Quantifiers

First, a little bit of Set Theory

Every a is b

No a is b

Some a is b

\[ \text{Every man smokes} = \text{All members of the set of men are also members of the set of people who smoke.} \]

Evidence that not all DPs are of type e

DPs with quantifiers fail subset to superset inferences

- X came yesterday morning
- Therefore-
- X came yesterday

(Try with: No students, no less than 3 students, no more than 3 students, few students, exactly 3 students... )

Quantifier DPs fail the Law of Contradiction

- Mount Rainier is on this side of the border, and Mount Rainier is on the other side of the border.
- More than two mountains are on this side of the border, and more than two mountains are on the other side of the border.

Quantifier DPs change in meaning with predicate extraction

- I answered number seven.
- Number seven, I answered.

vs

- Almost everybody answered at least one question.
- At least one question, almost everybody answered.

Why? Quantifiers denote relations between sets (of individuals)

Generalized Quantifiers are of type \((e>t)>t\)

Nothing, something, everything
So you plug in a property and get back a truth value

**Quantifying Determiners are type** 
\((e>t)>(e>t)>t)\)

Common nouns are type \(e>t\)

Quantifiers are type \((e>t)>(e>t)>t)\)

So for a DP like \([\text{every painting}]\), the type is \((e>t)>t\)

**Problems with Quantifiers in Object Position**

\([\text{DP every linguist}][\text{vp offended John}]\)

\(\text{John [vp offended]}[\text{DP every linguist}]\)

**Type mismatch!!** The Verb is looking to combine with something of type \(e\)

**Solutions to Quantifiers in Object Position**

Quantifier Raising

![Diagram showing quantifier raising]

Quantifier raises to the specifier of CP

The trace left behind is type \(e\) and has no problem combining with the verb

An index is added to tell you when to drop the “dummy” (trace) and replace it with the real DP

**Putting it all together with Lambda Calculus**

2 rules: function application and quantifier raising

\([\text{something}] = \lambda P. \exists x[P(x)]\)

\([\text{everything}] = \lambda P. \forall x[P(x)]\)

\([\text{who}] = \lambda p \lambda q \lambda z. q(z)^p(z)\)

\([\text{every}] = \lambda p \lambda q. \forall x[p(x)->q(x)]\)

**Ambiguities with 2+ quantifiers:**

There are 2 possible meanings for \([\text{Some teacher offended every student}]\)

Raise just \([\text{every student}]\) for the first meaning

Raise \([\text{every student}]\) and then raise \([\text{some teacher}]\) for the alternate meaning.