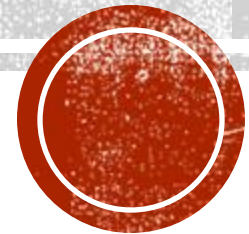# UNIT F

Evaluating Inductive Arguments

STRENGTH AND COGENCY

- Inductive arguments are evaluated on two grounds: **truth of premises** and **strength**

- Strength: an inductive argument is strong **if** the premises are true and it is improbable for the conclusion to be false

- i.e. the conclusion is *highly* likely to be true if the premises are true

- Upshot: **regardless of the content of the premises**, inductive arguments can be evaluated for their strength

- A **cogent** inductive argument is one which is **both** strong <u>and</u> has true premises

REJECTION MAKES A MAN STRONGER ~JIRAIYA

TEST FOR STRENGTH

- **Assume** that the premises are true,

- Is the conclusion **likely** to be true?

- If yes, then the argument is strong

- If no, then the argument is weak

WHICH IS STRONG?

- Eg 1

P1: All dinosaur bones discovered to this day have been at least 20 million years old.
C: The next dinosaur bone to be found will be at least 20 million years old. (P1)

- Eg 2

P1: All meteorites found to this day contain bananas.
C: the next meteorite to be found will contain bananas. (P1)

- Eg 3

P1: When a lighted match is immersed in water, the flame will be extinguished.
P2: kerosene is a liquid, just like water.
C: when a lighted match is immersed in kerosene, the flame will be extinguished. (P1-2)

STRENGTH

- Unlike deductive arguments, the strength of inductive arguments consists of **degrees**

- If the conclusion follows with 50% or more probability, it is strong

- Otherwise, it is weak

WHICH IS STRONG?

- Eg 1

P1: This drawer contains 100 pens.
P2: Three pens selected at random were found to be blue.
C: All the pens are blue. (P1-2)

- Eg 2

P1: This drawer contains 100 pens.
P2: Eighty pens selected at random were found to be blue.
C: All the pens are blue. (P1-2)

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TEST FOR COGENCY

- Is the inductive argument strong?

- Are the premises true?

- If **any** of the answers is a "no", then the argument is <u>not cogent</u>.

- i.e. an argument needs to be **both** strong <u>and</u> possesses true premises for it to be cogent

- Upshot: possible for an argument to be strong and still **not** cogent because of false premises.

SOME PERMUTATIONS

	Strong	Weak
True premise **Probably true conclusion**	All previous American Presidents were men. Therefore, probably the next American President will be a man. **[cogent]**	A few American Presidents were Christians. Therefore, probably the next American President will be a man. **[not cogent]**
True premise **Probably false conclusion**	None exist	A few American Presidents were Christians. Therefore, probably the next American President will be a Christian. **[not cogent]**
False premise **Probably true conclusion**	All previous American Presidents were television debaters. Therefore, probably the next American President will be a television debater. **[not cogent]**	A few American Presidents were Libertarians. Therefore, probably the next American President will be a television debater. **[not cogent]**
False premise **Probably false conclusion**	All previous American Presidents were women. Therefore, probably the next American President will be a woman. **[not cogent]**	A few American Presidents were Libertarians. Therefore, probably the next American President will be a Libertarian. **[not cogent]**

TEST FOR RELIABILITY

- On top of cogency, inductive arguments can be <u>further</u> tested for reliability.

- A reliable argument is cogent <u>and</u>:

- 1) contains all known relevant information,

- 2) and it would be impossible to insert additional premises that would change the probability of the conclusion

- Upshot: a cogent inductive argument might not be reliable because of some 'missing' information
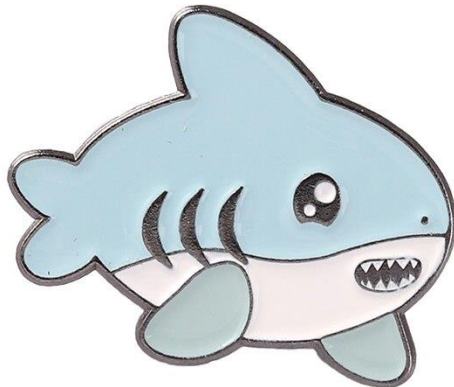
IS THIS RELIABLE?

- Example

P1: Swimming in the sea is usually lots of fun.
P2: Today, the water is warm, the waves are gentle and there are no dangerous jellyfish lurking around.
C: it would be fun to go swimming now. (P1-2)

COMMON TYPES OF INDUCTIVE ARGUMENTS

- Inductive reasoning is often used in the following areas:

- 1) Use of **analogy** in legal and moral fields

- 2) **Causality** in science

- 3) **Generalizations** in science

- 4) Statistics and **probability**

- Here are some common types of inductive arguments

ARGUMENT FROM ANALOGY

- Analogical reasoning depends on **the similarity of circumstances.**

- If the instances are **sufficiently similar**, the argument is strong; otherwise, it is weak

- General structure of argument:
  P1: Entity A has attributes *a, b, c* and *z*.
  P2: Entity B has attributes *a, b, c*.
  C: Entity B probably has attribute *z* also.(P1-2)

- Here, attributes a, b and c **must** be connected in an important way to z for the argument to be strong; otherwise, it is weak

- In other words, arguments by analogy are cogent if and only if:

- 1) the premises are true

- 2) there is a **systematic or causal connection** between the analogical properties (a, b, c) and the projected property (z)

EVALUATING ANALOGIES

- 1) How **relevant** is the analogy?
- 2) How many **similarities** are there between the instance and the analogy?
- 3) What is the **nature** and **degree** of disanalogy?
- 4) How **specific** is the conclusion?

- Example
- *"If we found by chance a watch or other piece of intricate mechanism, we should infer that it had been made by someone. But all round us we do find intricate pieces of natural mechanism, and the processes of the universe are seen to move together in complex relations; we should therefore infer that these too have a Maker." - William Paley, argument for the existence of God.*

IS THIS A GOOD ANALOGY?

- Eg 1

P1: Two buildings in New York were burnt down and in each instance, ten people died.
P2: In the first instance, it was a case of arson.
C: The second instance must be a case of arson. (P1-2)

INDUCTIVE GENERALISATIONS

- Generalising from a finite sample to a general conclusion

- A simplistic structure:
  P1: N% of a sample S is F
  C: N% of the population from which S is drawn is F (P1)

- Example

P1: A questionnaire was given to 50 students in all schools and years.
P2: 45 said they are opposed to the new grading system.
C: 90% of all the students in this university are opposed to the new grading system. (P1-2)

- Cogent **if and only if** the <u>premise is true</u>, and S is <u>randomly selected</u> and is of <u>sufficient size</u>.

STATISTICAL SYLLOGISM

- Simple structure:
  P1: N% of F are G   (where 0<N<100)
  P2: A is F
  C: A is G (P1-2)

- Example

P1: Most brightly colored frogs are poisonous.
P2: This frog is brightly colored.
C: This frog is poisonous. (P1-2)

- Cogent **if and only if** the premises are true and N is greater than 50%.

ARGUMENT FROM AUTHORITY

- An argument that bases its argumentative force on the source being an authority in a given field.

- Simple structure:

P1: Authority X said Y
C: Y (P1)

- <u>Example</u>

P1: Amnesty International say that prisoners are mistreated in Turkey.
C: prisoners are mistreated in Turkey. (P1)

- Cogent **if and only if** the supposed 'authority' is indeed <u>an authority in the given field</u> and <u>the premise is true</u>.

INFERENCE TO THE BEST EXPLANATION

- A.K.A. IBE, Occam's Razor, Abductive Reasoning

- An argument where one **does not know** for certain what the actual explanation is and makes the **best possible inference**.

- <u>Example</u>

P1: Most of the students in course X got A+.
C: the instructor is a lenient marker. (P1)

- Cogent **if and only if** the explanation offered is *really* the <u>best explanation possible</u> and <u>the premise is true</u>.

ARGUMENT ABOUT CAUSES

- A similar kind of argument to IBE but more information is provided such that one can infer the cause of some event X

- <u>Example</u>

P1: Deaths from heart disease are three to four times lower in France than they are in Britain.
P2: Yet known risk factors such as smoking levels and fat or cholesterol consumption are similar in the two countries.
P3: The French, however, consume much more alcohol than the British. And in particular, they drink a lot of red wine – which everyone now knows is full of anti-oxidants.
C: it must be red wine that is reducing the French incidence of heart disease. (P1-3)

- Cogent **if and only if** the 'cause' offered is *really* <u>the cause of event X</u> and <u>the premises are true</u>.

"Video Games Cause violence"

Me taking care of my fields

FALLACIES

- Note that the last 3 types of inductive arguments (Authority, IBE and Causes) can **easily** become fallacious if the argument is weak.

- More on this in unit G.

PREPARE YOURSELF

LOGICAL FALLACIES ARE COMING

DontFallacyMeBro.com

SUFFICIENT VS NECESSARY CONDITIONS

- "If" vs "Only if" vs "If and only if"

- If - SUFFICIENT
  - A sufficient condition may/may not be a necessary condition
  - Eg: Dropping a brick on a bare foot is a sufficient condition for feeling pain.
  - It is not a necessary condition since pain may be obtained in other ways.

- Only if - NECESSARY
  - A necessary condition may/may not be a sufficient condition
  - Eg: Being a man is a necessary condition for being a bachelor.
  - It is not a sufficient condition since one may be a married man.

- If and only if – SUFFICIENT AND NECESSARY

IN LOGICAL FORM...

- p only if q

= q is a necessary condition for p   You're a bachelor only if you're a man

= **If not q, then not p**   If you're not a man, then you're not a bachelor

= **If p then q**   If you're a bachelor, then you're a man

- p if q

= q is a sufficient condition for p   You'll feel pain if you drop a brick on your foot

= **If q, then p**   If you drop a brick on your foot, then you'll feel pain

- **If p is sufficient for q, then q is necessary for p (and vice versa)**

You're a man if you're a bachelor (Bachelor –p- is sufficient for maleness –q-)

You're a bachelor only if you're a man (Maleness –q- is necessary for bachelorhood –p-)

- **p iff. q means that both p and q fall or stand together**

UNLESS

- 'Unless' states a necessary condition = p unless q

- **But** unlike 'only if' (p only if q):

p unless q = q is <u>necessary</u> to avoid p, and no more

= if not q then p

= either p or q

You cannot run a marathon unless you have two legs

If you don't have two legs, you cannot run a marathon

Either you have two legs or you cannot run a marathon

RECAP

- An inductive argument is accepted only if the following conditions are **all** met:

- 1) Strong

- 2) True premises

- It would also be good for it to:

- 3) Possess all known relevant information

HOMEWORK

- Exercises E **and** F

LET'S DO A FEW TOGETHER

- Exercise E: determine if the inductive arguments are:

Strong or Weak, Cogent or not cogent, Reliable or Unreliable

- 1) The grave marker says that David Marshall is buried here. It must be the case that David Marshall is really buried here.

- 2) Franklin Roosevelt said that we have nothing to fear but fear itself. Therefore, women have no reason to fear serial rapists.