Some Hints for Translating into Predicate Logic: I

(Phil 210, Pelletier)

You should read *very carefully* Sections 7.4, 7.6, and 7.7 of *The Logic Book*, which contain a discussion of some of the ins and outs of translation. In this handout I will just mention some of the more common issues concerning translations and also a few complexities not touched on in the book.

First you should be aware that (∃x)Fx means that at least one thing has property F. It *allows* for more than one, and indeed allows that *everything* has property F. Therefore, if we want to translate sentences like *At least two things have property F*, or *Almost all things have property F*, or *Most/ Many things have property F*, we cannot do it completely. The best we can say is (∃x)Fx. [If we had identity–a topic treated in later parts of chapter 7 that we won't cover–we could translate the phrase "at least two").

Second, the phrase (∀x)Fx means that everything has property F. (Actually, "everything in the Universe of Discourse [UD]"). When you translate with (∀x), you really mean *everything* (in your UD). If the UD contains both dogs and cats, and you want to talk about all the dogs, then you cannot simply use (∀x) – you will have somehow to "restrict" your statement somehow (see below, about translating "A-statements").

Third, using different quantifier phrases to translate (e.g., (∃x) and (∃y)): the mere fact of using different variables does not *guarantee* that the relevant entities will be different…it merely *allows* them to be different. (We cannot guarantee this until we have (non-)identity.) Using the same variable in the scope of different quantifier phrases, does not guarantee sameness; using the same variable in the scope of the same quantifier phrase, does guarantee sameness. Let me say that again: Unless we have (non-)identity, then: (i) using different variables does not guarantee talking about different objects, (ii) using same variables with different quantifier phrases does not guarantee talking about the same object, (iii) using same variables with same quantifier phrase does guarantee talking about the same object. Thus: neither (∃x)(∃y)(Fx&Fy) nor ((∃x)Fx&(∃y)Fy) guarantee that there is more than one F. And neither (∃x)(∃y)(Fx&Gy) nor ((∃x)Fx&(∃y)Gy) guarantees that the F-thing and the G-thing are different. However, (∃x)(Fx&Gx) does guarantee that the same thing is both F and G.

Fourth. A major problem is to decide what is an "interesting" breakdown of predicates. It is pretty clear and obvious that "Fx: x loves Sally and hates Mary" is not interesting. At the very least it should be broken into "Fx: x loves Sally" and "Gx: x hates Mary". And probably it would be even more interesting if it were broken down further: "Fxy: x loves y", "Gxy: x hates y", "s: Sally", "m: Mary". But it is often difficult to tell when to stop with the breakdown. One hint is this: the lower case letters are *names*: this means that you should use them only for things that can be named. Thus, *kissed Mary passionately* should **not** be broken down into three parts like this: "Fxyz: x kissed y z-ly", "m: Mary", "p: passionate", since the *passionately* does not name anything. Similar remarks can be made about such phrases as *loves life* (does *life* really name anything??)

Fifth, remember that our quantifier phrases $(\exists x)$ and $(\forall x)$ are ***not*** names, and cannot go into locations that names go into, namely as arguments to predicates. Instead they are sentence operators or connectives, and therefore take a certain portion of a formula as being within their scope. This is different from English, where we can find phrases like *everyone* and *something* occurring as subjects, objects, etc…*Everyone gave some present to someone* makes it look as if 'everyone', 'some present', and 'someone' were names. But it would be **grossly and disgustingly wrong** to translate it like: $G(\forall x)(\exists y)(\exists z)$ – or anything remotely resembling that!!!

Both in class and in *The Logic Book* there is a discussion of "A,E,I,O" statements and how to translate them. These types of statements are the most common in ordinary arguments, and you should have a good feeling for them. Here they are: keep in mind that the F's and G's can be replaced by arbitrary formulas.

A-statements: All F's are G: $(\forall x)(Fx\supset Gx)$
E-statements: No F's are G: $(\forall x)(Fx\supset\sim Gx)$ equivalently, $\sim(\exists x)(Fx\&Gx)$
I-statements: Some F's are G: $(\exists x)(Fx\&Gx)$
O-statements: Some F's are not G: $(\exists x)(Fx\&\sim Gx)$

(now you just need to know English stylistic variants for 'all', 'no', 'some')

As I said, the F's and G's in the preceding can be arbitrarily complex: *All happy fat men who eat lasagna are tall if they are professors* is an A-statement. The F-part is: *happy fat men who eat lasagna* and the G-part is: *tall if they are professors*. To finish translating it you need to know that adjective-noun combinations are usually translated as conjunctions, and that these kinds of relative clauses are also translated as conjunctions. So, *happy fat men who eat lasagna* would be translated as $(Hx\&Fx\&Mx\&Ex)$, using the obvious scheme of abbreviation. And the G-part has *if–then* as a main connective, and therefore would be translated as $(Px\supset Tx)$, again using an obvious scheme of abbreviation. The whole A-statement sentence would therefore be translated:

$$(\forall x)((Hx\&Fx\&Mx\&Ex) \supset (Px\supset Tx))$$

(Although I said that adjective-noun combinations and noun-relative clause combinations are translated as conjunctions, be sure to look at *The Logic Book*'s discussion of this!!)