Lecture 5

Philosophy 109

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February 12, 2020

Translation to TFL

- Sentences with no connectives are easy to translate or symbolize ($\mapsto$):
  - It is cold $\mapsto C$
  - It is rainy $\mapsto R$
  - It is sunny $\mapsto S$
- The trick when symbolizing an atomic sentence is to:
  - Use a different letter for each sentence
  - Use the same letter whenever the same sentence reappears.

Translation to TFL

- Sentences with just one sentential connective are also pretty easy:
  - It is cold and rainy $\mapsto C \wedge R$ [Notice the two atomic letters]
  - If it is cold then it's rainy $\mapsto C \rightarrow R$
- Sentences with more than one connective can become trickier.
  - Either it is sunny or it is cold and rainy $\mapsto S \vee (C \wedge R)$.
  - Notice that $(S \vee C) \wedge R$ would be incorrect.

Translation to TFL

- The goal is to give the most precise (and fine-grained) TFL rendering you can, and try to come as close as possible to the meaning of the original.
- This week we will focus on translations.
    - For this purpose we will only touch on the meanings of the terms.
- Then the following week we will learn more about the meaning, or semantics, of sentential logic.
- After that, we will be in a position to evaluate arguments for sentential validity.

A Two Stage Process

- Sometimes, we will need to translate somewhat complicated sentences.
- It is useful to go through two separate stages:

Stage 1 Replace all basic sentences (explicit or implicit) with atomic letters. Result: a sentence of "Logish", halfway between the two.

Stage 2 Replace the remaining English connectives with their TFL symbols, and appropriately group them together with parentheses.

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Either it's raining or it's snowing		

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    - ★ "John is left handed **and** John is smart" $\mapsto L \wedge S$
    - ★ "John is left handed **but** John is smart"$\mapsto L \wedge S$
  - Only one of them implies something insulting about left-handed people.

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- But so far, no formal language has been successful in capturing all of the meaning of natural languages.
- Which is good news! There is still work for research logicians!

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- Generally, you will see "or", or "Either..., or" somewhere in the English sentence.
- The tricky word that can be translated into disjunction is *unless*
  - "p unless q" means $\neg q \to p$. But, as we will prove later, this is equivalent (means the same) as $p \vee q$.

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  - q whenever p.
  - When p, q.

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- "If p then q", "q if p", and "$p \rightarrow q$" are all ways of saying "p is a *sufficient* condition for q"
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- "q only if p", symbolized by $q \rightarrow p$, says that p is a necessary condition for q.
    - Again, this is equivalent to q being a *sufficient* condition for p.

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- Your tv will work *only if* it is plugged in (True)
- Your tv will work *if* it is plugged in (False, might be broken)
- Practice is necessary for becoming a great athlete, but it's not sufficient.

$\leftrightarrow$

- $p \leftrightarrow q$ is equivalent to $(p \rightarrow q) \wedge (q \rightarrow p)$
  - So p is a necessary and sufficient condition for q, and vice versa.
- Translated as $p \leftrightarrow q$
  - p if and only if q
  - p just in case q
  - p just when q
  - p is necessary and sufficient q
  - p when and only when q

Connectives of TFL

Symbol	Sentence	Name/Function	Translation
$\neg$	$\neg p$	negation	not
$\wedge$	$p \wedge q$	conjunction	and
$\vee$	$p \vee q$	disjunction	or
$\rightarrow$	$p \rightarrow q$	conditional	If..., then...
$\leftrightarrow$	$p \leftrightarrow q$	biconditional	if and only if

Grouping Connectives

Scope

Whenever three or more TFL sentence letters appear in an TFL sentence, parentheses must be used to indicate the *scope* of The connectives.

Scope: Definition

Scope of a connective: Which sentences are connected by the connective.

- The scope of two place connectives will always be two sentences.
- The scope of negation is always the unit to the right.

Scope

- $A \wedge B \vee C$ is not an TFL sentence.

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- But we must always group expressions with 3 or more sentence letters even when the meaning is the same:
  - $(A \vee B) \vee C$ and $A \vee (B \vee C)$ mean the same thing, but we have to choose one (doesn't matter which).
  - Similarly for $(A \wedge B) \wedge C$ and $A \wedge (B \wedge C)$

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- The Logish sentence "It's not the case that K or M" is ambiguous between the last two.
  - Usually, we will use it to mean the former, so default to that.

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In Class Assignment

Translate these

- Shell is not a polluter, but Exxon is.
- Not both Shell and Exxon are polluters.
- Both Shell and Exxon are not polluters.
- Not either Shell or Exxon is a polluter.
- Neither Shell nor Exxon is a polluter.
- Either Shell or Exxon is not a polluter.

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