Lecture 6

Philosophy 109

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September 27, 2019

Administrative Stuff

- HW 1 was due on Saturday if you have not turned it in, come see me!
- (Unless we have already talked about it)

Translation Quiz

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.

- Shell is not a polluter, but Exxon is.

- Shell is not a polluter, but Exxon is.
  - $\neg S \wedge E$

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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

Some Important Examples

Logish	**TFL**
Not either A or B	$\neg(A \vee B)$
Either not A or not B	$\neg A \vee \neg B$
Not both A and B	$\neg(A \wedge B)$
Both not A and not B	$\neg A \wedge \neg B$
Neither A nor B	$\neg A \wedge \neg B$

DeMorgan's Laws

- Some useful equivalences we will prove later:
  - $\neg(p \vee q)$ is equivalent to $\neg p \wedge \neg q$
  - $\neg(p \wedge q)$ is equivalent to $\neg p \vee \neg q$
- Don't confuse them for:
  - $\neg(p \vee q)$ is not equivalent to $\neg p \vee \neg q$
  - $\neg(p \wedge q)$ is not equivalent to $\neg p \wedge \neg q$

Main Connective

- Important to identify main connective both for English sentences and for TFL sentences.
- No algorithm for English. You have to understand what's being said
  - The main connective puts the two biggest sub-sentences together (or the one if the main connective is *not*).
- There is an algorithm for TFL.
  - When translating, the main English connective and the main TFL connective should correspond.

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If so, then then that $\neg$ is the main connective.

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Step 4 If there's more than one connective, and $\neg$ isn't it, the main connective is the one that isn't a $\neg$ and isn't enclosed in parentheses.

Examples

$A \rightarrow B$

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$$A \rightarrow B$$

$$\neg A \vee B$$

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$$A \rightarrow B$$

$$\neg A \vee B$$

$$\neg((A \vee B) \leftrightarrow (B \wedge \neg C))$$

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$$\neg(A \vee B) \leftrightarrow (B \wedge \neg C)$$

$$A \wedge (B \wedge C)$$

$$(A \wedge B) \wedge C$$

Examples

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$$\neg A \vee B$$

$$\neg((A \vee B) \leftrightarrow (B \wedge \neg C))$$

$$\neg(A \vee B) \leftrightarrow (B \wedge \neg C)$$

$$A \wedge (B \wedge C)$$

$$(A \wedge B) \wedge C$$

$$(A \rightarrow \neg(B \leftrightarrow \neg(A \vee (D \rightarrow E)))) \rightarrow \neg(F \vee \neg G)$$

A Two Stage Process

- It's useful to break up the task of translation into two big stages.
  - **Stage 1** Replace all basic sentences (explicit or implicit) with atomic letters. Result: A sentence of "Logish": a language in between English and TFL.
  - **Stage 2** Eliminate the remaining English Connectives with TFL connectives and group the resulting expression with parentheses to yield TFL.
- With complicated sentences, it can also be useful to break these stages down further into smaller parts.

Some Guidelines

- The ***primary*** goal of a translation is to capture truth conditions:
  - The TFL sentence and the English sentence should be true or false in **exactly the same circumstances**. In other words, their truth-values should match no matter what.
  - Often, the hard part here is the *English*, not the TFL. Make sure you know exactly what the English sentence is claiming.
- The **secondary** goal of a translation is to mirror the English sentence as well as possible.
- I'll highlight these going forth.

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- Step 2: Translate (Here I use an intermediate step.) into TFL:
  - S and B, and if L, then if S and B then A.
  - **Final product**: $(S \wedge B) \wedge (L \rightarrow ((S \wedge B) \rightarrow A))$

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(iii) If I, then P unless G.

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If you are intelligent, then if you don't goof off, you'll pass.

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Extra Problems from Hardegree

1. Jay and Kay are roommates, but they hate one another.
2. In order to get into med school, it's necessary but not sufficient to have good grades and take the admissions exam.
3. Both Jay and Kay will go to the beach this weekend, provided neither is sick.
4. If you concentrate well only if you're alert, then provided that you are wise, you will not fly an airplane unless you are sober.
5. If neither Jay nor Kay is home this weekend, we'll go to the beach; otherwise, we will stay home.

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- Need to **capture the interrelations** of content *across* the various sentences of the argument.
- A big part—the easier part—is choosing atomic sentences well.
- The harder part is **keeping the *intent* of the argumentative passage in mind**: the intended argumentative strategy.

Example 1

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

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O: God is omnipotent.

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- **Step 1**: Identify and symbolize the *conclusion* of the argument:

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  G: God exists.
  J: God is just.
  K: God is omniscient.
  E: There is evil in the world.
  O: God is omnipotent.

- **Step 1**: Identify and symbolize the *conclusion* of the argument:
  - 'God does not exist.' Symbolize as: $\neg G$.

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- **Step 2**: Identify and symbolize the premises, unpacking the English as necessary.

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- **Step 2**: Identify and symbolize the premises, unpacking the English as necessary.
  - P1: 'If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient.'

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- **Step 2**: Identify and symbolize the premises, unpacking the English as necessary.
  - P1: 'If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient.'
  - If G, then $\neg E$ unless $\neg J$, or $\neg O$, or $\neg K$

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- **Step 2**: Identify and symbolize the premises, unpacking the English as necessary.
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  - $G \rightarrow (\neg E \text{ unless } (\neg J \vee (\neg O \vee \neg K)))$

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If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- **Step 2**: Identify and symbolize the premises, unpacking the English as necessary.
  - P1: 'If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient.'
  - If G, then $\neg E$ unless $\neg J$, or $\neg O$, or $\neg K$
  - $G \rightarrow (\neg E \text{ unless } (\neg J \vee (\neg O \vee \neg K)))$
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If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- **Step 2**: Identify and symbolize the premises, **unpacking the English as necessary**.

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- **Step 2**: Identify and symbolize the premises, **unpacking the English as necessary**.
  - P2: 'If God exists, then He is none of these, and there is evil in the world.'

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- **Step 2**: Identify and symbolize the premises, **unpacking the English as necessary**.
  - P2: 'If God exists, then He is none of these, and there is evil in the world.'
  - 'He is none of these'=

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- **Step 2**: Identify and symbolize the premises, **unpacking the English as necessary**.
  - P2: 'If God exists, then He is none of these, and there is evil in the world.'
  - 'He is none of these'=He is neither unjust, nor not omnipotent, nor not omniscient.

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If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

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  - If G, then not $\neg J$ and not $\neg O$ and not $\neg K$, and E.

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- **Step 2**: Identify and symbolize the premises, **unpacking the English as necessary**.
  - P2: 'If God exists, then He is none of these, and there is evil in the world.'
  - 'He is none of these'=He is neither unjust, nor not omnipotent, nor not omniscient.
  - If G, then not $\neg J$ and not $\neg O$ and not $\neg K$, and E.
  - $(G \rightarrow (\neg\neg J \wedge (\neg\neg O \wedge \neg\neg K))) \wedge E$

PoE

If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

- Final Form:
  $G \rightarrow (\neg E \vee (\neg J \vee (\neg O \vee \neg K)))$
  $(G \rightarrow (\neg\neg J \wedge (\neg\neg O \wedge \neg\neg K))) \wedge E$
  $\therefore \neg G$

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If God exists, then there is no evil in the world unless God is unjust, or not omnipotent, or not omniscient. But, if God exists, then He is none of these, and there is evil in the world. So, we must conclude that God does not exist.

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  $(G \rightarrow (\neg\neg J \wedge (\neg\neg O \wedge \neg\neg K))) \wedge E$
  $\therefore \neg G$
- Is it valid?

Alternatives

- Alternative 1:
  $G \rightarrow (\neg E \vee (\neg J \vee (\neg O \vee \neg K)))$
  $(G \rightarrow (\neg\neg J \wedge (\neg\neg O \wedge \neg\neg K)))$
  E
  $\therefore \neg G$

Alternatives

- Alternative 1:
  $G \rightarrow (\neg E \vee (\neg J \vee (\neg O \vee \neg K)))$
  $(G \rightarrow (\neg\neg J \wedge (\neg\neg O \wedge \neg\neg K)))$
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- Alternative 2: For P1, we could also have:
  $G \rightarrow (\neg(\neg J \vee (\neg O \vee \neg K)) \rightarrow \neg E)$

Alternatives

- Alternative 1:
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  $(G \rightarrow (\neg\neg J \wedge (\neg\neg O \wedge \neg\neg K)))$
  E
  $\therefore \neg G$
- Alternative 2: For P1, we could also have:
  $G \rightarrow (\neg(\neg J \vee (\neg O \vee \neg K)) \rightarrow \neg E)$
- Alternative 3: In P2, we can switch around the order of the stuff after the arrow.
  $\neg\neg K \wedge (\neg\neg J \wedge \neg\neg O))$ for $(\neg\neg J \wedge (\neg\neg O \wedge \neg\neg K))$

Example 2

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

Example 2

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- Step 0: Basic sentences:

F: Yossarian flies his missions.
D: Yossarian puts himself in danger.
R: Yossarian is rational.
A: Yossarian asks to be grounded.

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

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If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- Step 1: Identify and symbolize the conclusion.

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- Step 1: Identify and symbolize the conclusion.
  - Yossarian will fly his missions whether he is rational or irrational.

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If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- Step 1: Identify and symbolize the conclusion.
  - Yossarian will fly his missions whether he is rational or irrational.
  - F whether R or $\neg R$

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If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- Step 1: Identify and symbolize the conclusion.
  - Yossarian will fly his missions whether he is rational or irrational.
  - F whether R or $\neg R$
  - $(R \rightarrow F) \wedge (\neg R \rightarrow F)$ (Alt: $(R \vee \neg R) \rightarrow F$)

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If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

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- **Premise 1**: If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger.

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- **Premise 1**: If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger.
  - If F then D, and if D then not R.

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- **Premise 1**: If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger.
  - If F then D, and if D then not R.
  - $(F \rightarrow D) \wedge (D \rightarrow \neg R)$

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- **Premise 1**: If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger.
  - If F then D, and if D then not R.
  - $(F \rightarrow D) \wedge (D \rightarrow \neg R)$
- **Premise 2**: If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks.

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- **Premise 1**: If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger.
  - If F then D, and if D then not R.
  - $(F \rightarrow D) \wedge (D \rightarrow \neg R)$
- **Premise 2**: If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks.
  - If R then A, and not F only if A.

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- **Premise 1**: If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger.
  - If F then D, and if D then not R.
  - $(F \rightarrow D) \wedge (D \rightarrow \neg R)$
- **Premise 2**: If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks.
  - If R then A, and not F only if A.
  - $(R \rightarrow A) \wedge (\neg F \rightarrow A)$

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

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- **Premise 3**: Only irrational people are grounded, and a request to be grounded is proof of rationality.

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- **Premise 3**: Only irrational people are grounded, and a request to be grounded is proof of rationality.
  - If $\neg F$ then $\neg R$, and A proves R.

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

- **Premise 3**: Only irrational people are grounded, and a request to be grounded is proof of rationality.
  - If $\neg F$ then $\neg R$, and A proves R.
  - $(\neg F \rightarrow \neg R) \wedge (A \rightarrow R)$

Catch 22

If Yossarian flies his missions, then he is putting himself in danger, and it is irrational to put oneself in danger. If Yossarian is rational, he will ask to be grounded, and he will be grounded only if he asks. But only irrational people are grounded, and a request to be grounded is proof of rationality. Consequently, Yossarian will fly his missions whether he is rational or irrational.

Final form:

$(F \rightarrow D) \wedge (D \rightarrow \neg R)$
$(R \rightarrow A) \wedge (\neg F \rightarrow A)$
$(\neg F \rightarrow \neg R) \wedge (A \rightarrow R)$
$\therefore (R \rightarrow F) \wedge (\neg R \rightarrow F)$

You Try It!

Contest

Suppose no two contestants enter, then there will be no contest. No contest means no winner. Suppose all contestants perform equally well. Still no winner. There won't be a winner unless there's a loser. And conversely. Therefore, there will be a loser only if at least two contestants enter and not all contestants perform equally well.