October 3, 2014: Quantificational DPs

1 The semantic type of quantifiers

1.1 Quantifiers as individuals?

To a first approximation, **quantificational DPs** like every man, most huskies, and a state in the NE go all the places DPs like Polly, New Jersey, and the husky Bea owns go:

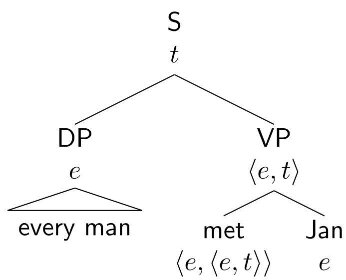
(1) Polly met Jan / Every man met Jan

(2) John likes the Husky Bea owns / John likes most huskies

(3) New Brunswick is part of NJ / New Brunswick is part of a state in the NE

[Record scratch.] Why are we talking about indefinites like a state in the NE as if they're quantificational DPs rather than predicates? Stay tuned..

Given the way interpretation works, these distributional facts might be construed as giving us a reason to think quantificational DPs have the same type as proper names and definite descriptions—that is, e—and that they compose with their surroundings via **FA**. For example:



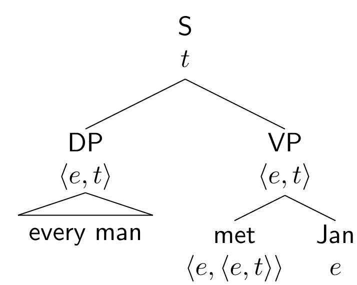
Pros: simplicity? Cons: many.

1. Predicts bad entailments.
   (a) Existential commitment:
   John left $\Rightarrow$ someone left
   nobody left $\not\Rightarrow$ someone left
   (b) Adverbial modification:
   John left quickly $\Rightarrow$ John left
   nobody left quickly $\not\Rightarrow$ nobody left
   (c) Contradiction schema:
   John left and John didn't leave $\Rightarrow \bot$
   somebody left and someboth didn't leave $\not\Rightarrow \bot$
   (d) Excluded middle schema:
   John left or John didn't leave $\Rightarrow \top$
   everyone left or everyone didn't leave $\not\Rightarrow \top$
   (e) Topicalization:
   the first question, everyone missed $\Rightarrow$ everyone missed the first question
   at least one question, everyone missed $\not\Rightarrow$ everyone missed at least one question
2. Moreover, quantifiers give rise to **ambiguity**, while expressions we've been analyzing as having type e do not. That is, (a) and (b) are unambiguous, but (c) is ambiguous:
   (a) Somebody likes John.
   (b) Somebody likes the outgoing Secret Service head.
   (c) Somebody likes everybody.
3. More generally, what semantics *could* they have on this picture?
   (a) "Negative" quantifiers like few cats, less than three linguists, and nobody? Which individual(s)?
   (b) Indefinites like a state in the NE? Which individual(s)?
   (c) Most cats? Modified numerals like at least one husky? Which individual(s)?

   We might imagine the question of *which individual(s)* is answered by context, same as pronouns, but it's really not clear how this could extend to "negative" quantifiers.

1.2 Quantifiers as sets?

Ok, type e really isn't gonna work. Let's climb the type ladder. Can we give a semantics for quantificational DPs in terms of sets/properties, type $\langle e,t\rangle$?



Need a new notion of predication. Notice that this competes with PM! Composition would no longer be deterministic.

$$[\![\text{DP VP}]\!]^g := \{x : [\![\text{DP}]\!]^g(x)\} \subseteq \{x : [\![\text{VP}]\!]^g(x)\}$$

Another possibility: upping the type of VPs from $\langle e,t\rangle$ to $\langle\langle e,t\rangle,t\rangle$:

$$[\![\textsf{met Jan}]\!]^g = \lambda P.P \subseteq \{x : \text{met(j)}(x)\}$$

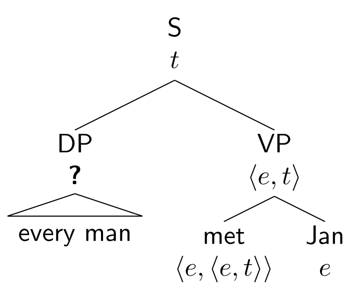
This gets a semantics off the ground for everyone (but notice that its "quantificational force" lives elsewhere, i.e. in the grammar/in the lexical semantics of the verb). But we still have issues:

1. Need to coerce individuals into sets for this strategy to work generally.
2. Other cases less clear. Again, most and modified numerals like at least one question. Which set? Again, context-dependence might be some help here.
3. Still, which set is denoted by nobody? The empty set? Then how does nobody differ from no linguists? It is certainly the case that no linguists left can be true even if nobody left is false.

And I'll leave it to you to sort out the lexical semantics for transitive (and ditransitive) verbs on this picture, and to determine whether the predictions are good ones when there's more than one quantifier in a sentence. Good luck ;)

2 Follow the types

Let's go back to our old setup, i.e. with **FA**, **PM**, and **PA**.



FA suggests another type for the subject DP here. How about $\langle\langle e,t\rangle,t\rangle$?

That is, **quantifiers map properties into truth values**. Given a quantificational DP of the form Det cat (for Det some quantificational determiner), $[\![\textsf{Det cat}]\!]$ requires It is often easier to talk loosely in terms of sets, and we will do so here.

1. Every cat maps a P to 1 iff P holds of every cat.
   i.e. $\text{cat}' \subseteq P$
2. No cat maps a P to 1 iff P holds of no cat.
   i.e. $\text{cat}' \cap P = \emptyset$
3. At least one cat maps a P to 1 iff P holds of at least one cat.
   i.e. $\text{cat}' \cap P \neq \emptyset$
4. Most cats maps a P to 1 iff P holds of more cats than not.
   i.e. $|\text{cat}' \cap P| > |\text{cat}' - P|$

Notice that in addition to quantificational DPs, we can characterize the semantics of names this way. The following $\langle\langle e,t\rangle,t\rangle$ meaning maps a property P to true iff P holds of John.

$$\lambda P.P(\text{j})$$

2.1 How this avoids the problematic inferences

Existential commitment: many $\langle\langle e,t\rangle,t\rangle$ functions exist that map the empty property $P_\emptyset$ (i.e. $[\![\textsf{left}]\!]^g$) to true without thereby requiring $P_\emptyset$ to hold of anything.

Adverbial modification: a function can map P (i.e. $[\![\textsf{left quickly}]\!]^g$) to true and Q (i.e. $[\![\textsf{left}]\!]^g$) to false even if $P \subseteq Q$.

Contradiction schema: no problem supposing a single function can map both P (i.e. $[\![\textsf{left}]\!]^g$) and Q (i.e. $[\![\textsf{didn't leave}]\!]^g$) to 1 even if $P \cap Q = \emptyset$.

Excluded middle schema: no problem supposing a single function can map neither P (i.e. $[\![\textsf{left}]\!]^g$) nor Q (i.e. $[\![\textsf{didn't leave}]\!]^g$) to 1, even if $P \cup Q = U$.

Topicalization is taken up in the next section.

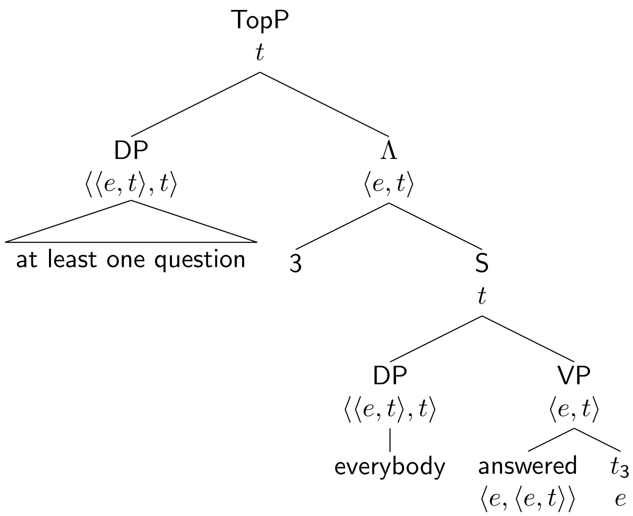
3 Semantics for topicalization

What we assume is that the relationship between a topicalized expression and an extraction gap is much the same as the relationship between a relative pronoun like who and an extraction gap.

See Figure 1 for a full derivation.

Notice that this structure is unambiguously associated with the interpretation on which the set of questions and the set of things everybody answered have a nonempty intersection.

Scope ambiguity is yet to come (and will require perhaps the final major revision in our basic architectural assumptions), but the way we analyze it will turn out to look extremely similar to this..



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\begin{aligned}
[\![\textsf{TopP}]\!]^g &= [\![\textsf{at least one question}]\!]^g([\![\Lambda]\!]^g) && \textbf{FA}\\
&= \mathrm{aloq}'([\![\Lambda]\!]^g) && \text{Lexicon}\\
&= \mathrm{aloq}'(\lambda x.[\![\textsf{S}]\!]^{g[x/3]}) && \textbf{PA}\\
&= \mathrm{aloq}'(\lambda x.[\![\textsf{everybody}]\!]^{g[x/3]}([\![\textsf{VP}]\!]^{g[x/3]})) && \textbf{FA}\\
&= \mathrm{aloq}'(\lambda x.\mathrm{eb}'([\![\textsf{VP}]\!]^{g[x/3]})) && \text{Lexicon}\\
&= \mathrm{aloq}'(\lambda x.\mathrm{eb}'([\![\textsf{answered}]\!]^{g[x/3]}([\![t_3]\!]^{g[x/3]}))) && \textbf{FA}\\
&= \mathrm{aloq}'(\lambda x.\mathrm{eb}'(\mathrm{answered}'([\![t_3]\!]^{g[x/3]}))) && \text{Lexicon}\\
&= \mathrm{aloq}'(\lambda x.\mathrm{eb}'(\mathrm{answered}'(x))) && \text{Pronoun rule}
\end{aligned}
$$

Figure 1: at least one question, everybody answered