Exercises due on: Monday 17 May, 23:59

Semantic Theory 2021: Exercise sheet 3

Exercise 1

1.1 Translate the following English words into lambda expressions:

a. $\text{blond}_{\langle\langle e,t\rangle,\langle e,t\rangle\rangle}$ (As in the sentence: "Luke is a <u>blond</u> Jedi"; use $\text{blond}^*_{\langle e,t\rangle}$ as the underlying first-order predicate)

b. $\text{on}_{\langle e,\langle\langle e,t\rangle,\langle e,t\rangle\rangle\rangle}$ (As in the sentence: "Padmé lives <u>on</u> Naboo")

c. $\text{only}_{\langle e,\langle\langle e,t\rangle,t\rangle\rangle}$ (As in the sentence: "<u>Only</u> Luke defeated Darth Vader")

1.2 Translate the following sentences into expressions of Typed Lambda Calculus, assuming the syntactic structure indicated by the brackets. Use function application and lambda conversions to arrive at the simplest possible expressions.

a. Padmé lives [on Naboo].

b. [Luke [and Darth Vader]] fight.

c. [Only Luke] [is a [blond Jedi]].

Use the translations for *blond*, *on*, and *only* from exercise 1.1. If you didn't find a good interpretation, you can simply use: blond', on', only'. In addition, use the following lexical entries:

- Padmé_e, Naboo_e, Luke_e, $\text{Darth Vader}_e \mapsto$ p', n', l', d'
- $\text{live}_{\langle e,t\rangle}$, $\text{Jedi}_{\langle e,t\rangle}$, $\text{fight}_{\langle e,t\rangle} \mapsto$ live', jedi', fight'
- $\text{and}_{\langle e,\langle e,\langle\langle e,t\rangle,t\rangle\rangle\rangle} \mapsto \lambda x.\lambda y.\lambda P(P(x) \wedge P(y))$
- $\text{is-a}_{\langle\langle e,t\rangle,\langle e,t\rangle\rangle} \mapsto \lambda F.F$

Exercises due on: Tuesday May 25, 23:59

Semantic Theory 2021: Exercise sheet 4

Exercise 1

Sentence (1) is syntactically ambiguous between the two readings indicated in (1a) and (1b), due to the notorious "modifier attachment ambiguity". The syntactic ambiguity induces a semantic ambiguity.

(1) President Trump called a senator in Washington DC.

   a. [S [S [S President Trump [VP call- [NP a senator]]] [PP in Washington DC]] PAST]

   b. [S [S President Trump [VP call- [NP a [N' senator [PP in Washington DC]]]]] PAST]

a. Represent the two readings as predicate-logic formulas, using an event-semantic analysis of the verb "call" (type: $\langle e, \langle e, \langle e, t\rangle\rangle\rangle$). In addition, give informal paraphrases of the two readings.

b. Provide the logical form for both (1a) and (1b), and derive the semantic representation for one of these readings compositionally using beta-reduction. Assume the following lexical semantics for the syntactic units:

   - President Trump $\mapsto t' :: e$
   - Washington DC $\mapsto w' :: e$
   - call- $\mapsto \lambda Q \lambda x \lambda e.Q(\lambda y.\text{call*}(y)(x)(e)) :: \langle\langle\langle e, t\rangle, t\rangle, \langle e, \langle e, t\rangle\rangle\rangle$
   - senator $\mapsto s' :: \langle e, t\rangle$
   - in $\mapsto \lambda z \lambda F \lambda v.\text{in'}(z)(v) \wedge F(v) :: \langle e, \langle\langle e, t\rangle, \langle e, t\rangle\rangle\rangle$
   - PAST $\mapsto \lambda E.\exists e(E(e) \wedge e < e_u) :: \langle\langle e, t\rangle, t\rangle$

Note that the lambda expression for "call" reflects the type-raised version that takes a generalized quantifier expression (type: $\langle\langle e, t\rangle, t\rangle$) as its first argument. For simplicity, we assume that the subject (second argument) of "call" and the internal argument of the preposition "in" are type e expressions (denoting standard objects). The indefinite article is translated as usual (see slides week 3). The lambda variables F and v in the translation of the preposition are of the general kind, ranging over standard predicates/entities as well as event predicates/entities.

Exercise 2

As we have seen, we can extend models containing event structure with the notion of time. This can be done by extending the model structures with an asymmetrical relation over events (representing temporal precedence), and incorporating a constant representing the utterance event; the resulting model structure is shown below:

$M = \langle U, E, <, e_u, V \rangle$, with:

- $U \cap E = \emptyset$
- $< \subseteq E \times E$ is an asymmetric relation (temporal precedence)
- $e_u \in E$ is the utterance event
- V is an interpretation function like in standard FOL

One of the limitations of this model is that it does not formally capture the duration of events, which means that it cannot formalize the temporal event structure represented in the following sentence:

(2) Although Mary started running shortly after John, she ran twice as long.

Try to come up with a model structure that can formalize the temporal structure of sentence (2). Provide the formal details of the model, as well as the formula representing the meaning of sentence (2). Describe in one or two sentences the implications of your solution on the level of representation (logical syntax) and interpretation (model structure). What are the advantages/disadvantages/limitations of your model?