Valid v. Invalid Inference

Philosophy and Logic
Unit 2, Section 1.2
Two distinctions from last time

• A mere collection of statements vs. an argument (e.g., a collection of statements plus an inference)

• Deductive inferences vs. inductive inferences
Four assertions sitting on a hill
Four assertions sitting on a hill, some true, some false
A valid argument
Characterizing an inference: Validity

The technical term "validity" applies to the relation of support *between* the premises and the conclusion.

Does the argument have a structure that will reliably transmit truth *from* the premises *to* the conclusion?

An inference is *bad* if it is of a sort that can lead one from true premises to a *false* conclusion. Otherwise it is good (or at least, not bad).
Deductive vs. Inductive

• Deductive: the kind of reasoning used in mathematical proofs
  – See unit 2!
• Inductive: the kind of reasoning used in statistics, probability, and empirical science
  – See unit 5!
• Good Deductive Arguments
  – Similar to *proofs*
  – Aim at an absolutely air-tight or conclusive relation of support.
  – If all the premises are true, then the conclusion MUST be true

• Good Inductive Arguments
  – Similar to *statistical* arguments
  – Premises provide *good* reasons to believe the conclusion, but not conclusive ones.
  – If all the premises are true, then it is *very probable* that the conclusion is true.
Deductive arguments with a proper relation of support are called *deductively valid* (or just "valid").

It is *impossible* for all the premises to be true and the conclusion false.

Inductive arguments with a proper relation of support are called *inductively strong*.

It is *very unlikely* for all the premises to be true and the conclusion false (but it is possible.)
Some other contrasts

• Deductive
  – Validity is all or none.
  – A valid inference is the best possible.
  – If an inference is valid, adding more premises cannot make it more valid.

• Inductive
  – Inductive soundness is a matter of degree.
  – At best it establishes the conclusion to a high probability.
  – Adding more premises might increase that probability.
a *deductively valid* argument is one in which it is impossible for all the premises to be true and the conclusion to be false.

The premises, if true, would provide *absolutely conclusive* grounds for believing the conclusion.

If all the premises are true, then the conclusion *must* be true.
If McCain loses in New Hampshire, then his campaign will be over.

McCain loses in New Hampshire.

McCain’s campaign will be over.

\[ \text{If } L \text{ then } O \]

\[ L \]

\[ \text{Therefore } O \]

valid: *modus ponens*
A valid argument
A valid argument

Validity characterizes the relation between the premises and the conclusion.
A valid argument

In a valid argument, that connection is absolutely reliable. It cannot lead you astray.
Invalid

An invalid argument *doesn't* have the right sort of connection between premises and conclusion. It *can* lead you astray.
If the majority votes for Forbes, then Forbes must have spent lots of money.

Forbes spent lots of money.

The majority votes for Forbes.

If M then S

S

Therefore F

invalid: *affirming the consequent*
How to characterize an inference

By the patterns of truth values it does or does not allow:

An argument is *deductively valid* if and only if it is *impossible* for all the premises to be true and the conclusion false. Otherwise it is *invalid.*
Valid
Valid
Valid
Valid
Valid
Valid
Valid
Valid

No Way! The one *IMPOSSIBLE* combination:
Invalid
Invalid
Invalid
The Moral of the Story:

Validity $\neq$ Truth of the conclusion

• A valid inference can have a false conclusion; it can have any combination of truth values except all true premises and a false conclusion.

• An invalid inference can have any combination of truth values—period.
REPEAT:

Validity ≠ truth of conclusion

• A valid inference can have any combination of truth values except all true premises and a false conclusion.

• An invalid inference can have any combination of truth values—period.
Invalid
Valid

The one IMPOSSIBLE combination:
If we have *this* pattern of truth values, then we know that the inference is ....
Modus ponens

If P then Q
P
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Q
If Connecticut borders Massachusetts, then it will sometimes get the weather pattern called a “Nor’Easter”.

Connecticut borders Massachusetts.

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Connecticut sometimes gets the weather pattern called a “Nor’Easter”.

Valid, with true premises. Hence it must have a true conclusion. (A sound argument.)
If Connecticut borders Arizona, then Connecticut taxes are the highest in the country.
Connecticut borders Arizona.

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Connecticut taxes are the highest in the country.

Valid. False premises. The conclusion happens to be true.
If Connecticut borders Arizona, then it rarely goes below freezing in Connecticut.
Connecticut borders Arizona.

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It rarely goes below freezing in Connecticut.

Valid. False conclusion. Hence, at least one false premise.
Affirming the consequent

If P then Q
Q
Q
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P
If Ted Turner was a chipmunk then Ted Turner would have a lot of body hair.
Ted Turner has a lot of body hair.
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Hence Ted Turner is a chipmunk.

True premises and a false conclusion. It *must* be invalid. (It is!)
If Ted Turner was a chipmunk then Time-Warner would give stock options to a rodent.
Time-Warner gives stock options to a rodent.

Hence Ted Turner is a chipmunk.

Invalid, false conclusion. Premises could be true or false. (Here at least one is false.)
If Ted Turner runs a 32,000 acre ranch then the US government provides agricultural subsidies to a vice-president of Time-Warner.

The US government provides agricultural subsidies to a vice-president of Time-Warner.

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Hence Ted Turner runs a 32,000 acre ranch.

An invalid inference: truth of the premises does not establish the conclusion. The conclusion happens to be true. Both premises are true.