Introduction to Logical Form

Philosophy and Logic
Unit 1, Section 1.2
This week

• On the agenda: the notion of *logical form*. Transition from units 1 to 2.
An argument is deductively valid if and only if it is impossible for all the premises to be true and the conclusion to be false.

Validity

- An argument is deductively valid if and only if it is impossible for all the premises to be true and the conclusion to be false.
Two other implications

• One can show by logical means alone that if all the premises are true then the conclusion is also true.

• The argument is one in which the truth of the premises would guarantee the truth of the conclusion. The truth of the premises would provide absolutely conclusive support for the conclusion.
Some dirty laundry from last time

• What, pray tell, does “impossible” mean? And how are we supposed to tell what is impossible?
Is this argument valid?

If we can construct a warp engine, we can travel faster than light.

We can travel faster than light.

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Hence we can construct a warp engine.
What Aristotle Noticed

- If an argument is valid, then any argument with the same logical form is valid.
  
  If $P$ then $Q$

  $P$

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  Therefore $Q$

  *modus ponens: valid*
And furthermore

• If an argument is invalid, then any argument with the same logical form is invalid.

  If P then Q

  Q

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  Therefore P

  *affirming the consequent: invalid*
So he concluded

• Perhaps validity is a matter of logical form.
  – Roughly: an argument is valid if it has a form that can never lead one to affirm a false conclusion on the basis of true premises.
  – If the argument has a form that can lead one from true premises to a false conclusion, then the argument is invalid.

• Not too shabby for 350 B.C.!
“if an argument is valid, then any argument of the same form is valid”

One *cannot* find any “instance” of the form

If P then Q.
P.
Therefore Q.

in which both premises are in fact true and the conclusion is false.
A wager

- If you can find an instance of the above form in which both premises are in fact true and the conclusion is false, I will give you an “A” for the course, on the spot. (And you should publish the result!)
Why the wager is difficult:

If P then Q

T       P

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F       Q

or:

If P then Q

?       P

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F       Q
Examples:

? If P then Q
T The sun appears to move across the sky.

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F The sun revolves around the earth.

or:

T If the celestial spheres are centered on the earth, then the sun revolves around it.

? P

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F The sun revolves around the earth.
Avoiding “impossibility”

A valid deductive argument is an argument with a valid logical form.

An argument has a valid logical form if and only if no argument with that form has true premises and a false conclusion.

Two arguments have the same logical form if one can be converted to the other by lexical substitution. (One can substitute clauses for clauses, predicates for predicates, and names for names, as long as one substitutes the same for the same throughout.)
Last gasp from unit 1

• An argument has a *deductively valid logical form* if and only if no argument with the same form has true premises and a false conclusion.
  – The word “impossible” has disappeared
  – It gives us a plan of attack
Logical form: the plan

• Define what a “logical form” is
• Define what it is for two arguments to have the *same* logical form
• Devise a test for the question “Is there any argument with *this* form that has all true premises and a false conclusion?”
  – If yes: *invalid*
  – If no: *valid*