$$
\begin{tikzcd}
 & \text{Denotational semantics} \\
\text{Object language} \arrow[ur] \arrow[dr] & \\
 & \text{Operational semantics}
\end{tikzcd}
$$

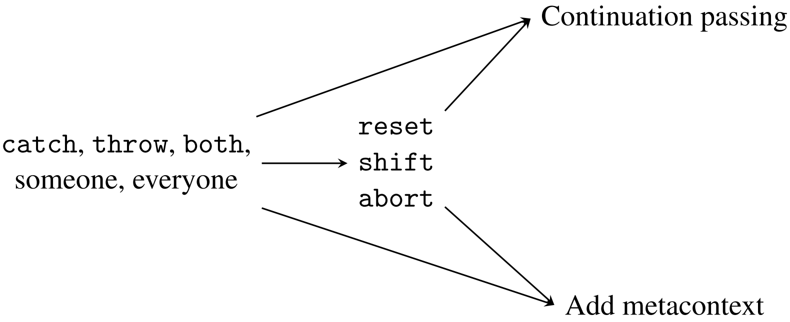
Cheating?

$$
\begin{tikzcd}
 & \text{State passing} \\
\texttt{save, load} \arrow[ur] \arrow[dr] & \\
 & \text{Add register}
\end{tikzcd}
$$

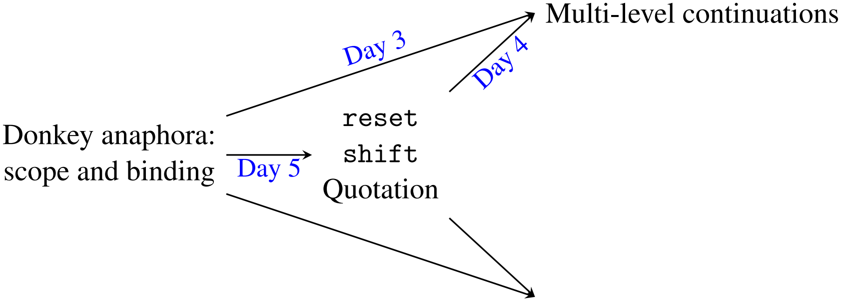
Cheating?

$$
\begin{tikzcd}
 & & \text{State passing} \\
\texttt{save}, \texttt{load} \arrow[r] \arrow[urr] \arrow[drr] & \texttt{set!} \arrow[ur] \arrow[dr] & \\
 & & \text{Add register}
\end{tikzcd}
$$

Cheating?


Continuation passing
catch, throw, both,
someone, everyone
reset
shift
abort
Add metacontext

The rest of this course



Donkey anaphora is in-scope binding

Chris Barker and Chung-chieh Shan

ESSLLI, 6 August 2008
Semantics and Pragmatics 1(1):1–42, 2008

Donkey anaphora

If a donkey eats, it sleeps.
Every farmer who owns a donkey beats it.

Donkey anaphora

If a donkey eats, it sleeps.
Every farmer who owns a donkey beats it.

A *donkey pronoun* is a pronoun that lies outside the antecedent of a conditional (or the restrictor of a quantifier) yet covaries with an indefinite (or some other quantifier) inside it.

Donkey anaphora

If a donkey eats, it sleeps.
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A *donkey pronoun* is a pronoun that lies outside the antecedent of a conditional (or the restrictor of a quantifier) yet covaries with an indefinite (or some other quantifier) inside it.

Donkey anaphora is in-scope binding

If a donkey eats, it sleeps.
Every farmer who owns a donkey beats it.

A *donkey pronoun* is a pronoun that lies outside the antecedent of a conditional (or the restrictor of a quantifier) yet covaries with an indefinite (or some other quantifier) inside it.

Our claim: the indefinite takes scope over and binds the donkey pronoun *as usual*.

Every boy loves his mother.

Why not?

Quantifier scope is clause-bound? But not indefinites.

A donkey eats. It sleeps.

Why not?

Quantifier scope is clause-bound? But not indefinites.

A donkey eats. It sleeps.

Binding requires c-command? Just evaluation order.

Every boy's mother loves him.

Why not?

Quantifier scope is clause-bound? But not indefinites.

A donkey eats. It sleeps.

Binding requires c-command? Just evaluation order.

Every boy's mother loves him.

How to get the right truth conditions?

$$\text{not} \quad \exists d.\, (\mathbf{donkey}\, d) \wedge \big((\mathbf{eats}\, d) \rightarrow (\mathbf{sleeps}\, d)\big)$$

Why not?

Quantifier scope is clause-bound? But not indefinites.

A donkey eats. It sleeps.

Binding requires c-command? Just evaluation order.

Every boy's mother loves him.

How to get the right truth conditions?

$$\begin{array}{ll} \text{not} & \exists d.\,(\mathbf{donkey}\,d) \wedge \big((\mathbf{eats}\,d) \to (\mathbf{sleeps}\,d)\big) \\ \text{but} & \neg\exists d.\,(\mathbf{donkey}\,d) \wedge (\mathbf{eats}\,d) \wedge \neg(\mathbf{sleeps}\,d) \end{array}$$

A donkey takes scope over the entire conditional but under *if*.

A donkey sleeps if it eats.

Our account

Compositional truth conditions: *if*, *every*, *most*, *usually*, strong/weak.

Key: multiple levels of continuations

Plan: Everyone loves someone. (surface scope)
Everyone loves his mother.
If a donkey eats, it sleeps.

Our account

Compositional truth conditions: *if*, *every*, *most*, *usually*, strong/weak.

Key: multiple levels of continuations

Plan: Everyone loves someone. (surface scope)
Everyone loves his mother.
If a donkey eats, it sleeps.

Everyone loves someone. (inverse scope)
If a farmer owns a donkey, he beats it.
Every farmer who owns a donkey beats it.
Most farmers who own a donkey beat it.

$$\begin{array}{ccc} A & \text{Lift} & B /\!\!/ (A \backslash\!\!\backslash B) \\ \textit{expression} & \Longrightarrow & \textit{expression} \\ x & & \lambda c.\, c(x) \end{array}$$

$$\begin{array}{ccc} A & \text{Lift} & B /\!\!/ (A \backslash\!\!\backslash B) \\ \textit{expression} & \Longrightarrow & \textit{expression} \\ x & & \lambda c.\, c(x) \end{array}$$

$$\begin{array}{ccccc} C /\!\!/ ((A/\boldsymbol{B}) \backslash\!\!\backslash \boldsymbol{D}) & \boldsymbol{D} /\!\!/ (\boldsymbol{B} \backslash\!\!\backslash E) & & C /\!\!/ (A \backslash\!\!\backslash E) \\ \textit{left} & \textit{right} & \Longrightarrow & \textit{left right} \\ L & R & & \lambda c.\, L(\lambda f.\, R(\lambda x.\, c(fx))) \end{array}$$

$$\begin{array}{ccc} A & \text{Lift} & B /\!\!/ (A \backslash\!\!\backslash B) \\ \textit{expression} & \Longrightarrow & \textit{expression} \\ x & & \lambda c.\, c(x) \end{array}$$

$$\begin{array}{cccc} C /\!\!/ ((A/\boldsymbol{B}) \backslash\!\!\backslash \boldsymbol{D}) & \boldsymbol{D} /\!\!/ (\boldsymbol{B} \backslash\!\!\backslash E) & & C /\!\!/ (A \backslash\!\!\backslash E) \\ \textit{left} & \textit{right} & \Longrightarrow & \textit{left right} \\ L & R & & \lambda c.\, L(\lambda f.\, R(\lambda x.\, c(fx))) \end{array}$$

$$\begin{array}{cccc} C /\!\!/ (\boldsymbol{B} \backslash\!\!\backslash \boldsymbol{D}) & \boldsymbol{D} /\!\!/ ((\boldsymbol{B} \backslash A) \backslash\!\!\backslash E) & & C /\!\!/ (A \backslash\!\!\backslash E) \\ \textit{left} & \textit{right} & \Longrightarrow & \textit{left right} \\ L & R & & \lambda c.\, L(\lambda x.\, R(\lambda f.\, c(fx))) \end{array}$$

$$
\begin{array}{ccc}
A & \text{Lift} & B /\!\!/ (A \backslash\!\!\backslash B) \\
\textit{expression} & \Longrightarrow & \textit{expression} \\
x & & \lambda c.\, c(x)
\end{array}
\qquad\qquad
\begin{array}{ccc}
A /\!\!/ (\mathrm{S} \backslash\!\!\backslash \mathrm{S}) & \text{Lower} & A \\
\textit{expression} & \Longrightarrow & \textit{expression} \\
F & & F(\lambda x.\, x)
\end{array}
$$

$$
\begin{array}{ccccc}
C /\!\!/ ((A/\boldsymbol{B}) \backslash\!\!\backslash \boldsymbol{D}) & \boldsymbol{D} /\!\!/ (\boldsymbol{B} \backslash\!\!\backslash E) & & C /\!\!/ (A \backslash\!\!\backslash E) \\
\textit{left} & \textit{right} & \Longrightarrow & \textit{left right} \\
L & R & & \lambda c.\, L(\lambda f.\, R(\lambda x.\, c(fx)))
\end{array}
$$

$$
\begin{array}{ccccc}
C /\!\!/ (\boldsymbol{B} \backslash\!\!\backslash \boldsymbol{D}) & \boldsymbol{D} /\!\!/ ((\boldsymbol{B} \backslash A) \backslash\!\!\backslash E) & & C /\!\!/ (A \backslash\!\!\backslash E) \\
\textit{left} & \textit{right} & \Longrightarrow & \textit{left right} \\
L & R & & \lambda c.\, L(\lambda x.\, R(\lambda f.\, c(fx)))
\end{array}
$$

Linear notation	Tower notation
$B \mathbin{/\!\!/} (A \mathbin{\backslash\!\!\backslash} C)$	$\dfrac{B \mid C}{A}$
$\mathrm{S} \mathbin{/\!\!/} (\mathrm{DP} \mathbin{\backslash\!\!\backslash} \mathrm{S})$	$\dfrac{\mathrm{S} \mid \mathrm{S}}{\mathrm{DP}}$

Linear notation	Tower notation
$B /\!\!/ (A \backslash\!\!\backslash C)$	$\dfrac{B \mid C}{A}$
$\mathrm{S} /\!\!/ (\mathrm{DP} \backslash\!\!\backslash \mathrm{S})$	$\dfrac{\mathrm{S} \mid \mathrm{S}}{\mathrm{DP}}$
$\lambda c. f[c(x)]$	$\dfrac{f[\;]}{x}$
$\lambda c.\, \neg\exists x.\, c(\textbf{mother}\, x)$	$\dfrac{\neg\exists x.\, [\;]}{\textbf{mother}\, x}$

$$
\begin{array}{ccc}
A & \text{Lift} & B \mathbin{/\!\!/} (A \mathbin{\backslash\!\!\backslash} B) \\
\textit{expression} & \Longrightarrow & \textit{expression} \\
x & & \lambda c.\, c(x)
\end{array}
\qquad
\begin{array}{ccc}
A \mathbin{/\!\!/} (\mathrm{S} \mathbin{\backslash\!\!\backslash} \mathrm{S}) & \text{Lower} & A \\
\textit{expression} & \Longrightarrow & \textit{expression} \\
F & & F(\lambda x.\, x)
\end{array}
$$

$$
\begin{array}{cccc}
C \mathbin{/\!\!/} ((A/\boldsymbol{B}) \mathbin{\backslash\!\!\backslash} \boldsymbol{D}) & \boldsymbol{D} \mathbin{/\!\!/} (\boldsymbol{B} \mathbin{\backslash\!\!\backslash} E) & & C \mathbin{/\!\!/} (A \mathbin{\backslash\!\!\backslash} E) \\
\textit{left} & \textit{right} & \Longrightarrow & \textit{left right} \\
L & R & & \lambda c.\, L(\lambda f.\, R(\lambda x.\, c(fx)))
\end{array}
$$

$$
\begin{array}{cccc}
C \mathbin{/\!\!/} (\boldsymbol{B} \mathbin{\backslash\!\!\backslash} \boldsymbol{D}) & \boldsymbol{D} \mathbin{/\!\!/} ((\boldsymbol{B} \backslash A) \mathbin{\backslash\!\!\backslash} E) & & C \mathbin{/\!\!/} (A \mathbin{\backslash\!\!\backslash} E) \\
\textit{left} & \textit{right} & \Longrightarrow & \textit{left right} \\
L & R & & \lambda c.\, L(\lambda x.\, R(\lambda f.\, c(fx)))
\end{array}
$$

$$
\begin{array}{c} A \\ \textit{expression} \\ x \end{array}
\overset{\text{Lift}}{\Longrightarrow}
\begin{array}{c} \dfrac{B \mid B}{A} \\ \textit{expression} \\ \dfrac{[\ ]}{x} \end{array}
\qquad\qquad
\begin{array}{c} \dfrac{A \mid \mathrm{S}}{\mathrm{S}} \\ \textit{expression} \\ \dfrac{f[\ ]}{x} \end{array}
\overset{\text{Lower}}{\Longrightarrow}
\begin{array}{c} A \\ \textit{expression} \\ f[x] \end{array}
$$

$$
\begin{array}{c} \dfrac{C \mid \boldsymbol{D}}{A/\boldsymbol{B}} \\ \textit{left} \\ \dfrac{g[\ ]}{f} \end{array}
\quad
\begin{array}{c} \dfrac{\boldsymbol{D} \mid E}{\boldsymbol{B}} \\ \textit{right} \\ \dfrac{h[\ ]}{x} \end{array}
\Longrightarrow
\begin{array}{c} \dfrac{C \mid E}{A} \\ \textit{left right} \\ \dfrac{g[h[\ ]]}{f(x)} \end{array}
$$

$$
\begin{array}{c} \dfrac{C \mid \boldsymbol{D}}{\boldsymbol{B}} \\ \textit{left} \\ \dfrac{g[\ ]}{x} \end{array}
\quad
\begin{array}{c} \dfrac{\boldsymbol{D} \mid E}{\boldsymbol{B}\backslash A} \\ \textit{right} \\ \dfrac{h[\ ]}{f} \end{array}
\Longrightarrow
\begin{array}{c} \dfrac{C \mid E}{A} \\ \textit{left right} \\ \dfrac{g[h[\ ]]}{f(x)} \end{array}
$$

$$\begin{array}{c} \\ A \\ \textit{expression} \\ x \\ \\ \end{array} \overset{\text{Lift}}{\Longrightarrow} \begin{array}{c} \dfrac{B \mid B}{A} \\ \textit{expression} \\ \dfrac{[\,]}{x} \end{array} \qquad\qquad \begin{array}{c} \dfrac{A \mid \mathrm{S}}{\mathrm{S}} \\ \textit{expression} \\ \dfrac{f[\,]}{x} \end{array} \overset{\text{Lower}}{\Longrightarrow} \begin{array}{c} \\ A \\ \textit{expression} \\ f[x] \\ \\ \end{array}$$

$$\begin{array}{c} \dfrac{C \mid \boldsymbol{D}}{A/\boldsymbol{B}} \\ \textit{left} \\ \dfrac{g[\,]}{f} \end{array} \quad \begin{array}{c} \dfrac{\boldsymbol{D} \mid E}{\boldsymbol{B}} \\ \textit{right} \\ \dfrac{h[\,]}{x} \end{array} \quad \Longrightarrow \quad \begin{array}{c} \dfrac{C \mid E}{A} \\ \textit{left right} \\ \dfrac{g[h[\,]]}{f(x)} \end{array}$$

$$\begin{array}{c} \dfrac{C \mid \boldsymbol{D}}{\boldsymbol{B}} \\ \textit{left} \\ \dfrac{g[\,]}{x} \end{array} \quad \begin{array}{c} \dfrac{\boldsymbol{D} \mid E}{\boldsymbol{B}\backslash A} \\ \textit{right} \\ \dfrac{h[\,]}{f} \end{array} \quad \Longrightarrow \quad \begin{array}{c} \dfrac{C \mid E}{A} \\ \textit{left right} \\ \dfrac{g[h[\,]]}{f(x)} \end{array} \qquad\qquad \begin{array}{c} \dfrac{\mathrm{DP} \rhd B \mid B}{\mathrm{DP}} \\ \textit{he} \\ \dfrac{\lambda y.\,[\,]}{y} \end{array}$$

$$\begin{array}{c} A \\ \textit{expression} \\ x \end{array} \quad \overset{\text{Lift}}{\Longrightarrow} \quad \begin{array}{c} B \mid B \\ \hline A \\ \textit{expression} \\ [\,] \\ \hline x \end{array} \qquad\qquad \begin{array}{c} A \mid \mathrm{S} \\ \hline \mathrm{S} \\ \textit{expression} \\ f[\,] \\ \hline x \end{array} \quad \overset{\text{Lower}}{\Longrightarrow} \quad \begin{array}{c} A \\ \textit{expression} \\ f[x] \end{array}$$

$$\begin{array}{c} C \mid \boldsymbol{D} \\ \hline A/\boldsymbol{B} \\ \textit{left} \\ g[\,] \\ \hline f \end{array} \quad \begin{array}{c} \boldsymbol{D} \mid E \\ \hline \boldsymbol{B} \\ \textit{right} \\ h[\,] \\ \hline x \end{array} \quad \Longrightarrow \quad \begin{array}{c} C \mid E \\ \hline A \\ \textit{left right} \\ g[h[\,]] \\ \hline f(x) \end{array} \qquad\qquad \begin{array}{c} A \mid B \\ \hline \mathrm{DP} \\ \textit{expression} \\ f[\,] \\ \hline x \end{array} \quad \overset{\text{Bind}}{\Longrightarrow} \quad \begin{array}{c} A \mid \mathrm{DP} \rhd B \\ \hline \mathrm{DP} \\ \textit{expression} \\ f([\,]x) \\ \hline x \end{array}$$

$$\begin{array}{c} C \mid \boldsymbol{D} \\ \hline \boldsymbol{B} \\ \textit{left} \\ g[\,] \\ \hline x \end{array} \quad \begin{array}{c} \boldsymbol{D} \mid E \\ \hline \boldsymbol{B}\backslash A \\ \textit{right} \\ h[\,] \\ \hline f \end{array} \quad \Longrightarrow \quad \begin{array}{c} C \mid E \\ \hline A \\ \textit{left right} \\ g[h[\,]] \\ \hline f(x) \end{array} \qquad\qquad \begin{array}{c} \mathrm{DP} \rhd B \mid B \\ \hline \mathrm{DP} \\ \textit{he} \\ \lambda y.\,[\,] \\ \hline y \end{array}$$

$$\begin{array}{c} A \\ \textit{expression} \\ x \end{array} \overset{\text{Lift}}{\Longrightarrow} \begin{array}{c} \dfrac{B \mid B}{A} \\ \textit{expression} \\ \dfrac{[\,]}{x} \end{array} \qquad \begin{array}{c} \dfrac{A \mid \mathrm{S}}{\mathrm{S}} \\ \textit{expression} \\ \dfrac{f[\,]}{x} \end{array} \overset{\text{Lower}}{\Longrightarrow} \begin{array}{c} A \\ \textit{expression} \\ f[x] \end{array}$$

$$\begin{array}{c} \dfrac{C \mid \boldsymbol{D}}{A/\boldsymbol{B}} \\ \textit{left} \\ \dfrac{g[\,]}{f} \end{array} \quad \begin{array}{c} \dfrac{\boldsymbol{D} \mid E}{\boldsymbol{B}} \\ \textit{right} \\ \dfrac{h[\,]}{x} \end{array} \Longrightarrow \begin{array}{c} \dfrac{C \mid E}{A} \\ \textit{left right} \\ \dfrac{g[h[\,]]}{f(x)} \end{array} \qquad \begin{array}{c} \dfrac{A \mid B}{\mathrm{DP}} \\ \textit{expression} \\ \dfrac{f[\,]}{x} \end{array} \overset{\text{Bind}}{\Longrightarrow} \begin{array}{c} \dfrac{A \mid \mathrm{DP} \rhd B}{\mathrm{DP}} \\ \textit{expression} \\ \dfrac{f([\,]x)}{x} \end{array}$$

$$\begin{array}{c} \dfrac{C \mid \boldsymbol{D}}{\boldsymbol{B}} \\ \textit{left} \\ \dfrac{g[\,]}{x} \end{array} \quad \begin{array}{c} \dfrac{\boldsymbol{D} \mid E}{\boldsymbol{B}\backslash A} \\ \textit{right} \\ \dfrac{h[\,]}{f} \end{array} \Longrightarrow \begin{array}{c} \dfrac{C \mid E}{A} \\ \textit{left right} \\ \dfrac{g[h[\,]]}{f(x)} \end{array} \qquad \begin{array}{c} \dfrac{\mathrm{DP} \rhd B \mid B}{\mathrm{DP}} \\ \textit{he} \\ \dfrac{\lambda y.\,[\,]}{y} \end{array} \qquad \begin{array}{c} \dfrac{\mathrm{S} \mid \mathrm{S}}{(\mathrm{S}/\mathrm{S})/\mathrm{S}} \\ \textit{if} \\ \dfrac{\neg[\,]}{\lambda p \lambda q.\, p \wedge \neg q} \end{array}$$

Every farmer who owns a donkey beats it

$$\dfrac{\mathrm{S} \,|\, \mathrm{S}}{\mathrm{N}}$$

farmer who owns a donkey

$$\dfrac{\exists y.\, (\mathbf{donkey}\; y) \wedge [\;]}{\lambda z.\, (\mathbf{farmer}\; z) \wedge (\mathbf{owns}\; y\; z)}$$

Every farmer who owns a donkey beats it

$$\frac{\mathrm{S} \mid \mathrm{DP} \rhd \mathrm{S}}{\mathrm{N}}$$

farmer who owns a donkey

$$\frac{\exists y.\, (\mathbf{donkey}\, y) \wedge ([\;]\, y)}{\lambda z.\, (\mathbf{farmer}\, z) \wedge (\mathbf{owns}\, y\, z)}$$

Every farmer who owns a donkey beats it

$$
\left(
\begin{array}{cc}
\dfrac{\mathrm{S} \,\big|\, \mathrm{S}}{\dfrac{\mathrm{S} \,|\, \mathrm{S}}{\mathrm{DP}} \Big/ \mathrm{N}}
&
\dfrac{\mathrm{S} \,|\, \mathrm{DP} \rhd \mathrm{S}}{\mathrm{N}}
\\
\textit{every} & \textit{farmer who owns a donkey}
\\
\dfrac{\neg\exists x.\, [\;]}{\lambda P.\, \dfrac{Px \wedge \neg[\;]}{x}}
&
\dfrac{\exists y.\, (\mathbf{donkey}\, y) \wedge ([\;]\, y)}{\lambda z.\, (\mathbf{farmer}\, z) \wedge (\mathbf{owns}\, y\, z)}
\end{array}
\right)
$$

Every farmer who owns a donkey beats it

$$\left(\begin{array}{cc}
\dfrac{\mathrm{S} \mid \mathrm{S}}{\dfrac{\mathrm{S} \mid \mathrm{S}}{\mathrm{DP}} \Big/ \mathrm{N}} & \dfrac{\mathrm{S} \mid \mathrm{DP} \triangleright \mathrm{S}}{\mathrm{N}} \\
\textit{every} & \textit{farmer who owns a donkey} \\
\dfrac{\neg\exists x.\,[\;]}{\lambda P.\, \dfrac{Px \wedge \neg[\;]}{x}} & \dfrac{\exists y.\,(\mathbf{donkey}\, y) \wedge ([\;]\, y)}{\lambda z.\,(\mathbf{farmer}\, z) \wedge (\mathbf{owns}\, y\, z)}
\end{array}\right)
\begin{array}{c}
\dfrac{\mathrm{DP} \triangleright \mathrm{S} \mid \mathrm{S}}{\dfrac{\mathrm{S} \mid \mathrm{S}}{\mathrm{DP}\backslash\mathrm{S}}} \\
\textit{beats it} \\
\dfrac{\lambda w.\,[\;]}{\dfrac{[\;]}{\mathbf{beats}\, w}}
\end{array}$$

Every farmer who owns a donkey beats it

$$\left(\begin{array}{cc} \dfrac{\mathrm{S} \mid \mathrm{S}}{\dfrac{\mathrm{S} \mid \mathrm{S}}{\mathrm{DP}} \Big/ \mathrm{N}} & \dfrac{\mathrm{S} \mid \mathrm{DP} \triangleright \mathrm{S}}{\mathrm{N}} \\ \textit{every} & \textit{farmer who owns a donkey} \\ \dfrac{\neg\exists x.\,[\,]}{\lambda P.\,\dfrac{Px \wedge \neg[\,]}{x}} & \dfrac{\exists y.\,(\mathbf{donkey}\,y) \wedge ([\,]\,y)}{\lambda z.\,(\mathbf{farmer}\,z) \wedge (\mathbf{owns}\,y\,z)} \end{array} \right) \begin{array}{c} \dfrac{\mathrm{DP} \triangleright \mathrm{S} \mid \mathrm{S}}{\dfrac{\mathrm{S} \mid \mathrm{S}}{\mathrm{DP}\backslash\mathrm{S}}} \\ \textit{beats it} \\ \dfrac{\lambda w.\,[\,]}{\dfrac{[\,]}{\mathbf{beats}\,w}} \end{array}$$

$$\neg\exists x \exists y.\,\mathbf{donkey}\,y \wedge ((\mathbf{farmer}\,x \wedge \mathbf{owns}\,y\,x) \wedge \neg(\mathbf{beats}\,y\,x))$$

Most farmers who own a donkey beat it

$$
\frac{\mathrm{S} \mid \mathrm{S}}{\dfrac{\mathrm{S} \mid \mathrm{S}}{\mathrm{DP}} \Big/ \mathrm{N}}
$$

$$
\textit{most}
$$

$$
\frac{\textsc{most}(\lambda x \lambda p.\,[\,])}{\lambda P.\, \dfrac{Px \wedge (p \vee [\,])}{x}}
$$

$$
\textsc{most}(F) \quad = \quad \left(\frac{\#\{\, x \mid F(x)(\textsc{false})\,\}}{\#\{\, x \mid F(x)(\textsc{true})\,\}} \;>\; \frac{1}{2} \right)
$$

Most farmers who own a donkey beat it (weak)

$$\dfrac{\dfrac{\mathrm{S} \mid \mathrm{S}}{\dfrac{\mathrm{S}\,|\,\mathrm{S}}{\mathrm{DP}} \Big/ \mathrm{N}}}{\dfrac{\textit{most}}{\dfrac{\textsc{most}(\lambda x \lambda p.\,[\,])}{\lambda P.\, \dfrac{Px \wedge (p \vee [\,])}{x}}}}$$

$$\textsc{most}(F) \quad = \quad \left(\frac{\#\{\, x \mid F(x)(\textsc{false})\,\}}{\#\{\, x \mid F(x)(\textsc{true})\,\}} \;>\; \frac{1}{2} \right)$$

Most farmers who own a donkey beat it (strong)

$$\frac{\mathrm{S} \mid \mathrm{S}}{\dfrac{\mathrm{S}\mid\mathrm{S}}{\mathrm{DP}} \Big/ \mathrm{N}}$$

$$\mathit{most}$$

$$\frac{\textsc{most}(\lambda x \lambda p.\,[\,])}{\lambda P.\,\dfrac{Px \wedge (p \vee \neg[\,])}{x}}$$

$$\textsc{most}(F) \quad = \quad \left(\frac{\#\{\,x \mid F(x)(\textsc{false})\,\}}{\#\{\,x \mid F(x)(\textsc{true})\,\}} < \frac{1}{2} \right)$$