may cover verbs...what about nouns?

1.1. Nouns

- ⟦**Lincoln is a president**⟧ = TRUE iff Lincoln is a president.
  ⟦**president**⟧ = ...?

We have two options: one is to assign meanings to **is**, **a**, and **president**; the other is to ignore the little words and assume that the meaning comes only from **Lincoln** and **president**. Let's ignore **is** and **a**. Then, since all we have is function application, we'll end up with a meaning much like the one we had above:

⟦**president**⟧ = that function from individuals to truth values such that, given an individual, it returns TRUE if and only if that individual is a president.

1.2. Adjectives

Do adjectives work in exactly the same way?

- ⟦**Lincoln is happy**⟧ = TRUE iff Lincoln is happy.
  ⟦**happy**⟧ = that function from individuals to truth values such that, given an individual, it returns TRUE if and only if that individual is happy.

Apparently so. [But stay tuned!]

1.3. Some concerns about these meanings

- Can we really justify treating **is** and **a** as meaningless?

Well, consider Hebrew: the sentence **Lincoln is a president** is expressed as **Lincoln nasi**,[1] with no word for **is** or **a**. (Adjectives are the same: there's no **is** in the Hebrew translation of **Lincoln is happy**.)

Our two options can be recast as follows: either we combine "Lincoln" directly with "president", and English has a few words without meaning; or we include "is" and "a", and Hebrew (along with, e.g., Chinese) expresses these words invisibly. The first option seems much simpler...

- Aren't nouns more like individuals?

Possibly. But a noun like "president" doesn't just name a particular individual. Names of individuals can be swapped around freely, e.g.

> Hesperus, the evening star, is Venus.
> Bosperus, the morning star, is Venus.
> Therefore, Hesperus is Bosperus.

That doesn't work so well with:

> Abraham Lincoln is X, the individual denoted by "president".
> George W. Bush is X, the individual denoted by "president".
> Therefore, Abraham Lincoln is George W. Bush.

So we need something more complex than just an individual. (It *is* the case that nouns get used to pick out individuals, e.g. **the dog barked** or **the president snores**; but not on their own! The word **the** has to be doing some work there—similarly in, say, Hebrew, where **ha-nasi** picks out the individual.)

- If ⟦**~~is a~~ president**⟧ = that function from individuals to truth values such that, given an individual, it returns TRUE if and only if that individual is *a* president, then will we have:

  ⟦**~~is the~~ president**⟧ = that function from individuals to truth values such that, given an individual, it returns TRUE if and only if that individual is *the* president?

Well...by hypothesis, **a** isn't contributing any meaning. On the other hand, **the** presumably is (as was just claimed above). We don't want to just freely substitute **α** for **β** in the object language and then substitute α for β in the metalanguage.

For instance...

[1] I had "naasi" on the board in class, but I gather "nasi" is the usual representation.

2. BACK TO VERBS: TRANSITIVE VERBS

- ⟦**Booth killed Lincoln**⟧ = TRUE iff Booth shot Lincoln

How do we analyze this? We don't want to just say:

- ⟦**killedlincoln**⟧ = that function from individuals to truth values such that, given an individual, it returns TRUE if and only if that individual killed Lincoln

  (and then ⟦**killedkennedy**⟧ is the same if we substitute "Kennedy" for "Lincoln" in the metalanguage description, and so forth)

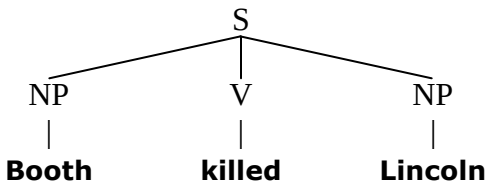
...because here, we want **killed** and **Lincoln** to each contribute their separate meanings.

The good news: that's not too hard to do, as long as our functions can take ordered pairs as arguments.

⟦**killed**⟧ = that function from pairs of individuals to truth values such that, given an pair of individuals $\langle x, y \rangle$, it returns TRUE if and only if *x* killed *y*

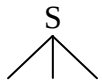
The bad news is that we need a new interpretation rule, because **Booth killed Lincoln** won't just have the S-over-NP-and-VP structure, but instead something like:

(2)



So we'll need a new rule like the following:

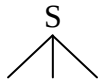
(3) **The Rule of Transitive Verb Interpretation**
If we have a Sentence node, and its daughters are NP, V, and NP, then



⟦NP_1 V NP_2⟧ = TRUE if ⟦V⟧(<⟦NP_1⟧, ⟦NP_2⟧>)

That's not too bad, though it's not great...but worse, we now have to have a different rule for Japanese, where the word order is Subject-Object-Verb:

(4) **The Rule of Transitive Verb Interpretation in Japanese**
If we have a Sentence node, and its daughters are NP, NP, and V, then



$[\![NP_1\ NP_2\ V]\!]$ = TRUE if $[\![V]\!](<[\![NP_1]\!], [\![NP_2]\!]>)$

(Why not just say "If we have a sentence node with these three daughters, in whatever order?" Because we have to be able to distinguish NP_1 from NP_2.)

And there are other reasons to think that perhaps **shot Lincoln** is a unit of the sentence, whereas **Booth shot** is not. What we need is a vast simplification of things.

3. THE RULE OF INTERPRETATION, REVISITED

We started with a very particular rule of interpretation for S = NP VP. Instead, we can use a much more general rule:

(5) **Function Application (Rule #1 of Interpretation)**
If a node M has daughters D_1, D_2 [in either order!], and D_1 is a function that can take D_2 as an argument, then $[\![M]\!] = [\![D_1]\!]([\![D_2]\!])$

You can verify for yourself that the rule in (1) is just a special case of this rule.

Now the only problem is that we can only combine two things at a time, not three, and our semantics for **killed** is such that it requires an ordered pair, rather than a single individual.

Fortunately, this can be done with...Schönfinkelization!