Semantic Theory 2014 – Exercise sheet 1

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Exercises are due on Tuesday, April 29

1. Translation to Predicate Logic

Translate the following NL sentences to FOL formulas. Use the non-logical expressions as indicated in the respective parantheses. Ignore tense and tempral adverbials.

a. *Barking dogs don't bite* (bark, dog, bite)
b. *If somebody is noisy, everybody is annoyed.* (noisy, annoyed)
c. *Bill helps everyone who doesn't help himself.* (b*, help)
d. *Only John passed the exam.* (j*, pass, the-exam)
e. *If John owns a dog, he has never shown it to anyone*. (j*, own, dog, show)
f. *People who live in Saarbrücken or close by don't own a car.* (person, live-in, sb*, close-to, own, car)
g. *Homburg is closer to Saarbrücken than any other city.* (h*, sb*, city, closer-to)
h. *Homburg is closer to Saarbrücken than Munich to Berlin.* (h*, sb*, m*, b*, closer-to)
i. *Any person has two parents.* (person, parent)
j. *People who love everybody but themselves are altruists.* (person, love, altruist)
k. *Altruists love each other.* (altruist, love)

2. Truth-conditional interpretation and entailment

(1) Show for the following instance of "quantifier movement" that the two expressions are equivalent:

a. $\exists xFx \rightarrow Fa \Leftrightarrow \forall x(Fx \rightarrow Fa)$

Since both expressions are close formulas, it is sufficient to show that left-hand side and right-hand side entail each other. First, compute the truth conditions of both expressions first, and then provide an explicit argument using the results of your computation.

(2) As shown on the slides, we can show the logical equivalence in b. through a series of equivalence transformations:

b. $\neg\exists x\forall y(Py \rightarrow Rxy) \Leftrightarrow \forall x\exists y(Py \wedge \neg Rxy)$

c. $\forall x\exists y(Py \wedge \neg Rxy) \Leftrightarrow \exists y\forall x (Py \wedge \neg Rxy)$

The formulas in c. are not equivalent: There is no left-to-right entailment. Show this by computing the truth conditions of both formulas in c. , and give an argument based on the truth conditions.

3. Logical equivalence

Slide 12 shows three different versions to express "sameness of truth conditions" between logical formulas A and B: mutual entailment between A and B, logical equivalence $A \Leftrightarrow B$, and logical validity of formula $A \leftrightarrow B$. The three versions are equivalent only for closed formulas. Consider the general case, where the formulas may contain free variables. Choose a simple example (e.g., the pair of formulas "Fx" and "Fy"), and compare the conditions imposed on them by the three variants of the equivalence statement. State in short, which of the variants are equivalent in the general case (if any), and what makes the difference in the other cases.