Quantification

1 Reminder: Final papers

Due Friday, April 14. "Should be approximately 10 pages. The paper should identify an original puzzle, in a language you speak or in another language by working with a native speaker consultant. Use the skills developed in class to carefully diagnose and describe the issue, and sketch a possible solution."

Advice for finding a topic: Look around your language for functional morphology or constructions whose meanings are not immediately obvious. What is the contribution of this morpheme? (Is it an entailment or presupposition?) Using the Principle of Compositionality and reasonable syntactic assumptions, figure out what its semantic contribution is.

A sample outline:

1. Introduction: I am studying X and I will propose that it means X.
2. Some basic data: Comparing minimal pairs of sentences with X and without X, we see that X must contribute meaning Y. X is grammatical in these sentences but not those others. A generalization for X's meaning and/or distribution is Z.
3. Proposal: I propose X's denotation is $[\![X]\!]$. Here are trees and computations for a couple examples above, showing that my proposed denotation yields the desired meaning.
4. Conclusion / open questions / problems with this analysis

This is just one sample; your paper does not have to follow it closely.

Advice for writing: Follow the advice in this short set of guidelines to writing Linguistics papers: `https://mitcho.com/teaching/newmeyer1988.pdf` .

If you want to work on another language, through elicitation: I would suggest looking at expressions for universal quantifiers (*every student*), different forms of negation, or words like 'only,' 'also,' 'again.'

Talk to me or email me about your topic by March 13 and I can give you some comments and/or references.

2 How to study the meaning of a part

Using the Principle of Compositionality, we can figure out the meaning of individual parts of sentences.

(1) Kara **and** Tama sleep.

(2) John likes **himself**.

(3) Sarah swims **again**.

Step by step:

1. What does the whole sentence mean? Paraphrase without using the target part (in bold).
2. What is the structure of the sentence? Draw a tree.
3. Fill in semantic types. Use the Triangle Method if necessary.
4. Using your paraphrase from Step 1, work backwards to figure out the meaning of the target part (in bold).
   - Make sure the meaning you write for the target part is general: it should not include meanings which are contributed from other material in the sentence.
   - Remember that each λ should correspond to a variable in the return value. When you add a λ variable, make sure it's used.
5. Check that your final meaning matches the predicted type. Recompute the structure bottom-up to make sure it works. Make sure the meaning you proposed also works in other, similar examples.

3 Subject quantifiers

The DPs we have studied so far have generally been of type e. Let's now consider subject DPs like *everyone*, *no one*,[1] and *someone*.

(4) Everyone sleeps.

Option 1: Include "plurals" in D_e, including a symbol that refers to 'nothing,' ϵ. *Everyone* is type e, the sum of all individuals.

(5) a. $D_e = \left\{ \begin{array}{c} \epsilon, \text{John, Mary, Kara,} \\ \text{John + Mary, John + Kara, Mary + Kara,} \\ \text{John + Mary + Kara} \end{array} \right\}$

b. $[\![\text{everyone}]\!]$ = John + Mary + Kara (type e)

c. $[\![\text{everyone sleeps}]\!]$ = 1 iff (John + Mary + Kara) sleeps

This sort of works for *everyone*, but it does not work for *no one* and *someone*. Why?

[1] Although we spell this as two words, "no one," we will treat it as one word, just like *nothing*.

Option 2: *Everyone* is not type e.

(6) a. $[\![\text{everyone}]\!] = \lambda Q_{\langle e,t\rangle}$. for all $x \in D_e$ [x is animate $\rightarrow$ $Q(x) = 1$]

b. $[\![\text{everyone sleeps}]\!] = 1$ iff for all $x \in D_e$ [x is animate $\rightarrow$ x sleeps]

Quantificational DPs are type $\langle\langle e, t\rangle, t\rangle$. In other words, they take the VP as their argument.

Exercise

(7) **Every** dog sleeps.

Recall from Handout 2 that we wrote meanings for quantificational determiners as relations between sets:

(8) **Quantificational determiners as set-relations, from Handout 2:**

a. *every/all*$(A)(B) = 1$ iff $A \subseteq B$

b. *a/some*$(A)(B) = 1$ iff $A \cap B \neq \emptyset$

c. *no*$(A)(B) = 1$ iff $A \cap B = \emptyset$

d. *two*$(A)(B) = 1$ iff $|A \cap B| = 2$

e. *more-than-two*$(A)(B) = 1$ iff $|A \cap B| > 2$

f. *most*$(A)(B) = 1$ iff $|A \cap B| > |A \setminus B|$

Because we normally work with truth conditions and functions, not sets, we have to translate (8a) into non-set terms:

(9) $[\![\text{every dog sleeps}]\!] = \{x : x \text{ is a dog}\} \subseteq \{y : y \text{ sleeps}\}$

$\Leftrightarrow$ for all $z \in \{x : x \text{ is a dog}\}$ $[z \in \{y : y \text{ sleeps}\}]$

$\Leftrightarrow$ for all $z \in D_e$ [$\underbrace{z \text{ is a dog}}_{\textit{every}\text{'s first argument}}$ $\rightarrow$ $\underbrace{z \text{ sleeps}}_{\textit{every}\text{'s second argument}}$]

(10) $[\![\text{every}]\!] = \lambda P_{\langle e,t\rangle}$. $\lambda Q_{\langle e,t\rangle}$. for all $z \in D_e$[if $P(z) = 1$, then $Q(z) = 1$]

Exercise

Rewrite the quantificational determiners in (8) as λ functions of type $\langle\langle e, t\rangle, \langle\langle e, t\rangle, t\rangle\rangle$.

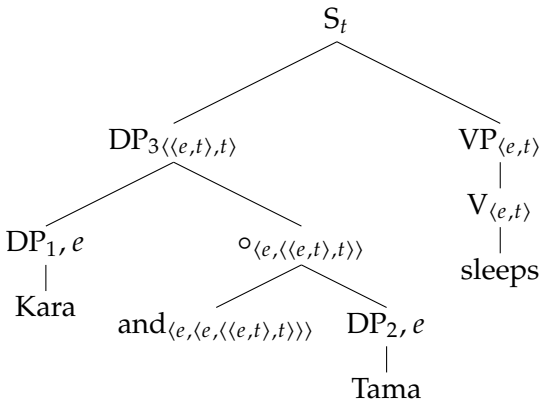
Some mathy notation you can use

- $\rightarrow$ *if...then...*
- $\forall$ *for all...*
- $\exists$ *there exists...*

Sample answer:

(1) Kara and Tama sleep.

First, to figure out the types. The important thing to note is that there is no plural "Kara+Tama" in D_e. This teaches us that the type of the DP "Kara and Tama" cannot be type e. The only other option (using the Triangle Method, using Functional Application) is type $\langle\langle e,t\rangle,t\rangle$. Our goal is to figure out a way to get (3) to mean the same thing as "Kara sleeps and Tama sleeps."



- $[\![\text{VP}]\!] \underset{NN}{=} [\![\text{sleep}]\!] \underset{TN}{=} \lambda x_e \,.\, x \text{ sleeps}$
- $[\![\text{DP}_1]\!] \underset{TN}{=} \text{Kara}$
- $[\![\text{DP}_2]\!] \underset{TN}{=} \text{Tama}$
- Definition of *and*: $[\![\text{and}]\!] \underset{TN}{=} \lambda x_e \,.\, \lambda y_e \,.\, \lambda P_{\langle e,t\rangle} \,.\, P(x) = 1 \text{ and } P(y) = 1$
- $[\![\circ]\!] \underset{FA}{=} [\![\text{and}]\!]\,([\![\text{DP}_2]\!])$
  $= \left[\lambda x_e \,.\, \lambda y_e \,.\, \lambda P_{\langle e,t\rangle} \,.\, P(x) = 1 \text{ and } P(y) = 1\right]$ (Tama)
  $= \lambda y_e \,.\, \lambda P_{\langle e,t\rangle} \,.\, P(\text{Tama}) = 1 \text{ and } P(y) = 1$
- $[\![\text{DP}_3]\!] \underset{FA}{=} [\![\circ]\!]\,([\![\text{DP}_1]\!])$
  $= \left[\lambda y_e \,.\, \lambda P_{\langle e,t\rangle} \,.\, P(\text{Tama}) = 1 \text{ and } P(y) = 1\right]$ (Kara)
  $= \lambda P_{\langle e,t\rangle} \,.\, P(\text{Tama}) = 1 \text{ and } P(\text{Kara}) = 1$
- $[\![\text{S}]\!] \underset{FA}{=} [\![\text{DP}]\!]\,([\![\text{VP}]\!])$
  $= \left[\lambda P_{\langle e,t\rangle} \,.\, P(\text{Tama}) = 1 \text{ and } P(\text{Kara}) = 1\right]$ $(\lambda x_e \,.\, x \text{ sleeps})$
  $= 1$ iff $(\lambda x_e \,.\, x \text{ sleeps})(\text{Tama}) = 1$ and $(\lambda x_e \,.\, x \text{ sleeps})(\text{Kara}) = 1$
  $= 1$ iff Tama sleeps and Kara sleeps