LOGIC I

BASIC CONCEPTS 1 & 2

Dr. Ethan SAHKER, PhD

Basic Concepts

ARGUMENT

PREMISE

CONCLUSION

Basic Concepts

ARGUMENT

- A themed group of statements
- Must contain premises and a conclusion
- Statement
  - A statement must be falsifiable
  - Either true or false

  ex.

  Chocolate has many calories.

  Politicians always tell the truth.

  Ichiro played baseball and played internationally.

- Non-statement
  - ex. Questions, proposals, commands, exclamation

PREMISE

CONCLUSION

Basic Concepts

ARGUMENT

PREMISE

CONCLUSION

- Statements that make up the argument
- Can be one or more
- Serve as evidence

- Premise indicator words:

since	in that	seeing that
as indicated by	may be inferred from	for the reason that
because	as	inasmuch as
for	given that	owing to

Basic Concepts

ARGUMENT

PREMISE

CONCLUSION

- Statements that make up the argument
- Can be one ore more
- Serve as evidence

- Premise indicator words:

ex.
All movie stars are celebrities.
Arnold Schwarzenegger is a movie star.

Basic Concepts

ARGUMENT

PREMISE

CONCLUSION

- The statement claimed to be true based on the premises
- Follows directly from the evidence presented

- Conclusion indicator words:

therefore	accordingly	entails that
wherefore	we may conclude	hence
thus	it must be that	it follows that
consequently	for this reason	implies that
we may infer	so	as a result

Basic Concepts

ARGUMENT

PREMISE

CONCLUSION

- The statement claimed to be true based on the premises
- Follows directly from the evidence presented

- Conclusion indicator words:

ex.

P → All movie stars are celebrities.

P → Arnold Schwarzenegger is a movie star.

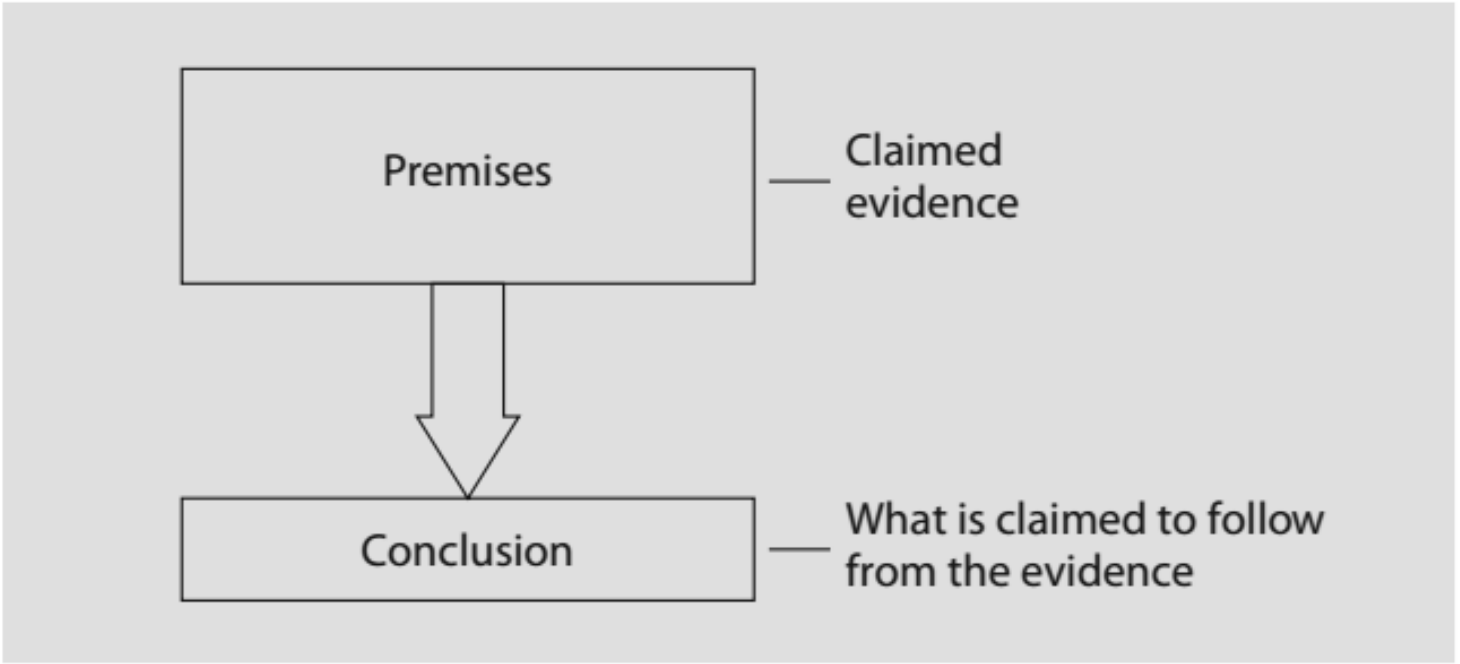
C → Therefore, Arnold Schwarzenegger is a celebrity.

Basic Concepts

ARGUMENT

PREMISE

CONCLUSION



Arguments

What is an argument?

Arguments

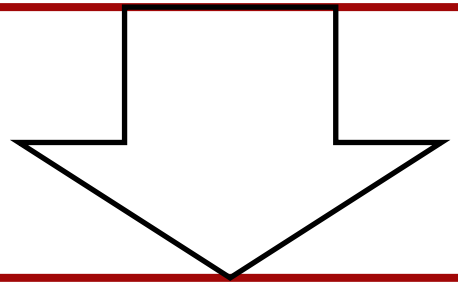
What is an argument?

Written or spoken statements that *claim* a conclusion that is supported by one or more premises (p).

Arguments

P_1: Many of our bridges are in horrible condition.
P_2: Our transit system is in serious need of repair.
P_3: Improving transportation would create many jobs.

→ Claimed Evidence



C: We must invest in repairing our old bridges.

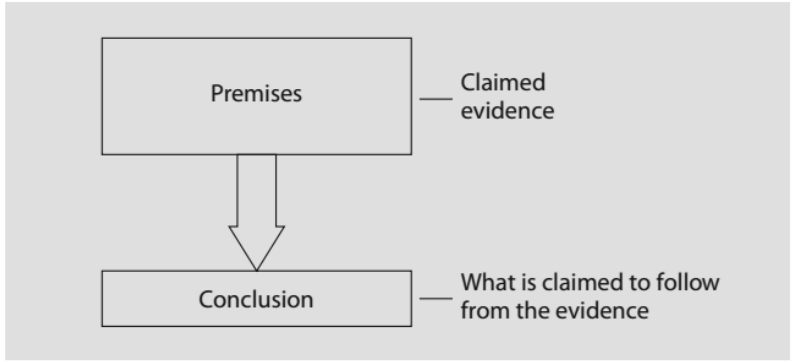
→ What is Claimed to follow from the Evidence

Arguments

It's not always so straightforward.

It is extremely important that historical sites are preserved.
Historical sites provide essential cultural value.
Cultural value includes reminders or our past, symbols of who we are as a people, and it is an educational model for our future.

Identifying Arguments



The *claim* is the key, but it's not always obvious.

Explicit claims – Obvious

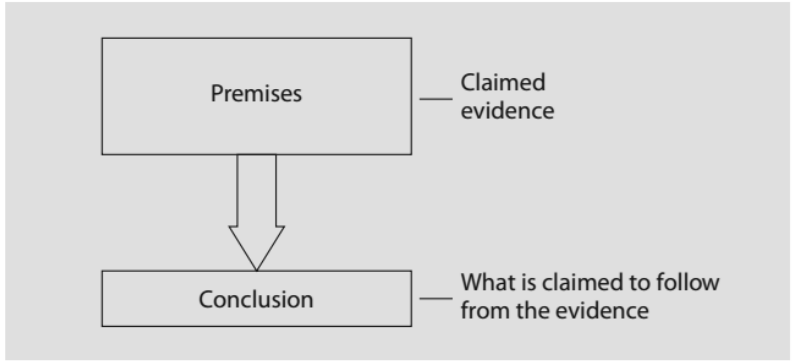
The Ebola virus still exists, and it kills on average 50% of the people it infects. Thus, Ebola remains a threat to human health.

P_1: The Ebola virus still exists,

P_2: and it kills on average 50% of the people it infects.

C: Thus, Ebola remains a threat to human health.

Identifying Arguments



- The *claim* is the key, but it's not always obvious.
  Implicit claims – implied and not always obvious

Genetic modification of food is risky business. Genetic engineering can introduce unintended changes into the DNA of the food-producing organism, and these changes can be toxic.

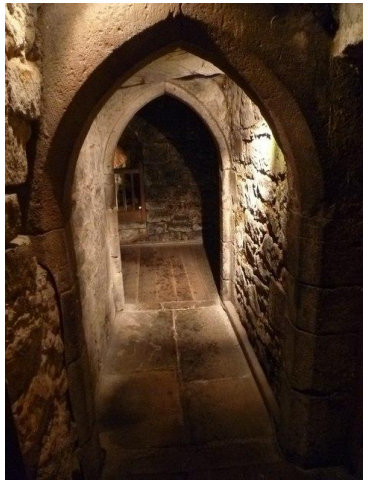
P_1: Genetic engineering can introduce unintended changes into the DNA of the food-producing organism

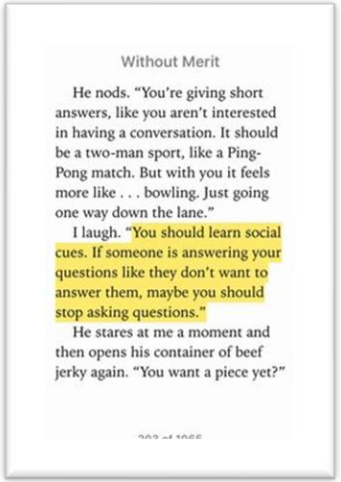
P_2: and these changes can be toxic.

C: Genetic modification of food is risky business.

Identifying Arguments

PASSAGE
A section of writing
≥ 1 Sentence





Without Merit

He nods. "You're giving short answers, like you aren't interested in having a conversation. It should be a two-man sport, like a Ping-Pong match. But with you it feels more like . . . bowling. Just going one way down the lane."

I laugh. "You should learn social cues. If someone is answering your questions like they don't want to answer them, maybe you should stop asking questions."

He stares at me a moment and then opens his container of beef jerky again. "You want a piece yet?"

Identifying Arguments

Not every passage is an argument.

Non-Inferential Passages – passages that contain statements but do not claim conclusions are supported by premises.

1. **Warnings** – Whatever you do, don't tell secrets to Hobo-san.
2. **Advice** – You should not pet burning dogs. Frozen cats are okay to pet.
3. **Opinion** – Soba is far superior to udon.
4. **Loose Associations** - Honor is pure, fear is distorted, act from honor.
5. **Report** – Today, I made my bed, brushed my face, and washed my teeth.
   -- be careful about reports.

Identifying Arguments

Challenge – What was missing from the argument?

Not every passage is an argument.

Non-Inferential Passages – passages that contain statements but do not claim conclusions are supported by premises.

ex.
I love chocolate.
Chocolate has many calories.

Identifying Arguments

Not every passage is an argument.

Expository Passages – These have a topic sentence and are followed by sentences that develop the topic, but do not claim conclusions are supported by premises. The key here is the purpose of the passage.

America is categorized in many ways. It is divided into 50 states that each have their own laws. However, the different regions of the US have unique mind-sets or personalities. This includes the Pacific-Northwest, West Coast, Southwest, Rocky Mountain, Northern Plains, Southern Plains, the Midwest, the South, Mid-Atlantic, and New England regions.

Identifying Arguments

Not every passage is an argument.

Illustrations – An illustration is an expression involving examples intended to demonstrate meaning or how to act.

Chemical elements, as well as compounds, can be represented by molecular formulas. Oxygen is represented by "O_2," water by "H_2O," and sodium chloride by "NaCl."

Again, the key is purpose. 🔑

Identifying Arguments

Not every passage is an argument.

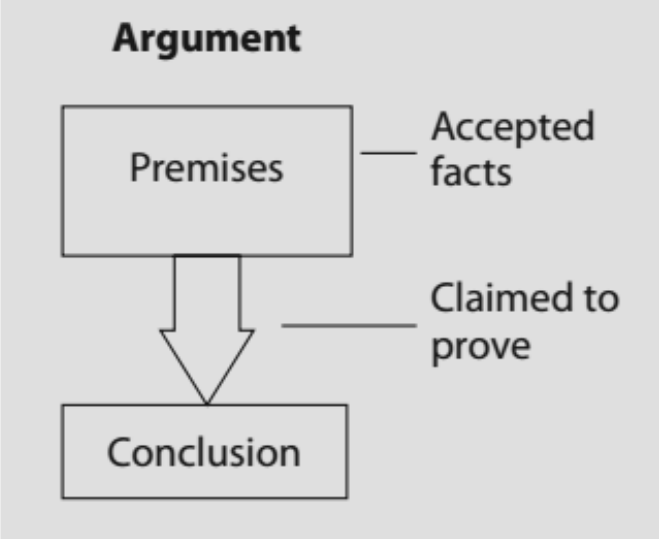
Explanations – an expression that aims to "shed light" on some event or phenomenon. The event is usually accepted as a matter of fact.

Light rays from the sun are scattered by particles in the atmosphere. That's why the sky appears blue from the earth's surface.

Identifying Arguments

Not every passage is an argument.

Explanations



Identifying Arguments

<u>Not every passage is an argument.</u>

Conditional Statements – where one outcome depends on another. Known as “if…then…” statements.

If you study hard then you will improve.

Identifying Arguments

Not every passage is an argument.

Conditional Statements – where one outcome depends on another. Known as "if…then…" statements.

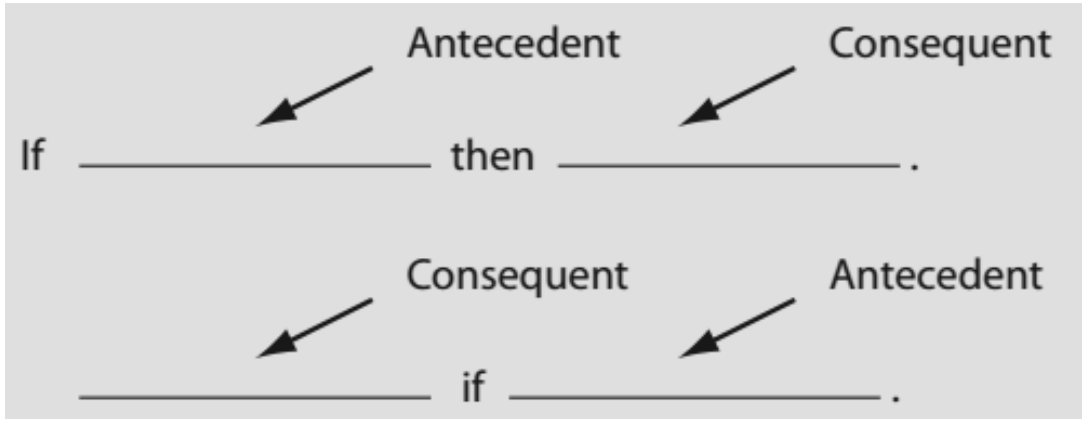
If you study hard then you will improve.

↓ ↓

you study hard — you will improve

↓ ↓

Antecedent — Consequent



Identifying Arguments

<u>Not every passage is an argument.</u>

Conditional Statements – Can sound like an argument but….

1. A single conditional statement is not an argument.
2. A conditional statement may serve as either the premise or the conclusion (or both) of an argument.
3. The inferential content of a conditional statement may be expressed to form an argument.

Identifying Arguments

Not every passage is an argument.

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If sugary drinks cause heart disease and diabetes, **then** they should be regulated.

Identifying Arguments

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If sugary drinks cause heart disease and diabetes, then they should be highly taxed.

Identifying Arguments

<u>Not every passage is an argument.</u>

Conditional Statements – Can sound like an argument but….

1. A single conditional statement is not an argument.
2. The inferential content of a conditional statement may be expressed to form an argument.
3. A conditional statement may serve as either the premise or the conclusion (or both) of an argument.

Heart disease is a leading cause of death in Japan. If sugary drinks cause heart disease and diabetes, then they should be regulated.

Identifying Arguments

When correctly identifying an argument, you should look for three things:

1. indicator words: such as “therefore,” “since,” “because,” etc.
2. an inferential relationship between statements (claimed conclusion supported by premises)
3. Typical nonarguments

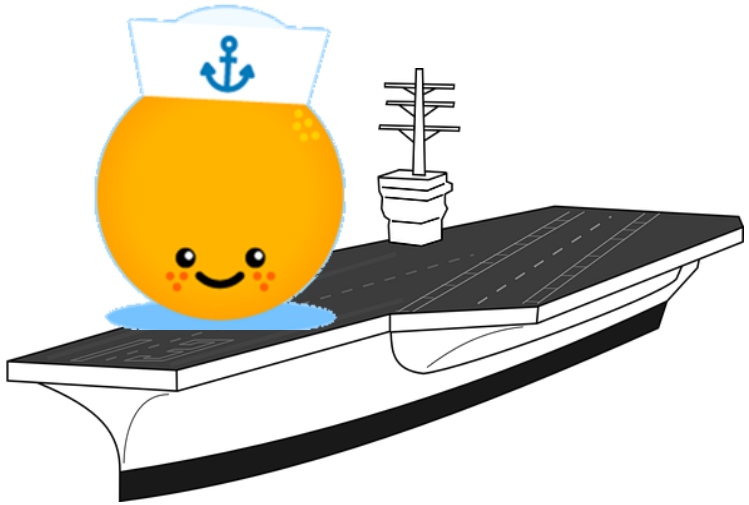
- Many arguments lack indicator words.
- The conclusion may be the first statement.
- It helps to mentally insert “therefore” to decide if they are conclusions.
- Typical nonarguments include: warnings, reports, advice, expository passages, illustrations, opinion, explanations, loose associations, conditional statements.

Identifying Arguments

Human Navel

Navel Orange

Naval Orange



Poll Everywhere Apps

PollEv.com/ethansahker032

IOS App for iPhone

Android App

REVIEW

When correctly identifying an argument, look for 3 things:

1. indicator words: “therefore,” “since,” “because,” etc.
2. An inferential relationship between statements (claimed conclusion supported by premises)
3. Typical nonarguments

- Many arguments lack indicator words.
- The conclusion may be the first statement.
- It helps to mentally insert “therefore” to decide if they are conclusions.
- Typical nonarguments include: warnings, reports, advice, expository passages, illustrations, opinion, explanations, loose associations, conditional statements.

REVIEW

PASSAGES:

- **Statement** – falsifiable (true or false)
- **Proposal** – action w/ positive outcome
- **Command** – makes an order
- **Warning** – action w/ negative outcome
- **Advice** – suggests action
- **Opinion** – personal value or belief
- **Loose association** – poor connection
- **Report** – states actions in the past

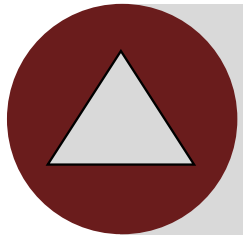
ARGUMENT:

- **Multiple passages**
- **At least 1 premise**
- **Only 1 conclusion**

NOT AN ARGUMENT:

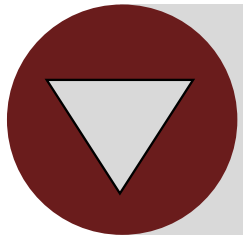
- **Expository Passages –** no conclusion
- **Illustrations -** examples
- **Explanations –** shed light
- **Conditional Statement –** if, then

Deduction & Induction



DEDUCTION

An argument incorporating the claim that it is ***impossible*** for the conclusion to be false given that the premises are true.



INDUCTION

An argument incorporating the claim that it is ***improbable*** that the conclusion be false given that the premises are true.

Deduction & Induction

DEDUCTION

DEDUCTIVE REASONING

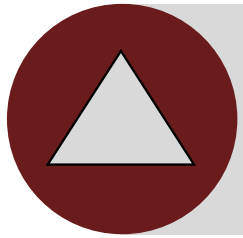
GENERAL THEORY → **SPECIFIC CONCLUSION**

INDUCTION

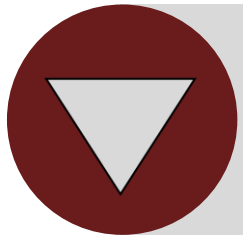
INDUCTIVE REASONING

SPECIFIC OBSERVATION → **GENERAL THEORY**

Deduction & Induction



DEDUCTION



INDUCTION

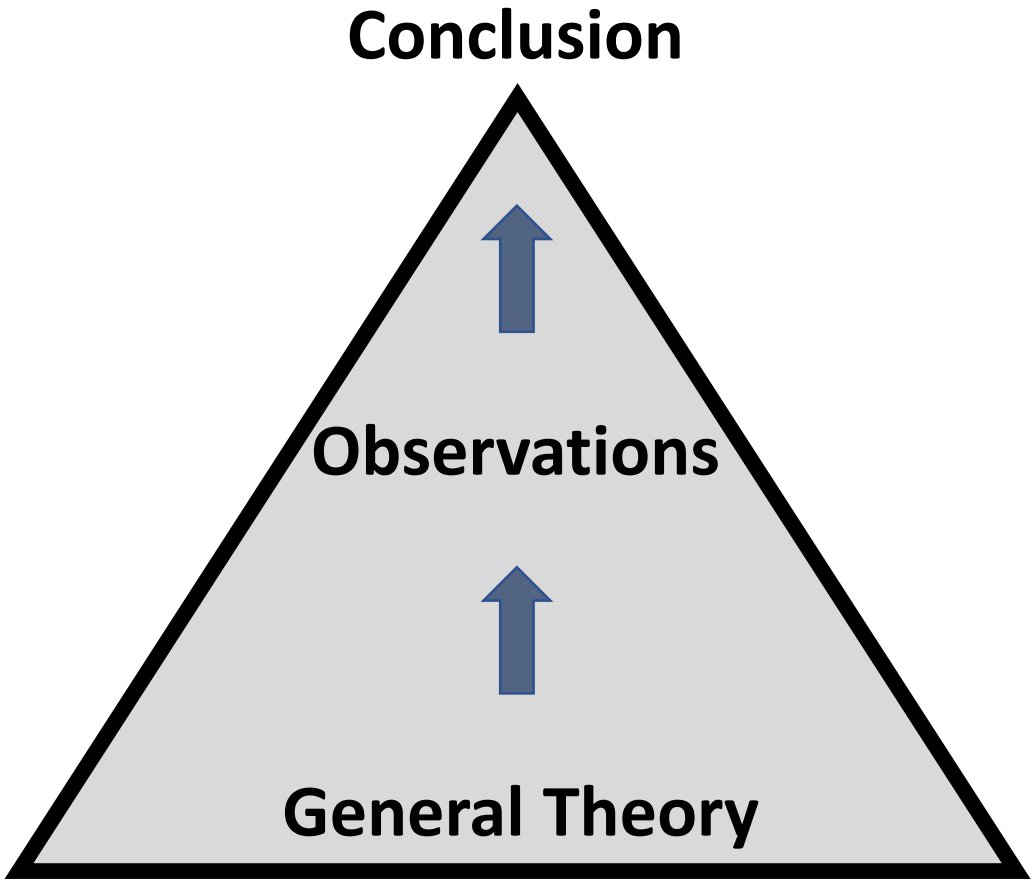
Is an argument inductive or deductive?

1. Check for indicator words
2. Evaluate the strength of the inferential link between premises and conclusion
3. Determine form of argumentation.

Deduction & Induction

DEDUCTION

INDUCTION



Deduction & Induction

DEDUCTION

PREMISE

PREMISE

PREMISE

TRUE

given

INDUCTION

CONCLUSION

impossible to be false

Deduction & Induction

DEDUCTION

P_1: Memorizing all the lectures can improve knowledge of the material.

P_2: Only lecture material is on the test

C: If I memorize everything and use good logic, I will do well.

INDUCTION

Deduction & Induction

DEDUCTION

Detective work
Law
Math
Medical Diagnosis

INDUCTION

Only Akira tested positive for Corona Virus.
The killer left Corona+ blood at the scene.
Therefore, Akira is guilty, should be charged, and needs medical attention.

Deduction & Induction

DEDUCTION

INDUCTION

Deductive Argument Forms

Argument Based on Mathematics – conclusion depends on a mathematical computation or measurement

Argument from Definition – conclusions depend on definitions

Syllogisms – 2 premises and 1 conclusion

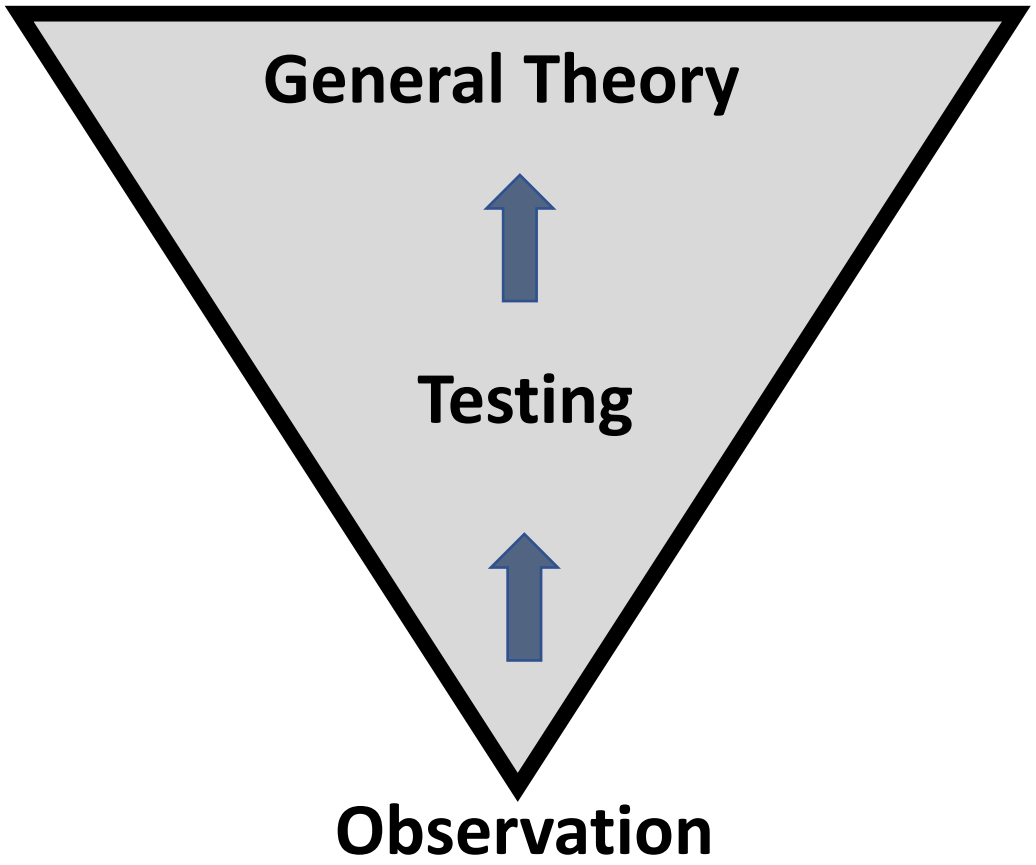
Categorical – (all, no, some)

Hypothetical – (if, let's assume)

Deduction & Induction

DEDUCTION

INDUCTION



Deduction & Induction

DEDUCTION

PREMISE

PREMISE

PREMISE

TRUE

given

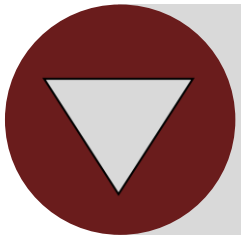
INDUCTION

CONCLUSION → ***likely*** to be true

Deduction & Induction

P_1: Aspirin has been tested to reduce headaches

P_2: The effectiveness is proven to be 70%



INDUCTION

C: Therefore, taking aspirin will probably make my head feel better.

Deduction & Induction

DEDUCTION

Polling
Statistics
Scientists
Medical Treatment

INDUCTION

Every time I eat peanuts, my throat swells up and I have difficulty breathing. Therefore, I'm probably allergic to peanuts.

Deduction & Induction

Inductive Argument Forms

Prediction– uses knowledge of the past to conclude future events

Argument from Analogy – conclusions depend on similarities between two things.

A is similar to B
X is true for A
X is probably true for B

Generalization – argument that uses knowledge of a sample and infers truth to the entire population.

Deduction & Induction

DEDUCTION

INDUCTION

Inductive Argument Forms

Argument Based on Signs – conclusions based on symbols, visual signals (not just text signs).

Causal Inference – argument from knowledge of a cause to a claim about an effect, or, conversely, from knowledge of an effect to a claim about a cause.

Deduction & Induction

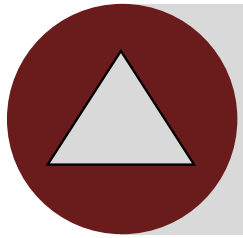
DEDUCTION

Words of certainty: Necessarily, certainly, absolutely, definitely

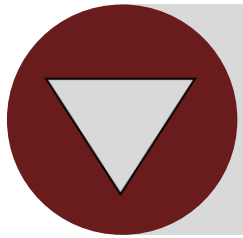
INDUCTION

Words of probability: Probably, improbable, plausible, implausible, likely, unlikely, and reasonably

Deduction & Induction



DEDUCTION



INDUCTION

Is an argument inductive or deductive?

1. Check for indicator words
2. Evaluate the strength of the inferential link between premises and conclusion
3. Determine form of argumentation.

Evaluating Arguments

Truth ✓ The actual state of things conforming with fact or reality

Validity ✓ Justified, conclusion cannot be denied from premises

Soundness ✓ Having no defect in truth or reason

Strength ✓ Power to convince

Cogency ✓ Convincing or believable, relevant

Evaluating Arguments

Truth

The actual state of things conforming with fact or reality

Deductive & Inductive - We evaluate every piece of the argument

PREMISE	T	Coupes have 4 wheels.	T	
PREMISE	T	Coupes have 2 doors.	T	
CONCLUSION	T	Therefore, this house is a coupe.	F	

Evaluating Deductive Arguments

Validity

Justified, conclusion cannot be denied from premises

Valid deductive argument - *impossible* for conclusion to be false given the premises are true. The conclusion follows with strict *necessity* from the premises.

Invalid deductive argument - it is possible for the conclusion to be false given that the premises are true.

Coupes have 4 wheels. T

Coupes have 2 doors. T

Therefore, this house is a coupe. F

Evaluating Deductive Arguments

Soundness

Having no defect in truth or reason

Sound argument - a deductive argument that is valid and has all true premises.

Unsound argument - a deductive argument that is invalid, has one or more false premises, or both.

Coupes have 4 wheels. T

Coupes have 2 doors. T

Therefore, this car is a coupe. T

Evaluating Deductive Arguments

Soundness

Having no defect in truth or reason

Sound argument - a deductive argument that is valid and has all true premises.

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Coupes have 4 wheels. T

Coupes have wings. F

Therefore, this car is a coupe. T

Evaluating Inductive Arguments

Strength

Power to convince

Strong inductive argument - *improbable* for conclusion to be false given the premises are true. The conclusion follows *probably* from the premises.

Weak inductive argument - The conclusion does not follow *probably* from the premises.

The Great Pyramids are made of massive blocks. T

It required unbelievable strength to lift those blocks. T

Therefore, it is likely that aliens built the pyramids. F

Evaluating Inductive Arguments

Cogency

Convincing or believable, relevant

Cogent argument - an inductive argument that is strong and has all true premises.

Uncogent argument - an inductive argument that is weak, has one or more false premises, fails to meet the total evidence requirement, or any combination of these.

The Great Pyramids are made of massive blocks. **T**

It required unbelievable strength to lift those blocks. **T**

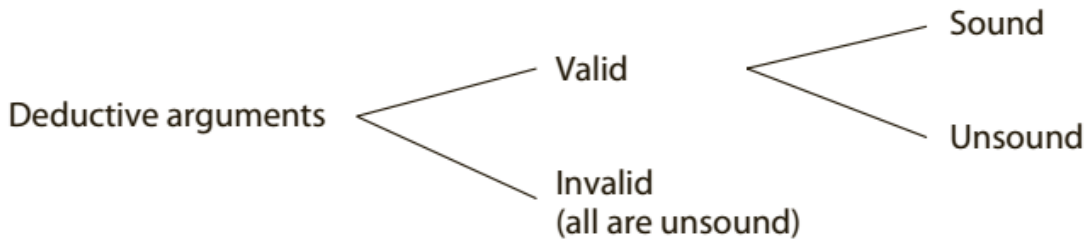
Therefore, they likely had technology we don't know about. **T**

Evaluating Arguments

Evaluation Algorithm

Evaluating Arguments

Evaluation Algorithm



Extended Arguments

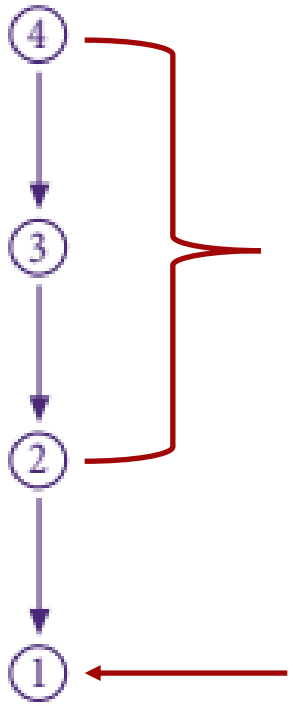
So far – Examples have been short and simple

Reality – Arguments are complex and long

Extended arguments have many forms
If identified, evaluation is easier

Extended Arguments

Diagraming: Vertical Pattern



Premises

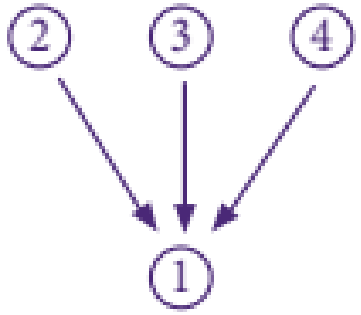
Conclusion

The vertical pattern consists of a series of arguments where a conclusion of a logically prior argument becomes a premise of a subsequent argument.

Example: ①The selling of human organs, such as hearts, kidneys, and corneas, should be illegal. ②Allowing organs sales will lead to transplants for only rich people. This is so because ③whenever something rare is sold, the price always goes up. ④The law of supply and demand requires it [the price to go up].

Extended Arguments

Diagraming: Horizontal Pattern



Premises

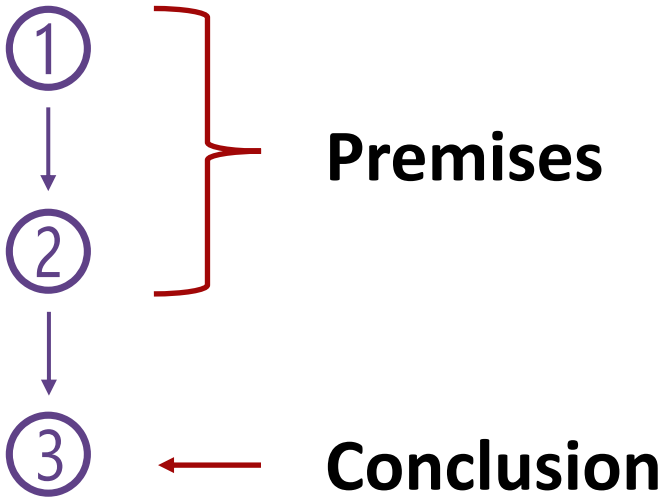
Conclusion

The horizontal pattern is a single argument in which premises provide independent support for a single conclusion.

Example: ①The selling of human organs, such as hearts, kidneys, and corneas, should be outlawed. ②If allowed, poor people will start selling their own organs to pay their bills. Alternately, ③ criminals will hurt healthy people to sell their organs. ④Finally, buying and selling human organs comes too close to buying and selling life itself.

Extended Arguments

① All decisions require logical thinking. ②All jobs require decisions. ③ Therefore, all jobs require logical thinking.



Extended Arguments

Complexity

Conjoint Premises

Multiple Conclusions