Transcription from English to Predicate Logic

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General Principles of Transcription

- In transcribing an English sentence into Predicate Logic, some general principles apply.
- A transcription guide must be provided.
- It should be determined in advance whether you are using restricted quantifiers or are giving a "complete" transcription.
- You should symbolize as much of the logical structure of the sentence as possible.
- If two sentences of Predicate Logic are equivalent, then neither is more adequate as a transcription than the other, although one of the two may make the logical form of the English sentence more perspicuous.
- If an English sentence is ambiguous, it may allow for more than one adequate transcription.
- In different contexts, we will "hear" the sentence in different ways.

The Indefinite Article

- The indefinite article 'a' can function as a universal and an existential quantity term.
  - 'A car can go very fast' can be "heard" as:
  - 'Any car can go very fast' (universal quantity).
  - 'At least one car can go very fast' (existential quantity).
- Generally, we use the article as a universal quantity term when the subject is taken to be a class of things, e.g. cars.
- We generally use the article as an existential quantity term when the subject is taken to be a specific thing which we do not wish to or cannot identify.
- Sometimes how we understand the predicate of the sentence makes a difference:

  - 'Fast' in comparison to the speed of non-motorized vehicles indicates that the universal might be the best reading.
  - 'Fast' is taken in comparison to the highest speeds of modern motorized vehicles, indicates the existential.

'Anyone'

- Generally, 'anyone' indicates a universal quantifier.
  - Anyone has the right to vote.
  - $(\forall x)_P Vx$.
- When used in the antecedent of a conditional without cross-reference, 'anyone' can function as an existential quantifier.
  - If anyone is at home, the lights will be on.
  - $(\exists x)_P Hx \supset J$.
- If there is cross-reference between the antecedent and the consequent, then the universal quantifier is usually called for.
  - If anyone is at home, it is a boy.
  - $(\forall x)_P(Hx \supset Bx)$.

'Someone'

- Generally, 'someone' indicates an existential quantifier.
  - Someone is a registered voter.
  - $(\exists x)_P Rx$.
- If there is cross-reference between the antecedent and the consequent, then 'someone' can function as a universal quantifier.
  - If someone is at home, it is a boy.
  - $(\forall x)_P(Hx \supset Bx)$.

Ambiguity with 'Anyone' and 'Someone'

- Some uses of 'anyone' in the antecedent of a conditional without cross-reference can be interpreted as universal quantification.
- These will be cases of logical truths in which the conditional expresses universal instantiation.
  - If anyone is a boy, then John is a boy.
  - $(\forall x)_P Bx \supset Bj$.

- Some uses of ‘someone’ which seem to apply to classes of things, and thus call for the universal quantifier, apply to a single thing and thus call for an existential quantifier.
  - Someone who is a registered voter has the right to vote.
  - $(\exists x)(Rx \ \& \ Vx)$.

Classes and Members of a Class

- Generally, we use the universal quantifier when we want to talk about a class of objects.
- Sometimes in a sentence we have more universal quantity expressions, each being about a class of objects.
  - All the boys kissed all the girls.
- This is perhaps most naturally taken to relate each member of the class of boys to each member of the class of girls.
  - $(\forall x)_B(\forall y)_G Kxy$.
- But it may also taken as stating that the boys, taken as a class, kissed the girls, taken as a class.
- The boys as a class all gave kisses to girls, and the girls as a class all received kisses from boys.
  - $(\forall x)_B(\exists y)_G Kxy \ \& \ (\forall x)_G(\exists y)_B(Kyx)$.

The Scope of Negation Expressions

- Ambiguity can arise because of the variability of the **scope** of natural language operators, including negation, and (in modal logic) words like ‘necessarily’ and ‘possibly’.
  - All the boys are not at home.
- The word ‘not’ might have “narrow” scope, governing the internal phrase ‘at home’.
  - $(\forall x)_P(Bx \supset \sim Hx)$.
- Or ‘not’ may have “wide” scope, governing the whole sentence.
  - $\sim(\forall x)_P(Bx \supset Hx)$.

Scope and Quantifiers

- Scope ambiguities also arise with the use of multiple quantifiers.
  - All the boys kissed a girl.
- We interpret 'a' as an existential quantifier.
- Its scope might be the whole sentence.
  - There is at least one girl whom each of the boys kissed.
  - $(\exists x)_G(\forall y)_B Kyx$.
- Or, the scope might be internal to the sentence.
  - Each of the boys is such that there is at least one girl whom he kissed.
  - $(\forall x)_B(\exists y)_G Kxy$.

Class and Scope Ambiguities Combined

- When we combine ambiguities of class and scope, even more interpretive possibilities arise.
  - All the boys did not kiss all the girls.
- The class/member ambiguity led to two different transcriptions of the sentence without negation.
  - $(\forall x)_B(\forall y)_G Kxy$.
  - $(\forall x)_B(\exists y)_G Kxy \ \& \ (\forall x)_G(\exists y)_B(Kyx)$.
- On the second reading (boys and girls as classes), the negation seems to govern the conjunction:
  - $\sim[(\forall x)_B(\exists y)_G Kxy \ \& \ (\forall x)_G(\exists y)_B(Kyx)]$.
- On the first reading (boys and girls as members of classes), there are three positions the negation sign could take.
  - $(\forall x)_B \sim(\forall y)_G Kxy$.
  - $(\forall x)_B(\forall y)_G \sim Kxy$.
  - $\sim(\forall x)_B(\forall y)_G Kxy$.

Transcribing 'Only'

- In sentence logic, 'only' reverses the order of a conditional.
- If Adam is an adult, then he has the right to vote.
  - Aa $\supset$ Va
- Only if Adam is an adult does he have the right to vote.
  - Va $\supset$ Aa
- This reversal holds when quantifiers are involved.
- If a person is an adult, then he has the right to vote (adults have the right to vote).
  - $(\forall x)_{P}$(Ax $\supset$ Vx).
- Only if a person is an adult does he have the right to vote (only adults have the right to vote).
  - $(\forall x)_{P}$(Vx $\supset$ Ax).

Negative Quantifier Expressions

- 'Nothing' makes a negative claim about everything in a whole class of objects, while 'not everything' negates the universality of a statement about a class of objects.
  - Nothing is furry: $(\forall x)\sim$Fx.
  - Not everything is furry: $\sim(\forall x)$Fx.
- 'None' and 'none but' are generally used to indicate a restricted class of things, where 'none but' says the same thing as 'only' and reverses the order of subject and predicate terms in the English sentence.
  - None of the boys are registered voters: $(\forall x)_{B} \sim$Rx, or $(\forall x)$(Bx $\supset \sim$Rx).
  - None but adults are registered voters: $(\forall x)_{R}$Ax, or $(\forall x)$(Rx $\supset$ Ax).
- No **P**s are **Q**s is transcribed as $(\forall \mathbf{u})_{\mathbf{P}} \sim \mathbf{Q}(\mathbf{u})$, or as $(\forall \mathbf{u})(\mathbf{P}(\mathbf{u}) \supset \sim \mathbf{Q}(\mathbf{u}))$.