Q02: Existential Quantification

Ling 331 / 731
Spring 2016

1 Truth-conditions

Existential quantifiers say "there is a thing with the NP property that also has the VP property." Those are pretty much the truth conditions.

(1) A [dog]$_{NP}$ [is barking outside]$_{VP}$
  a. There is an individual x, such that
  b. x is a dog, and
  c. x is barking outside

(2) A [red hen]$_{NP}$ [clucked all night]$_{VP}$
  a. There is an individual x, such that
  b. x is a red hen, and
  c. x clucked all night

(3) A [helpful lighthouse]$_{NP}$ [sits at the edge of the harbor]$_{VP}$
  a. There is an individual x, such that
  b. x is a helpful lighthouse, and
  c. x sits at the edge of the harbor

Existential quantifiers in English include *a some* (singular or plural), and the negative-polarity *any*.

(4) *A dog is barking outside*

(5) *Some dog is barking outside*

(6) *Some dogs are barking outside*

(7) *Some of the dogs are barking outside*

(8) *I don't think any dogs are barking outside*

2 Existential constructions

Existential quantifiers are often used in so-called **existential** constructions, which many languages have. In English, we have *there be*.

(9) There is a dog barking outside = A dog is barking outside

(10) There are some kids on my porch = Some kids are on my porch

(11) I don't think there were any dogs barking outside = I don't think any dogs were barking outside

Special particles:
French : *il y a*
Russian: *jest*
Turkish: *var*
Spanish: *hay*
Hebrew: *yesh*

Locative constructions

(12) Je, ku-na maswali?
Q $_{\text{CL}}$17-poss.be 6.question
Are there any questions? (Swahili)

(13) ŋa-sə tə-rupiya li-zya
I-with one-rupee be-continuative
'I have one rupee' (Kham)

One question: What do these existential 'constructions' add if the quantifier already gives us the meaning? See Francez 2010 for one recent examination.

In any case, we will focus for now on the simple subject existential like in (1).

3 Formalizing the meaning

We saw the truth-conditions above. How do we formalize that?

We saw in the lecturelet that the type of the meaning of the DP *a dog* works if it is $\langle\langle e,t\rangle,t\rangle$. It cannot be of type e, of course. Since $[\![\, dog \,]\!]$ is also of type $\langle e,t\rangle$, we can deduce that *a* must be of type $\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle$.

$$t$$
$$\langle\langle e,t\rangle,t\rangle \qquad \langle e,t\rangle$$
$$\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle \qquad \langle e,t\rangle$$

Some of that type takes a function (of type $\langle e,t\rangle$), and then another function of the same type. It returns 1 if the truth conditions are met, 0 otherwise. The truth conditions involve something having two properties. As it happens, the functions I just mentioned denote properties. So let's make those functions the ones that give us the properties in the truth conditions.

(14) $[\![\, a \,]\!] = \text{h} : \text{D}_{\langle \text{e, t}\rangle} \rightarrow \text{D}_{\langle\langle \text{e, t}\rangle, \text{t}\rangle}$
for all $\text{f} \in \text{D}_{\langle \text{e, t}\rangle}$,
$\text{h(f)} = \text{k} : \text{D}_{\langle \text{e, t}\rangle} \rightarrow \text{D}_t$
for all $\text{g} \in \text{D}_{\langle \text{e, t}\rangle}$, k(g) = 1 if and only if there is an
$\text{x} \in \text{D}_\text{e}$ such that f(x) = 1 and g(x) = 1

(15) $[\![\, a \,]\!] = \lambda \text{f} \in \text{D}_{\langle \text{e, t}\rangle} . \lambda \text{g} \in \text{D}_{\langle \text{e, t}\rangle}$. there is an individual x such that f(x) = 1 and g(x) = 1

4 The symbol ∃

We use the operator ∃ to signal "there is a(n)".

(16) ∃x is read "There is an x."

(17) The expression that ∃x operates over (its scope) is put in brackets. When reading we lead it in with "such that"

a. ∃x[P(x)] : There is an x such that P of x
b. ∃y[dog(y) = 1] : There is a y such that dog of y equals 1 = There is a y such that y is a dog = There is a dog
c. ∃R[R(x)(y) = 1] : There is an R such that R x y equals 1

d. $\exists$z[P(z) = 1& Q(z) = 0] : There is a z such that P of z equals 1 and Q of z equals 0

Sometimes you can even nest them together.

(18) $\exists$x$\exists$y[x likes y] : There is an x and a y such that x likes y

(19) $\exists$R$\exists$x [R(x)(Bill) = 1] : There is an R and an x such that R x of Bill equals 1

Strictly speaking, it's:

(20) $\exists$x[$\exists$y[x likes y]] : There is an x and a y such that x likes y

(21) $\exists$R[$\exists$x [R(x)(Bill) = 1]] : There is an R and an x such that R x of Bill equals 1

5 Finishing up

5.1 A proper denotation

Given our denotation and the symbol, we can rewrite things.

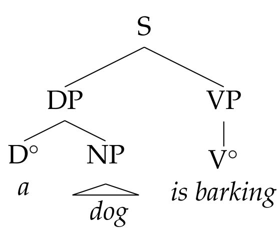
(22) $[\![a]\!]$ = h : $D_{\langle e,t\rangle} \rightarrow D_{\langle\langle e,t\rangle, t\rangle}$
for all f $\in D_{\langle e,t\rangle}$,
h(f) = k : $D_{\langle e,t\rangle} \rightarrow D_t$
for all g $\in D_{\langle e,t\rangle}$,
k(g) = 1 iff $\exists$x $\in D_e$[f(x) = 1 & g(x) = 1]

(23) $[\![a]\!] = \lambda f \in D_{\langle e,\, t\rangle} . \lambda g \in D_{\langle e,\, t\rangle} . \exists x \in D_e[\, f(x) = 1 \,\&\, g(x) = 1 \,]$

5.2 Composition

The composition proceeds normally. We plug in $[\![$ *dog* $]\!]$ to $[\![$ *a* $]\!]$, the way we'd plug it into *the*.

(24) $[\![$ *A dog is barking* $]\!]$



FA : $\langle\langle e,t\rangle,t\rangle$
$\lambda g \in D_{\langle e,t\rangle}.\ \exists x \in D_e[\ dog(x) = 1\ \&\ g(x) = 1\ ]$
$\lambda g \in D_{\langle e,t\rangle}.\ \exists x \in D_e[\ [\lambda x \in D_e.\ dog(x)](x) = 1\ \&\ g(x) = 1\ ]$
$[\lambda f \in D_{\langle e,t\rangle}.\lambda g \in D_{\langle e,t\rangle}.\ \exists x \in D_e[\ f(x) = 1\ \&\ g(x) = 1\ ]\ ](\lambda x \in D_e.\ dog(x))$

NN : $\langle e,t\rangle$
$\lambda x \in D_e.\ bark(x)$

LT : $\langle e,t\rangle$
$\lambda x \in D_e.\ bark(x)$

LT : $\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle$
$\lambda f \in D_{\langle e,t\rangle}.\lambda g \in D_{\langle e,t\rangle}.\ \exists x \in D_e[\ f(x) = 1\ \&\ g(x) = 1\ ]$

NN : $\langle e,t\rangle$
$\lambda x \in D_e.\ dog(x)$

Then, we do the same process again. This gives us the sentence that we wanted.

FA : t
$\exists x \in D_e[\ dog(x) = 1\ \&\ bark(x) = 1\ ]$
$\exists x \in D_e[\ dog(x) = 1\ \&\ [\lambda x \in D_e.\ bark(x)](x) = 1\ ]$
$[\lambda g \in D_{\langle e,t\rangle}.\ \exists x \in D_e[\ dog(x) = 1\ \&\ g(x) = 1\ ](\lambda x \in D_e.\ bark(x))$

FA : $\langle\langle e,t\rangle,t\rangle$
$\lambda g \in D_{\langle e,t\rangle}.\ \exists x \in D_e[\ dog(x) = 1\ \&\ g(x) = 1\ ]$

NN : $\langle e,t\rangle$
$\lambda x \in D_e.\ bark(x)$

LT : $\langle e,t\rangle$
$\lambda x \in D_e.\ bark(x)$

LT : $\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle$
$\lambda f \in D_{\langle e,t\rangle}.\lambda g \in D_{\langle e,t\rangle}.\ \exists x \in D_e[\ f(x) = 1\ \&\ g(x) = 1\ ]$

NN : $\langle e,t\rangle$
$\lambda x \in D_e.\ dog(x)$

6 Hypothesis

Now, we'll want to check if this meaning for *a* solves the problems we saw in the lecturelet.

$\exists x \in D_e[\ dog(x) = 1\ \&\ bark(x) = 1\ ]$

> Arvo is barking
> Arvo is outside
> $\Rightarrow$ Arvo is barking outside

> $\exists x \in D_e[\ dog(x) = 1\ \&\ bark(x) = 1\ ]$
> $\exists y \in D_e[\ dog(y) = 1\ \&\ outside(y) = 1\ ]$
> $\not\Rightarrow \exists x \in D_e[\ dog(x) = 1\ \&\ bark(x) = 1\ \&\ outside(x) = 1]$