Problem Set #6

PROBLEM SET #6

Read the two page handout giving an overview of the system

Using the sample calculations as a model, calculate the truth-conditions (starting with an arbitrary filler a and an arbitrary world w) for the following sentence:

> *Hannibal is a dog who t saw Shelby*.

For each step of your calculation, give an annotation of what justifies the step (lexicon entry, the FA, PA, PM principles, the definition of the λ-notation).

Handout

24.903 Our System So Far

[Based on material from Heim & Kratzer 1998]

1. The Lambda Notation for Functions

(1) Read "[λ α . β]" as either (i) or (ii), whichever makes sense.
   (i) "the function which maps every α to β"
   (ii) "the function which maps every α to 1, if β, and to 0 otherwise"

2. Lexicon

Some words:

(2) For any world w and (filler) individual a,
   a. $[\![\text{Shelby}]\!]^{w,a}$ = Shelby.
   b. $[\![\text{Hannibal}]\!]^{w,a}$ = Hannibal.
   c. $[\![\text{barks}]\!]^{w,a} = \lambda x.x$ barks in w.
   d. $[\![\text{dog}]\!]^{w,a} = \lambda x.x$ is a dog in w.
   e. $[\![\text{smart}]\!]^{w,a} = \lambda x.x$ is smart in w.
   f. $[\![\text{saw}]\!]^{w,a} = \lambda x.\ \lambda y.\ y$ saw x in w.

The special rule for traces:

(3) For any world w and (filler) individual a,
   $[\![t]\!]^{w,a} = a$.

3. Functional Application

(4) Functional Application (FA)
   For any world w and (filler) individual a, if α is a branching node, $\{\beta, \gamma\}$ the set of α's daughters, and $[\![\beta]\!]^{w,a}$ is a function whose domain contains $[\![\gamma]\!]^{w,a}$, then $[\![\alpha]\!]^{w,a} = [\![\beta]\!]^{w,a}([\![\gamma]\!]^{w,a})$.

4. Predicate Abstraction

(5) Predicate Abstraction (PA)
   For any world w and (filler) individual a, if α is a branching node whose daughters are a relative pronoun and β, then $[\![\alpha]\!]^{w,a} = \lambda x.\ [\![\beta]\!]^{w,x}$.

5. Predicate Modification

(6) Predicate Modification (PM)

For any world w and (filler) individual a, if α is a branching node, $\{\beta, \gamma\}$ the set of α's daughters, and if $[\![\beta]\!]^{w,a}$ and $[\![\gamma]\!]^{w,a}$ are both functions from individuals to truth-values (one-place predicates), then $[\![\alpha]\!]^{w,a} = \lambda x.\ [\![\beta]\!]^{w,a}(x) = [\![\gamma]\!]^{w,a}(x) = 1$.

6. Two Sample Calculations

Pick an arbitrary filler, say a and an arbitrary world w.

(7) $[\![\text{Hannibal is a smart dog}]\!]^{w,a}$
= $[\![\text{Hannibal (smart dog)}]\!]^{w,a}$
= $[\![\text{smart dog}]\!]^{w,a}([\![\text{Hannibal}]\!]^{w,a})$
= $[\![\text{smart dog}]\!]^{w,a}$ (Hannibal)
= $[\lambda x.\ [\![\text{smart}]\!]^{w,a}(x) = [\![\text{dog}]\!]^{w,a}(x) = 1]$ (Hannibal)
= 1 iff $[\![\text{smart}]\!]^{w,a}$ (Hannibal) = $[\![\text{dog}]\!]^{w,a}$ (Hannibal) = 1
iff [$\lambda x.x$ is smart in w] (Hannibal) = [$\lambda x.x$ is a dog in w] (Hannibal) = 1
iff Hannibal is smart in w and Hannibal is a dog in w.

(8) $[\![\text{Hannibal is who Shelby saw t}]\!]^{w,a}$
= $[\![\text{who Shelby saw t}]\!]^{w,a}([\![\text{Hannibal}]\!]^{w,a})$
= $[\![\text{who Shelby saw t}]\!]^{w,a}$ (Hannibal)
= $\lambda x.[\![\text{Shelby saw t}]\!]^{w,x}$ (Hannibal)
= $[\![\text{Shelby saw t}]\!]^{w,\text{Hannibal}}$
= $[[\![\text{saw}]\!]^{w,\text{Hannibal}}([\![\text{t}]\!]^{w,\text{Hannibal}})]([\![\text{Shelby}]\!]^{w,\text{Hannibal}})$
= $[[\![\text{saw}]\!]^{w,\text{Hannibal}}$ (Hannibal)] (Shelby)
= [($\lambda x.\ \lambda y.\ y$ saw x in w) (Hannibal)] (Shelby)
= [$\lambda y.\ y$ saw Hannibal in w] (Shelby)
= 1 iff Shelby saw Hannibal in w.

7. Problem Set #6

Using the sample calculations as a model, calculate the truth-conditions (starting with an arbitrary filler a and an arbitrary world w) for the following sentence:

Hannibal is a dog who t saw Shelby.

For each step of your calculation, give an annotation of what justifies the step (lexicon entry, the FA, PA, PM principles, the definition of the λ-notation).