Individual Variables and Assignment Functions in PredL

Additions/Modifications to our logical language PredL

I. A new kind of expression for our PredL vocabulary:

individual constants: a, b, c, d, ... (old; correspond to prop. names)
individual variables: $x_1, x_2, x_3, x_4, \ldots$ (new; correspond to pronouns)

Together, the individual constants of PredL and the individual variables of PredL constitute the **terms** of PredL.

II. A slight modification to our PredL syntax rule for constructing simple predicate/argument formulas:

If P is an *n*-place predicate constant, and $t_1, t_2, \ldots, t_n$ are *n* terms, then $P(t_1, t_2, \ldots, t_n)$ is a formula of PredL.

III. A new piece of technology for our PredL semantics, namely:

an **assignment function** *g*, which assigns a denotation (= an inhabitant of our model *M*) to each individual variable.

We also give ourselves a handy means of referring to the **denotation of a term t** relative to a model *M* and an assignment function *g*:

$$[\![t]\!]^{M,g} = Val(t) \text{ if t is an individual constant}$$
$$= g(t) \text{ if t is an individual variable}$$

IV. A slight modification to the rules of our PredL semantics which show how the truth conditions of a PredL formula depend upon the denotations of the vocabulary items that appear within it:

(i) If P is a one-place predicate constant and t is term, then P(t) is true relative to a model *M* and an assignment function *g* if $[\![t]\!]^{M,g} \in Val(P)$.
Otherwise, P(t) is false relative to *M* and *g*.

(ii) If P is a two-place predicate constant and t_1, t_2 are terms, then $P(t_1, t_2)$ is true relative to *M* and *g* if $<[\![t_1]\!]^{M,g}, [\![t_2]\!]^{M,g}> \in Val(P)$.
Otherwise, $P(t_1, t_2)$ is false relative to *M* and *g*.

(and similarly for our rule concerning three-place predicate constants…)

Some practice calculating the truth values of PredL formulas

M: D = { Dexter, Rita, Debra, Charlie, Maria, Fido }

Val(m) = Maria *Val*(f) = Fido *Val*(d) = Dexter

Val(MAN) = { Dexter, Charlie } *Val*(WOMAN) = { Rita, Debra, Maria }

Val(DOG) = { Fido } *Val*(GREEK) = { Rita, Maria }

Val(BITE) = { <Fido, Dexter> , <Fido, Charlie> }

$$g_1: \begin{pmatrix} x_1 \mapsto \text{Rita} \\ x_2 \mapsto \text{Debra} \\ x_3 \mapsto \text{Dexter} \\ x_4 \mapsto \text{Maria} \\ \ldots \end{pmatrix} \qquad g_2: \begin{pmatrix} x_1 \mapsto \text{Maria} \\ x_2 \mapsto \text{Debra} \\ x_3 \mapsto \text{Charlie} \\ x_4 \mapsto \text{Debra} \\ \ldots \end{pmatrix}$$

Is GREEK(x_4) true relative to M and g_1? Is it true relative to M and g_2?

Is GREEK(m) true relative to M and g_1? Is it true relative to M and g_2?

Is BITE(f, x_3) true relative to M and g_1? Is it true relative to M and g_2?

Is BITE(f, d) true relative to M and g_1? Is it true relative to M and g_2?