Transitive Predicates and Scope

Heather Burnett (Université de Montréal/ÉNS, Paris)
heather.susan.burnett@gmail.com
https://sites.google.com/site/heathersusanburnett/home/teaching/
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1 Review

I have presented a system in which all DPs denote generalized quantifiers.

(1) a. \([\text{everyone}]_M = \lambda P(D_M \subseteq P)\)
    b. \([\text{John}]_M = \lambda P(\text{John} \in P)\)

- This proposal is useful for pursuing a unified analysis of the semantics of expressions that have the category \(DP\).
- But only in subject position...

Also: What about the all-important phenomenon of \textbf{scope}?

2 Scope and Logical Form

We know how to interpret:

(2) Everyone is vegetarian.

But what about sentences with transitive predicates?

(3) a. Everyone likes John.
    b. Everyone likes someone.

A \textbf{common assumption}: Transitive predicates denote binary relations between individuals (or their characteristic functions).

(4) \([\text{likes}]_M = \{\langle y, x \rangle : y \text{ likes } x \text{ in } M\}\)
    a. \([\text{likes}]_M = \lambda x \lambda y(\text{y likes x in M})\).

How do we do the compositional semantics for transitive predicates with quantifiers in object position?

\[ [\text{likes John}]_M = ? \]
\[ [\text{likes}]_M = \lambda x \lambda y(\text{y likes x}) \quad [\text{John}]_M = \lambda P(\text{John} \in P) \]
\[ [\text{likes someone}]_M = ? \]
\[ [\text{likes}]_M = \lambda x \lambda y(\text{y likes x}) \quad [\text{someone}]_M = \lambda P(D_M \cap P \neq \emptyset) \]
• *Someone* (unlike *John*) has the additional property that it gives rise to *scope ambiguities* when it appear with other quantified noun phrases.

(5) a. Everyone likes John. (not ambiguous)
\[ \forall x (LIKE(x, j)) \]

b. Everyone likes someone. (ambiguous)
\[ \forall x \exists y (LIKE(x, y)) \]
\[ \exists y \forall x (LIKE(x, y)) \]

Two questions for sentences with quantified noun phrases in object position:

1. How is the VP interpreted compositionally?
2. How do scope ambiguities arise?

I’ll go through two approaches to answering these questions:

1. Quantifier raising approach (à la May etc….*standard*: Heim and Kratzer (1998))
2. The Rich DP hypothesis (à la van Benthem & Keenan)
3. (Type shifting approach (Jacobsen etc.))

### 3 Quantifier Raising

Proposal (based on May (1985)):

- Quantifier scope ambiguity is structural ambiguity.
- The two readings of ambiguous sentences correspond to two different parses.
- The syntax of sentences with quantified noun phrases is more complicated than it appears.

(6) **Quantifier Raising:**

Quantified noun phrases undergo syntactic movement at the level of representation called *Logical Form.*

(7) LF for one reading of *Everyone likes someone.*

\[
\begin{array}{c}
\text{S'} \\
\text{Someone} \\
\text{i} \\
\text{S} \\
\text{Everyone} \\
\text{VP} \\
\text{likes} \\
\end{array}
\]
How is the interpretation done?

- When DPs move, they leave traces that are co-indexed with the moved phrase.
- Both traces and indexes are interpreted.

Proposal:

- Traces are interpreted like variables in predicate logic: on assignment.

**Definition 3.1 Assignment.** An assignment $g$ on a model $M$ is a (partial) function from the set of traces to members of $D_M$.

$$[t_i]_M^g = g(t_i), \text{ where } g(t_i) \in D_M$$

a. If $g(t_i) = $ Lisa, then $[t_i]_M^g = $ Lisa.

FYI: A similar analysis for pronouns.

$$[\text{she}]_M^g = g(\text{she}_i) = \text{Lisa}$$

(12) First part of reading 1: Everyone likes someone.

$$[\text{Everyone likes } t_i]_M^g = \text{True iff } D_M \subseteq \{ x : x \text{ likes } g(t_i) \}$$

$$[\text{Everyone}]_M^g = \lambda P(D_M \subseteq P) \quad [\text{likes } t_i]_M^g = \lambda y(\text{y likes } g(t_i))$$

$$[\text{likes}]_M^g = \lambda x \lambda y(\text{likes x}) \quad [t_i]_M^g = g(t_i)$$

We’re not done yet!
• We separate the interpretation of the index \( i \) from its moved phrase (\emph{someone}).

• \textbf{The index combines with its sister to create a property.}

• The index serves to introduce the rule of \emph{predicate abstraction}.

\begin{equation}
\text{(13) Predicate Abstraction Rule (PA) (Heim and Kratzer (1998); p. 186)}
\end{equation}

Let \( \alpha \) be a branching node with daughters \( \beta \) and \( \gamma \), where \( \beta \) dominates only a numerical index \( i \). Then, for any variable assignment \( g \), \( [\alpha]^g_M = \lambda x ( [\gamma]^g_{x/i} ) \)

\[ [i(\text{Everyone likes } t_i)]^g_M = \lambda x (\text{Everyone likes } x) \]

\[ [\text{Everyone likes } t_i]^g_M = \text{True iff everyone likes } g(t_i) \]

• Finally, we add the moved direct object.

\begin{equation}
\text{(14) Object wide-scope reading of } \text{Everyone likes someone}.
\end{equation}

True iff \( D_M \cap \{ x : \text{everyone likes } x \} \neq \emptyset \) iff there is some \( x : \text{Everyone likes } x \)

\[ [\text{Someone}]^g_M = \lambda Q (D_M \cap Q \neq \emptyset) \]

\[ \lambda x (\text{Everyone likes } x) \]

\[ [\text{Everyone}]^g_M = \lambda P (D_M \subseteq P) \]

\[ [\text{likes}]^g_M = \lambda x \lambda y (y \text{ likes } x) \]

\[ [t_i]^g_M = g(t_i) \]

\textbf{To do:} Object Narrow Scope Reading.

\textbf{Good things about this analysis:}

• A unified account of how transitive quantifiers are interpreted and how scope ambiguities arise.

\textbf{Not so good things about this analysis:}

• We can’t interpret quantifiers in object position? WTF?

• Do we really need these hidden movements?

Despite some head scratching, we will assume the QR analysis of scope ambiguities and the interpretation of quantifiers in object position.

• QR as syntactic movement makes some interesting predictions (see next class!).
4 The Rich DP Hypothesis

A common misconception:

- If we want to assign a single denotation to quantified noun phrases, we will have problems interpreting them in object position. (cf. Heim and Kratzer (1998) among many others)


To illustrate with a concrete example, consider the standard, non-directly compositional analysis of quantifier scope construal: a verb phrase such as saw everyone fails to have a semantic interpretation until it has been embedded within a large enough structure for the quantifier to take scope (e.g. Someone saw everyone). On such an analysis, there is no semantic value to assign to the verb phrase saw everyone at the point in the derivation in which it is first formed by the syntax (or any other point in the derivation, for that matter).

Is this right?

- Another approach: \([\text{saw everyone}]_M = \{x : x \text{ saw everyone in M}\}\)

4.1 Quantified NPs as arity reducers

Current analysis: quantifiers are functions from properties to truth values.

(15) For all properties \(P\):
   a. \([\text{everyone}]_M(P) = \text{True} \iff D_M \subseteq P\)

Remarks:

- Properties (i.e. sets) are unary relations (have an arity of 1).
- We can think of the set of truth values (\{True, False\}/\{1,0\}) are a 0-ary relation.

(16) Subject Quantifier Generalization:
Quantifiers map 1-ary relations to 0-ary relations (1 \rightarrow 0).

- The problem that transitive predicates pose is that the quantifier is trying to apply to a binary (2-ary) relation.

Temporary solution:

- We have two everyones.

Everyone in subject position (nominative):

(17) For all properties \(P\):
   a. \([\text{everyone}_{\text{nom}}]_M(P) = \text{True} \iff D_M \subseteq P\).

- Quantified noun phrases in object position denote functions from binary relations to unary relations (2 \rightarrow 1).
**Everyone** in object position (accusative):

(18) For all binary relations \( R \),
   a. \( \text{[everyone}_{\text{acc}}]_M(R) = \{ x : D_M \subseteq \{ y : R(x, y) \} \} \)

(19) \( \text{[saw everyone]}_M = \{ x : D_M \subseteq \{ y : \text{SEE}(x, y) \} \} \)
   a. \( \text{[saw everyone]}_M \) is the set of individuals that saw everyone.

\[
\text{[Someone saw everyone]}_M = \text{True iff } D_M \cap \{ x : D_M \subseteq \{ y : \text{SEE}(x, y) \} \}
\]

\[
\text{[see]}_M = \{ (x, y) : \text{SEE}(x, y) \} \quad \forall R, \text{[everyone}_{\text{acc}}]_M(R) = \{ x : D_M \subseteq \{ y : R(x, y) \} \}
\]

No need to quantifier raise!

**Observation:**

- Nominative **everyone** (subject position) and accusative **everyone** (object position) do not have two different meanings.

(20) \( \text{[saw everyone]}_M = \{ x : \text{[everyone}_{\text{nom}}]_M(\{ y : \text{SEE}(x, y) \}) = \text{True} \} \)

- Accusative **everyone** \((2 \rightarrow 1)\) is a straightforward generalization to binary predicates of nominative **everyone** \((1 \rightarrow 0)\).

(21) **The Rich DP Hypothesis** (Keenan (1987) and subseq. work (also van Benthem)):
    Quantified NPs denote arity reducing generalized quantifiers \((n + 1 \rightarrow n)\).

The formal generalization of unary GQs is a little intense...\(^1\)

**Important points to take away:**

- We can assign a single denotation to quantified noun phrases regardless of which syntactic position they appear in!
- Immediately extends of quantified noun phrases as oblique arguments.

(22) John gave some book to everyone.

**Good things about this analysis:**

- No need to QR to interpret quantified noun phrases in object position (or in any other syntactic position).

\(^1\) Where \( F^1 \) is a generalized unary quantifier (over \( D_M \)), we extend the domain of \( F \) to include all \( n + 1 \) ary relations \( R \) by setting \( F^{n+1}(R) = \{ \langle a_1, \ldots, a_n \rangle : F^1(\{ b : \langle a_1, \ldots, a_n, b \rangle \in R \} = 1) \} \)
• No hidden movements!

Not so good things about this analysis:
• This analysis only derives the object narrow scope reading.
  – We still need some other mechanism (such as QR) to create scope ambiguities.
• Small technical point: Functions such as those defined by (i) are not definable in the popular system of Heim & Kratzer.

5 Scopeless Quantifier Phrases

(23) Contrast between everyone and John

But we proposed analyzing John as quantifier denoting!
• Presumably, John can undergo quantifier raising.

(24) One possible LF for Everyone likes John.

(25) Another LF for Everyone likes John.
Question: Why no scope interactions?

Answer: Scope ambiguities depend on more than syntax!

Montague (1974); Zimmerman (1993): Certain quantifiers are ‘scopeless’.

- By virtue of their semantics, they cannot create non-trivial scopal relations with other ‘real’ quantified noun phrases.
- Montagovian individuals are just such quantifiers.

\[
\text{True iff } \text{John } \in \{x : \text{everyone likes } x\} \iff \text{everyone likes John}
\]

\[
\[\text{John}\]_M = \lambda Q(\text{John } \in Q)
\]

\[
\lambda x(\text{Everyone likes } x)
\]

\[
\text{i}
\]

\[
\text{True iff everyone likes } g(t_i)
\]

\[
[\text{Everyone}]_M = \lambda P(D_M \subseteq P)
\]

\[
\lambda y(y \text{ likes } g(t_i))
\]

\[
\text{i}
\]

\[
\text{True iff } \text{everyone likes } g(t_i)
\]

\[
[\text{likes}]_M = \lambda x \lambda y(y \text{ likes } x)
\]

\[
[t_i]_M = g(t_i)
\]

To do: Scopeless ‘wide scope’ reading.

References


